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Understanding International Energy Initiatives in the APEC Region

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FOREWORD

With this report entitled *Understanding International Energy Initiatives in the APEC Region*, the second phase within a two-year project undertaken by the Asia Pacific Energy Research Centre will be presented.

This report is published by the Asia Pacific Energy Research Centre as an independent study and does not necessarily reflect the views or policies of the APEC Energy Working Group or individual member economies. But we hope that it will serve as a useful basis for discussion and analysis both within and among APEC member economies for the enhancement of energy security, promotion of regional cooperation, and sustainable development.

Kenji Kobayashi
President
Asia Pacific Energy Research Centre

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Appreciation is extended to those who have made inputs to this project. The development of the report could not have been accomplished without the contribution of many professionals, both inside and outside of APERC.

The very idea of such study was proposed by APERC vice-president Yonghun Jung in early 2006.

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花の陰赤の他人はなかりけり

In the cherry blossom shade there's no such thing as a stranger

SUMMARY

This is the second and final phase of the study *Understanding International Energy Initiatives in the APEC Region*, undertaken by APERC to facilitate multilateral energy cooperation among APEC member economies by providing a common language and understanding of such undertakings.

International Energy Initiatives (IEI) are an important tool for policy makers to jointly reach political and economic goals. IEIs may have long-term missions, involve a diverse range of actors, and employ numerous mechanisms for their implementation. In their bid to improve multilateral energy security and environmental sustainability, IEIs help to strengthen business and political networks both within and across the APEC region as coalitions are formed from APEC and non-APEC member economies. This study explores IEIs both specifically and in general from the viewpoint of the energy industry, understood in a broad sense as economic activity along the whole energy supply chain.

The report consists of two sections. "Essentials," which follows, encapsulates an overview of IEIs and includes findings from both phases of this study. This is followed by the body of the report, an extended exploration of the experience of and potential for IEIs in the APEC region, adopting first an IEI case focus, followed by an energy issue focus.

KEY POINTS EXPLORED THROUGH THIS STUDY

- IEI working definition – An international energy initiative is a multilateral coordinated strategy to reach explicit goals within energy-related problems and which is voluntarily undertaken to address the market-external needs or ambitions of diverse partners.
- IEI taxonomy – IEIs can be categorised by their pursuit of two major purposes: (1) energy security and (2) energy-environmental sustainability. IEIs can be further described by six modes used to achieve these purposes: (1) infrastructure development; (2) financial mechanisms; (3) regulatory framework; (4) research and development; (5) information sharing, and; (6) education and capacity building.
- "Hard" approach IEIs, such as those which pursue infrastructure development or regulatory frameworks, are far fewer in number and generally larger in impact than "soft" approach IEIs, such as those which pursue information sharing or capacity building.
- IEI actors – IEIs participants include the public sector (international government-based organisations or governments themselves), the business sector, and civil society. Actors have unique driving forces which lead them to engage in energy-related multilateral cooperation.
- IEI lifecycle – IEIs change over time and inhabit two distinct stages: inception and implementation. At end of life, IEIs may reach their objectives, be formally abandoned, or, as is often observed, enter into a protracted period of benign neglect.

- Energy business and government both play key roles in the success of an IEI, but their expected costs and benefits are often asymmetric. Cooperation among both these actors is particularly important for the more advanced IEIs which deal with energy infrastructure, regulation, or finance.
- The international energy community perceives an element of issue-overlap among current IEIs. Though there is indeed some redundancy, much of this perception stems from IEIs' failure to understand and broadcast their own identities.
- IEIs can stall if mechanisms are ineffective or objectives become irrelevant. To amend mechanisms, or change objectives, sometimes the decision making process at the political level of the IEI is not enough. Complex long-term IEIs can benefit from special built-in facilities which require periodic review for policy makers' consideration.
- IEIs depend on effective organisational management for support and implementation. Three elements underlie bold organisational management of the IEI itself: (1) strong senior-level commitment; (2) access to sufficient financial resources, and; (3) effective coordination.
- The progress for many IEIs is generally regarded as unsatisfactory in part because of a disconnect between IEI mission or objectives and the concrete mechanisms implemented to address those goals. This is due, in part, to a failure to reconcile the large scale of an energy problem with the relatively small reach of most IEI activity, especially when compared to more organic tools such as market activity or domestic regulation.
- Some areas of energy development are better suited to IEI activity than others. Considering the nature and coverage of current IEIs against the problems which energy industry will face over the next 20-30 years, increased IEI activity will be particularly useful to address nuclear power development as the demand for activity will be great and it suffers from a relatively small pool of willing IEI participants. The creation of international regulatory framework IEIs also has good potential to address key energy cooperation issues like infrastructure investment as such frameworks support scalable and self-sustaining activity beyond the IEI itself.

ESSENTIALS

International Energy Initiatives (IEI) are one important facet of energy and environmental cooperation among APEC economies. A broad and loosely defined category, examples of IEI activity range from expert workshops on specific energy themes to political leader or senior official meetings, from joint international technological research to cross-boundary infrastructure development projects, and even the development of novel international regulatory regimes. Numerous such IEIs have been established around the world with well-intentioned missions and objectives, and in which some or all APEC economies are involved.

And while such IEIs excel at showcasing their *raison d'être* they often fail to frankly communicate the reality of their progress and potential. This difficulty is compounded by the dynamic nature of IEIs themselves, by their ability to transform over time so as to accommodate the changing needs of their participants, and also by their inherent sensitivity to political issues. Whatever the reasons, this phenomenon threatens to leave the international community of indirect stakeholders in such IEIs unsatisfied with particular pursuits and cynical towards the efficacy of the process as a whole.

But IEIs are an important and complex instrument within the broader set of energy policy tools. It is therefore useful to objectively assess the scope and performance of IEIs in a comprehensive way, taken both individually and as a group. They deserve special investigation in order to better understand their nature and scope and to provide policymakers, businesspersons, and experts within the research community with implications for facilitation of IEI best practices and issue-based targeting so as to optimise future IEI activity in the APEC region.

COVERAGE

The study aims to help this target audience catch the current picture of multilateral cooperation in energy-related areas in the APEC region by: providing the scope and useful taxonomy for such activity; explaining elements and their relationship within an initiative; assessing the factors affecting IEI progress, and; capturing new tendencies and future IEI potential. Study outputs include experience-based advice on the major obstacles for cooperation in an IEI and suggestions for further IEI attention on important but underserved international energy issues.

The study includes two phases. The first phase, *Understanding international energy initiatives in the APEC region phase I: scope and elements*, published by APERC in 2007, offered a taxonomy of IEIs and identification of key IEI elements such as actors, their driving forces, and the major stages of an initiative's evolution. This, the second phase of the study, looks at the experience of individual APEC region IEIs in practice and at the potential for IEIs in general to be used as an energy problem-solving tool. The most important findings and options from the whole study are summarised through this chapter.

PHASE I OVERVIEW

DEFINITION OF INTERNATIONAL ENERGY INITIATIVES

International energy initiatives are the process through which problems in energy-related areas that can be addressed through international cooperation are identified, respective goals are established, and appropriate mechanisms to achieve such goals are implemented. More specifically, the definition of APEC region IEIs used in this study can be broken down into three parts:

International

The undertaking involves partners in three or more APEC member economies, with a more complex nature of partner relationships than bilateral cooperation.

Energy

The undertaking focuses on issues which arise through the whole chain of energy supply from extraction/ production of energy to providing useful energy services. The ultimate aims of the undertaking address energy security, the environmental impact of energy consumption, or both.

Initiative

The undertaking is a coordinated strategy to reach explicit goals and it is voluntarily undertaken to address the market-external needs or ambitions of diverse partners. An initiative often evolves over time as such needs or ambitions change.

TAXONOMY OF INTERNATIONAL ENERGY INITIATIVES

The two ultimate purposes of IEIs are to ensure energy security and/or minimise the environmental impacts of energy consumption. Concerns about future energy supply and demand security are fuelled by rapid growth in energy consumption, dramatic energy market price fluctuations, fears over the finite nature of energy resources and access to them, and barriers arising in the delivery of energy from suppliers to consumers. Moreover, the local and global environmental impacts of energy consumption are quite clear. So while IEIs generally target goals more immediate or precise than these two, all are nevertheless working at least indirectly towards them. And when IEIs are designed to address such goals, a number of different modes are employed. This study identifies six categories to explain the overall approaches adopted by IEIs in working toward their goals. This taxonomy is presented in the table below.

ENERGY SECURITY	ENERGY-ENVIRONMENTAL SUSTAINABILITY
Infrastructure Development	
Financing Mechanisms	
Regulatory Frameworks	
Research and Development	
Information Sharing	
Education and Capacity Building	

5.1 **IEI taxonomy: purposes and modes**
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[Purpose 1] Energy security

Energy is a fundamental prerequisite for human activity, from cooking to transportation and production of commodities. The more cheap, concentrated, and technologically feasible energy is consumed, the more wealthy society becomes. Thus energy security (available, accessible, acceptable, and affordable energy) has become imperative for policymakers when trying to achieve higher levels of economic development. However, many economies face the problem that energy resources are not located evenly around the world, along with the finite nature of conventional and even renewable types of energy. While few economies are rich in conventional energy resources, international cooperation could facilitate better primary energy supply structure through trade (including power grids, gas and oil pipeline networks) and technology transfer. Energy security is essential not only for energy-intensive economies in the East Asian and North American regions, but also for energy exporting economies within APEC that deem energy security as a necessary prerequisite for establishing a stable energy market. There is no all-encompassing solution for securing energy supply in the APEC region that does not involve parties along the whole energy chain.

[Purpose 2] Energy-environmental sustainability

The energy sector can have great effects on the natural environment, whether local, regional or international in extent. At the local level, transportation can cause health problems from exhaust fumes along busy roads, or power plants/industrial activities may emit pollutants that affect localised air, water, or soil quality. As energy facilities are placed along the whole energy supply chain, negative environment effects could be encountered at the local level, from landscape disfiguration at coal mining sites to electromagnetic wave interference close to electricity transmission lines and electric appliances. On a more regional level, sulphur dioxide emitted from power plants can cause acid rain and adverse atmospheric conditions, accompanied by soil contamination and impacts on biodiversity. Sometimes such impacts can extend beyond economy boundaries. And at the global level, the focus of international attention in recent years is the spectre of energy consumption-related anthropogenic global climate change.

[Mode 1] Infrastructure development

Energy infrastructure development relates to the processes of construction and renovation, technological refurbishment and operation along the whole energy supply chain – from exploration, and subsequent extraction/production of primary energy, to transformation and transportation, and eventually to provide useful work and services in the form of final energy consumption. International cooperation is driven by several factors, including: increasing energy demand and net energy imports; insecurity of motor fuel supplies; large environmental footprints in relation to energy consumption (including those caused by low energy efficiency); positive synergistic effects of larger gas and power grids; requirements for capital investments which are not affordable by a single entity; weak oversight of the nuclear fuel cycle, and; insufficient penetration of new and renewable technologies.

As IEI activity by definition is primarily market external in nature, pure rent-seeking infrastructure development activity is not directly included in this mode. Rather, the focus is on building the financial, regulatory, technological, social, and political frameworks to support or encourage such business-led activity; IEI actors bargain within such frameworks to pave the way for business to accomplish the mission and satisfy actors' needs. International cooperation for energy infrastructure development also facilitates political processes among partners and thus might become an important factor to ease regional political tensions, or, alternately, be an indicator and consequence of such "peace dividend"-yielding processes.

[Mode 2] Financial mechanisms

Market-external in nature, IEI financial mechanisms here refer to innovative tools or funds that facilitate investment in the energy or energy-related environmental sectors. International cooperation in financial mechanisms often aims to internalise social external costs in order to make energy infrastructure projects commercially profitable and thus facilitate investment flow. Lack of appropriate tools/ mechanisms, unstable investment markets, low rates of return, insufficient start-up funding, and high transaction costs for implementation of renewable energy and energy efficient technologies are the major forces that encourage participants to cooperate under this mode.

[Mode 3] Regulatory frameworks

Regulatory activity is driven by the necessity to create and maintain international regimes that prevent abuse of the commons and improve international accountability, as well as the synchronisation of technical and economic regulation on international and domestic levels. Strongly dependant on the actors involved and the nature of their interactions, other motivations for international cooperation within the regulatory framework mode include: international political relations; synergies in the development of cross-border energy trade, and; the limited reach of any one economy's own policy agenda on the international scene or replication of economy-level initiatives internationally.

[Mode 4] Research and development

Research and development activity in the energy sector is now expensive and lengthy as technologies continue to increase in complexity. Long–term, high-risk, high-return technological research is in some respects a luxury available only to

monopolies and other powerful firms or very wealthy economies. Driving forces for research activity to provide commercially available technological advances for energy supply include the desire to reduce import dependency, improve energy efficiency (reduce costs), and reduce adverse environmental impacts.

[Mode 5] Information sharing

The driving forces for international cooperation in information sharing are the need to concentrate research activity for data/ information gathering in order to minimise the cost of such collection and analysis; the need to improve communication to the civil society and enhance the level of education, and; dissemination of knowledge and promotion of best practices among professionals. Implemented in an efficient way, information sharing can help to overcome such burdens to energy cooperation as language barriers; diversity, inconsistency, and incompatibility in resource categorisation and energy units; inaccurate data and information, and; lack of transparency in market signals. The internet has become a key tool to implement modern information sharing IEIs.

[Mode 6] Education and capacity building

Education and capacity building includes the facilitation of human capital growth, raising the education level of society, dissemination of non-technical knowledge and best practices, expansion of expert networks, awareness of new ideas, and consensus building around upcoming international energy issues. Capacity building sometimes extends to the professional and policy levels as well, taking the form of reports or workshops on important international energy issues.

Distinction between the education process and information sharing is that the educator bears responsibility for the personal level of knowledge, while information is provided according to the own interests of the provider. Participation in international cooperation on education and capacity building could significantly reduce the cost of human resource development at the economy level.

ACTORS

IEI actors include those participants who are involved in all stages of the IEI lifecycle, these individuals and bodies who launch, host, organise, join, negotiate, and implement the IEI, as well as those stakeholders who are directly affected by IEI action. Such actors are drawn from the public, business, and civil sectors and have both shared and unique drivers for participation in the cooperative process.

Public sector

International government-based organisations

Perhaps the most visible among IEI actors are those international public organisations such as ADB, APEC, ASEAN, G8, OECD, UN Family, or WB. Such organisations are the source of many IEIs and provide the forum and machinery for IEI implementation. Though only a few are devoted entirely to energy issues, many either have a special energy body established or energy-related programme arranged. In some respects, these organisations were established as mechanisms to implement coordinated international cooperative activities.

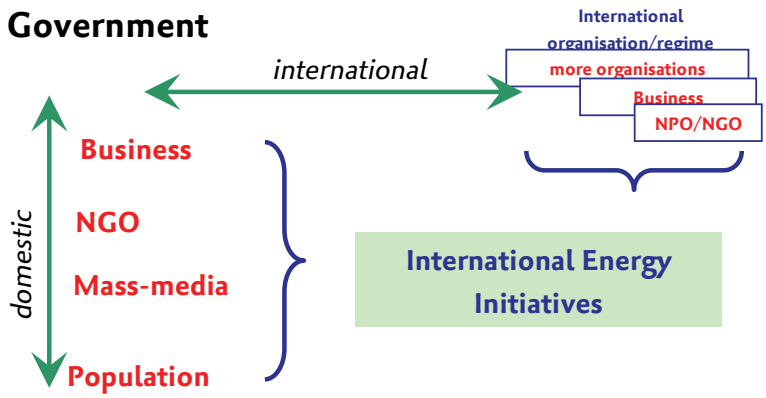
Such international public organisations often adopt similar hierarchies and implementation structures. In Asia Pacific, a network of energy-related bodies has already been created. In APEC, from the top down, annual leaders' meetings,

senior official and energy ministers meetings are undertaken regularly and are supported by the Energy Working Group (EWG) and individual taskforces under other working groups within the APEC secretariat. Further taskforces have been created under EWG's authority, including the Energy Group of Experts in Data Analysis (EGEDA). Similarly, in ASEAN, much of the energy-related cooperation is concentrated in the ASEAN Centre for Energy (ACE). While "EWG and ACE both lack, by design, regulatory authority, their accomplishments have been in coordination, facilitation, data collation, research, policy coordination, fund raising, and harmonisation of standards, as well as joint implementation of cooperative projects. Both organisations have five-year plans that provide vision for the programmes and set their goals, activities and indicators."[a]

[a] *Nexant 2005*

Governments

Of the actors that participate in international cooperation, domestic governments have the most influential role. Due to their inherent responsibility, governments (in both legislative and executive roles) interact with international bodies and other governments both on their own prerogative or to represent other domestic actors from all sectors. This complex, two-dimensional relationship is presented below.



8.1 **Two-dimensional government interaction**

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The most important role of governments in relation to IEIs is decision making based on assessment of total benefits and ultimate costs to domestic actors associated with any particular IEI. Mature political and social institutions help governments in such assessments of economic, social, and political priorities both domestically and internationally. An important feature of national governments is that more so than other actors, they are subject to domestic feedback within an economy and are thus more sensitive to the changing supporting environment for the IEI at the policy and working levels.

Business sector

Energy businesses and industry are by definition rent-seeking entities and are involved in energy extraction, transformation, transportation, energy wholesaling or retail trading, energy-intensive manufacturing, or energy-related services like research and development, education and training, and financing. However, for any business entity, regardless of scale, it is nevertheless important to be involved in activities that may only indirectly contribute to the bottom line, such as

lobbying for market interests or promoting a responsible corporate image. Participation in IEI activity can be for either of these aims, direct or indirect.

The business community is a very important actor in energy-related cooperative activities as it brings entrepreneurship and skilled operations within a market framework to IEIs. Energy business can offer valuable human, financial, or physical capital to IEI activity, which is often needed to elevate IEI activity beyond the "soft" approaches of capacity building or information sharing. Energy industry is also quite valuable to many IEIs for their technology holdings.

Energy business involvement within international cooperation may include: fulfilling public contracts in order to achieve market-external goals such as the provision of social energy services, mitigation of energy-originated environmental footprints; greenhouse gas reduction; promotion of new and renewable energy, or; technology development. Professional associations like REEEP or WBCSD provide a coalition advocacy group to build linkages on common interests within the energy-related community and facilitate information flow and contacts with other relevant business, civil-society, or government organisations.

Civil society

Civil society actors in IEIs include organisations operating domestically or at the international scale, such as academia, NGOs (but not international government-based organiations such as ADB, APEC, or UN Family), advocacy groups, and media in addition to individual members of society. International professional associations such as the International Gas Union and the World Energy Council are also powerful and important actors within IEIs.

The number of such actors, their variety, and potential for impact is growing very fast with the spread of international communications and sophisticated mechanisms for capital flow. Considering the broad reach of energy in modern human society, civil groups with a number of different aims may link their missions to energy issues such as access to reliable energy services and the environmental acceptability of them. IEI activities to address such aims include: implementing energy efficient technologies or environmentally-friendly building standards; organising campaigns or education for concerned stakeholders; designing regular workshops or training courses for policymakers and business; lobbying governments to amend/improve/expand legislation and regulatory frameworks, or; introducing new financial mechanisms.

An important concept for civil society actors is bi-directional communication regarding IEI aims and activities. Individuals and society as a whole are most likely to support actions when involved in the decision-making process or at least aware of the rationale behind the decisions that have been made. Mass-media is another important actor, as the process of international energy cooperation deeply involves people's preferences, expectations, modelling of current and future situations, establishing goals, and choosing approaches to reach such goals. The information and educational role played by mass-media features are extremely influential as sources of information transference. Importantly, however, it is the people of APEC economies who provide legitimacy for their governments and who, on an individual basis, will ultimately reap economic and social benefits or bare the costs of energy activity, including international cooperation like IEIs.

	INFRASTRUCTURE	FINANCIAL MECHANISMS	REGULATORY FRAMEWORK	RESEARCH & DEVELOPMENT	INFORMATION SHARING	EDUCATION & CAPACITY BUILDING
Awareness of new ideas and upcoming issues						●
Insecurity of energy supply, increasing energy consumption and energy imports	●	●	●	●	●	●
Minimising energy-environmental impact	●	●	●	●	●	●
Improving international relations with neighbours	●	●	●	●	●	●
Incremental energy supply and introduction of new energy sources		●	●	●		●
High project cost for single economy	●	●				●
Synergistic effects of larger gas and power networks / macro-level synergies in trade	●		●	●		●
Reliability and quality of energy services		●	●		●	●
Energy efficiency improvement	●	●	●	●	●	●
Insufficient penetration of new and renewable technology		●			●	●
Weak oversight of nuclear fuel cycle	●		●	●		●
Shortage of qualified human resources in governance, management, and the workforce		●			●	●
Communication with civil society concerning energy and environmental issues					●	●
Advancing scientific and technological levels		●		●		●
Lobbying or advocacy as a mechanism to facilitate cooperation			●	●		●
Abuse of commons, lack of international accountability, or limited reach of policy goals			●			●
Lack of financial mechanisms		●		●	●	●
Language barriers, inconsistent statistic methodologies and energy units					●	●
Inaccurate data and information on both domestic and international levels					●	●
Lack of transparency in market signals					●	●

10.1 **IEI driving forces by mode**

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DRIVING FORCES FOR COOPERATION

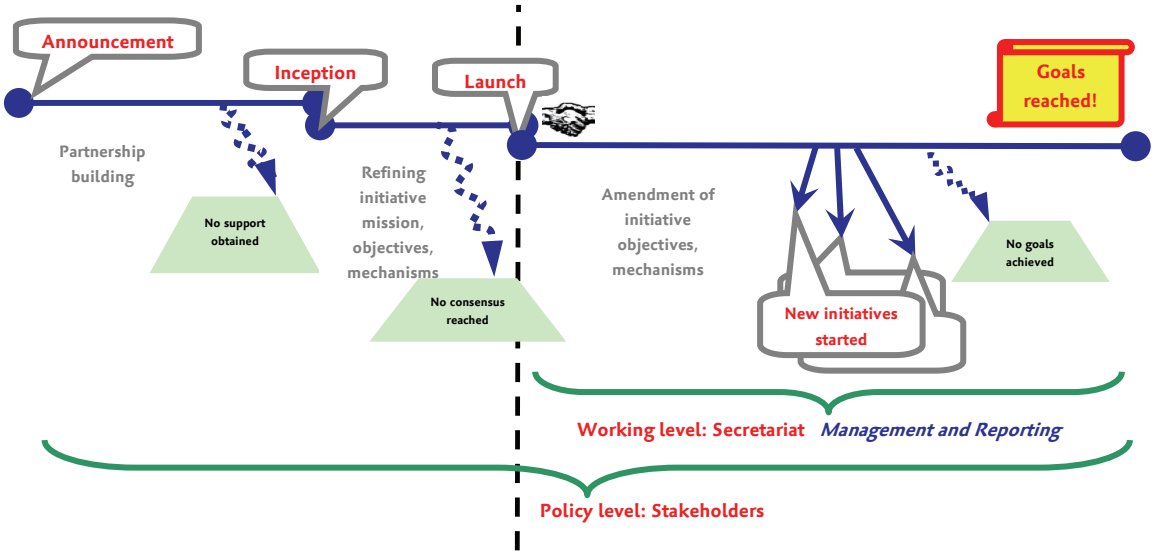
IEI actors have their own goals, objectives, and preferred mechanisms to meet their needs and desires. Broadly put, driving forces for IEI actors are the desire to reach some goal where overall benefits for society overcome social costs, while providing energy industry and business with enough incentive for attractive profits. These goals are market-external, and they have to be expressed in categories which are different from business assessments like profit and revenue. The IEI, as an international cooperative effort, should provide an environment for energy industry and business which will allow thus reshaped or even newly created markets to operate and develop in a desired/ required direction—that is, toward the IEI mission.

It is a political task for participating economies to identify and understand driving forces for domestic actors and finally make decisions based on principles and priorities. A non-ordered, non-exclusive list of driving forces for IEIs by mode is presented here. This table provides evidence for the fundamental role of capacity building activities, which are considered to be "soft" approaches for IEIs – in the sense that they are based on communication, training, and knowledge exchange activity that is relatively easily to arrange. On the other hand, "hard" approaches – including technology development/ transfer, synchronisation of technical/ economic regulation, introduction of financial mechanisms, and eventually such degree of political consensus and trust among initiative's participants that energy infrastructure construction is considered – are more rarely observed. However, "hard" modes of IEIs are often either the result over time of or built upon the foundations laid down by "soft" approaches such as capacity building and education, information sharing, and research activity.

LIFECYCLE OF AN INTERNATIONAL ENERGY INITIATIVE

IEI development relies heavily on the impact of current political, economic, and social or environmental frameworks. An initiative's lifecycle essentially involves all the elements discussed above, and provides an explanation of their interrelation and dynamic nature. This lifecycle is considered from the very initial steps to the end– whether that be reaching the goals of the initiative, abandonment of the initiative, or entering a "zombie" state of benign neglect.

Major IEI stages are: (1) initiation and (2) implementation. There are three major steps at the first stage: announcement of IEI mission, objectives, and desirable partners; inception of that proposal, development of mechanism to reach objectives, and further refinement of mission, objectives, and list of participants, and; finally the launch of the initiative, which begins the IEI's implementation stage. This implementation stage takes longer and is possibly less politically-fulfilling than that of initiation, but it nevertheless requires continued political commitment through attention and decision-making as objectives are amended or an entirely new IEI is needed due to changes in the operating environment. Of course financial issues are also important for IEIs. Without proper funding an initiative inevitably dies; the same result could be reached if broader benefits become eclipsed over time by total associated costs or in the absence of profitable drivers for energy industry and business if this sector is anticipated as major mechanism to achieve IEI objectives.



12.1 **IEI lifecycle**

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PHASE II OVERVIEW

What are the main missions and objectives for IEIs? Who are the actors involved? What are the reasons and driving forces for parties to form and participate in IEIs? By what means and mechanisms are the respective objectives supposed to be reached? What factors drive development and amendments of IEI and why are the paths of IEIs often not straight? What kind of problems can and cannot be solved by IEI activity? Where should IEIs focus in the future?

Findings from the first phase of this study, which identified the scope and key elements of IEIs in the APEC region, gave a basic understanding of the first of these questions. Phase I offered a convenient IEI taxonomy, actor characterisations, driving forces for cooperation, and a general life cycle of IEI evolution. This, the second phase, addresses the latter questions in an attempt to provide a more comprehensive picture of APEC region IEI activity.

The second phase focuses on factors which affect IEI progress and investigates areas that are ripe for future cooperation. It approaches these issues from two perspectives: (1) the IEI in practice, and (2) the IEI as a tool.

The first part of phase II, the IEI in practice, takes an initiative-based approach, concentrating on those large, multilateral, complex IEIs which employ infrastructure, regulatory, financial, or R&D modes, as these are most relevant to policymakers and energy industry. This extended analysis of the interaction of each IEI over time with various influential factors (both endogenous and exogenous) provides lessons to improve current IEI activity and avoid bad practices into the future.

The second section of phase II, the IEI as a tool, takes an issue-based approach, identifying important barriers to energy industry development which will arise over the next 20-30 years in the APEC region. An attempt is made to characterise the nature of concrete actions taken by IEIs today to address or avoid such problems and also to identify those areas which have both good and poor potential for future multilateral energy cooperation in the APEC region.

The empirical investigation of practices in international cooperation on APEC region energy-related issues in this phase is based on publicly available information, analysis provided by experienced experts, and insights from major IEI insiders. Findings and options from this second phase are presented below.

THE INTERNATIONAL ENERGY INITIATIVE IN PRACTICE

The role of energy industry

Energy business and government both play key roles in the success of an IEI, but their expected costs and benefits are often asymmetric. Cooperation among both these actors is particularly important for the more advanced IEIs which deal with energy infrastructure, regulation, or finance (as opposed to capacity building or information sharing IEIs, which can often succeed without one or the other). However, large complex IEIs often will be primarily driven by either government (for political, economic, or social ends) or business interest (profit-seeking activity), with the other actor taking a supporting role.

Infrastructure IEIs are generally asymmetrically driven by either actor depending on circumstances. Examples include transnational energy

transportation network projects such as the Trans-ASEAN Gas Pipeline Project (TAGP) and the Northeast Asian Gas and Pipeline Forum (NAGPF). Cooperation under TAGP is based largely on the political will of regional governments, with market forces playing only a supporting role in initiative design and implementation. NAGPF, on the other hand, is driven primarily by energy industry interests who perceive the market potential of growing energy demand in East Asia alongside large natural gas reserves in nearby Siberia and Central Asia, however complicated by political issues which require (but still lack) closer public sector involvement.

Research and development IEIs are generally driven by both parties working together on an equal basis. Examples include those IEIs for advanced nuclear technologies, where governments are looking for long-term solutions for energy security and environmental sustainability, while industry seeks future market advantages through development of new technologies or markets, such those related to a global closed fuel cycle.

Regulatory framework IEIs, though primarily implemented by public sector actors, are also driven by the interests of both governments and energy industry. Here, though, energy industry interests are generally represented by government negotiators in a unidirectional but cyclical process, as opposed to the more bi-directional relationships depicted above. The Energy Charter Treaty (ECT), for example, involves government actors who channel the need of energy industry to the development of binding international legal regimes for investment protection and access to energy resources.

Options

When seeking to involve the participation of either government or business actors with an IEI driven by the other, consider how the other party's costs and benefits will compare to one's own. While participation of both government and business together is often beneficial to the IEI's achieving its objective through leveraging each party's comparative advantages, it is rare to expect returns on IEI participation to be the same for everybody. This means that government-driven environmental initiatives, for example, should recognise that though certain parts of the IEI may create good opportunities for business involvement, business actors should not be expected to show the same enthusiasm (and resources or efforts) as those government actors who will ultimately be seeing more return from their IEI commitments through market-external benefits. Similarly, though an energy interconnection infrastructure IEI championed by business interests necessarily relies on government support, those business drivers should not expect government participation unless attractive returns can be demonstrated. Unequal returns among government and business parties are not a problem, however, as long as participants acknowledge that the balance of cost, benefit, and risk are, indeed, unequal.

Unique identity and overlap

The international energy community perceives an element of issue-overlap among current IEIs. Though there is indeed some redundancy, much of this perception stems from IEIs' failure to understand and broadcast their own identities. For example, two nuclear technology initiatives, Generation IV International Forum (GIF) and the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), once seemed to be redundant in aims and objectives, separated only by membership. But, recent cross-joining by major

participants in these IEIs helped provide a clearer idea of operational identity uniqueness – GIF now concentrates on the supply side commercial designs for innovative nuclear systems with appropriate intellectual property right sharing, while INPRO focuses on developing demand through knowledge sharing and capacity building among members.

An IEI may have similar geographic coverage, similar actors, and similar objectives, but it does not necessarily overlap with another IEI if its mechanisms are unique. Such a situation is in fact desirable, as having numerous approaches to and perspectives on complex problem solving can increase overall robustness through diversity.

Options

IEI planners or managers should be aware of similar endeavours which may share actors or objectives—particularly those operating in the same area (be that geographic, economic, or social). Direct coordination of activities or knowledge bases may be beneficial among such similar IEIs, but is not always necessary—in fact, more value may be added to regional energy development by maintaining some distance so as to preserve diversity. Instead, this can be an opportunity to define a unique and specific identity for the IEI so as to better differentiate it from other similar undertakings—be that through refinement of IEI objectives or mechanisms—and defend its value to stakeholders. Coordination and collaboration is an option, though such synchronisation might in fact be more useful among IEIs with similar objectives and mechanisms but with different actors or which operate in different areas. In these cases, direct competition for resources and other support is less of an issue.

Evaluation and amendment

IEIs can stall if mechanisms are ineffective or objectives become irrelevant. This can happen as the result of external IEI implementation environment changing or internal failures. All IEIs could face this, though to varying extents. To amend mechanisms, or change objectives, sometimes the decision making process at the political level of the IEI is not enough. Complex long-term IEIs such as ECT benefit from special built-in facilities which require periodic review for policy makers' consideration.

Options

Built-in evaluation and adaptation mechanisms are important for IEI sustainability. Repeated evaluation of the effectiveness of IEI mechanisms should part of any IEI implementation strategy, and IEI managers should be given the power to recommend modifications on IEI mechanisms to the governing body. Moreover, broader IEI objectives should face a natural review by setting a termination date/ event from the outset which can be extended only through positive action of the IEI's governing body. Such periodic, built-in mechanism and objective evaluations and modifications should apply to voluntary IEIs as well to ensure continued interest among and usefulness for actors.

Implementation

From the larger perspective, IEIs require the proper targeting, approach, and coalition to have a good impact. More immediately, however, they also depend on effective organisational management for support and implementation. Three elements underlie bold organisational management of the IEI itself: (1) strong

senior-level commitment; (2) access to sufficient financial resources, and; (3) effective coordination. Lacking any one of these three elements can result in a "zombie" IEI—that is, an IEI not which has failed, but which continues indefinitely in a period of benign neglect with little cost, benefit, or progress and which can be later usefully revived if needed.

Strong senior-level commitment is usually the result of direct involvement of high-ranking politicians or businesspeople and helps the implementation of mechanisms to run much smoother and faster. Strong leadership within the IEI can also help the initiative to successfully pass through periods of neglect by other members, re-establishing other participants' resolve.

Access to sufficient financial resources follows from IEI relevance to actors and senior level commitment. New initiatives often must prove the uniqueness of mission and mechanisms along with the positive balance of benefits over costs for its actors to commit financially. Moreover, as time passes, whatever the success of an IEI's activity, IEI management often struggles to keep financial interest in the IEI's mission and approach.

Effective coordination within the IEI between domestic and international levels or political and working levels is necessary to establishing a robust IEI management structure.

Options

Identify a "hero" (or group of heroes) who is willing to take the lead by guiding an IEI through its lifecycle and championing the IEI's value when faced with challenges such as shortages in financial resource or wavering senior-level commitment. Such a hero takes *de facto* managerial ownership of the IEI (whatever its legal ownership structure) and helps ensure follow-through and consistency in the IEI despite personnel rotation, fluctuations in participant interest, and the changing international context.

THE INTERNATIONAL ENERGY INITIATIVE AS A TOOL

Some areas of energy development are better suited to IEI activity than others. Considering the nature and coverage of current IEIs against the problems which energy industry will face over the next 20-30 years, increased IEI activity will be particularly useful to address nuclear power development as the demand for activity will be great and it suffers from a relatively small pool of willing IEI participants. The creation of international regulatory framework IEIs also has good potential to address key energy cooperation issues like infrastructure investment as such frameworks support scalable and self-sustaining activity beyond the IEI itself.

The progress for many IEIs is generally regarded as unsatisfactory in part because of a disconnect between IEI mission or objectives and the concrete mechanisms implemented to address those goals. This is due in part to a failure to reconcile the large scale of an energy problem with the relatively small reach of most IEI activity, especially when compared to more organic tools such as market activity or domestic regulation. The result is that many IEIs have good impacts toward their goal, but these results are extremely localised, with mechanisms incapable of scaling to a level where the IEI's success would be obvious to its set of broader stakeholders. This is witnessed by the proliferation of soft approach IEIs, such as those which adopt capacity building or information sharing

approaches, and the paucity of hard approach IEIs, such as those which establish regulatory frameworks.

One example is that of the Asia Pacific Partnership (APP). This IEI is often described in relation to the Kyoto Protocol in that they have similar stated missions. However, they in fact are not truly comparable; whereas the Kyoto Protocol established a broad regulatory framework which is now organically perpetuated by market forces and supplement by domestic regulations and even a host of other hard and soft approach IEIs, APP in practice has instead adopted a capacity building approach with potential for largely localised, project-based impacts which appear unlikely to organically scale or be duplicated on the level required to realise the IEI's mission. This observation, however, applies only to the targeting and approach taken by the IEI, and does not suggest positive or negative evaluation of IEI impacts themselves.

A related phenomenon is the tendency of newly-established IEIs with long time horizons to set a highly ambitious target without a clear roadmap showing how to arrive there. A common practice is to establish multiple future phases for IEI activity, but to only develop concrete mechanisms for the first of these phases. This may be an efficient means to establish initial commitment among actors, but it often results in magnanimous-sounding IEIs which successfully complete soft approach-type capacity building or information sharing first phases, only to flounder and stagnate after failing to convert these results into hard action and follow through.

Options

It is important that IEI initiators recognise that tools other than IEIs exist to deal with specific energy problems, and, in particular, that IEIs should be careful to avoid duplicating market-internal activity. To be effective, increased international cooperation in those areas which can benefit from it may require goal-oriented member associations which do not currently exist. Economies with particular interest in these issues should consider identifying other members who could bring most cooperative value to a new association.

IEI planners should establish realistic targets and continue to evaluate the structural potential of IEI mechanisms to achieve this target.

THE IEI IN PRACTICE

Here, the IEI is viewed in practice, as the sum of its inputs and outputs. The experiences of five IEIs are explored according to those environmental elements which both influence the implementation of an IEI over time and are, in turn, eventually affected by the IEI itself. The purpose of such case analysis is to understand how different IEIs interface with various environmental stimuli as they move towards their ultimate objectives and to draw helpful lessons from their experiences. The case histories presented here are:

- Trans-ASEAN Gas Pipeline Project (TAGP)
- Northeast Asian Natural Gas & Pipeline Forum (NAGPF)
- International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)
- Generation IV International Forum (GIF)
- Energy Charter Treaty Process (ECT Process)

These cases have been selected in that they share certain characteristics but differ in other key areas. All are ongoing, large, complex IEIs with diverse economy-level membership and which seek to address ambitious long-term objectives with an ambiguous time frame. They differ, however, in mode and ultimate purpose: two are infrastructure-based gas transportation IEIs meant to improve energy security; two are R&D-based nuclear power technology IEIs; the last seeks to create multinational energy investment regulatory frameworks for both energy security and environmental ends.

Each case offers an overview of factual elements about the IEI, including mission, mechanisms, and milestones along with other background elements such as IEI actor composition or the surrounding environmental drivers for IEI inception. Following this, the IEI's changing experience over time is broken down from the perspective of various primary IEI-environment interactions—those elements which both influence and are influenced by IEI activity: government; economy; energy industry and technology; society and the natural environment, and; organisational structure.

Through this exploration of IEI experience, lessons are drawn for future IEIs in four key areas:

- the role of energy industry in IEIs
- the importance of a unique IEI identity the implications for IEI overlap
- the usefulness of ongoing IEI evaluation and amendment
- requirements for effective implementation

It must be emphasised that here, IEIs have not been *evaluated*. The environment and objectives of IEIs are so varied that the application of a label for success or failure obscures the value offered by the experience of IEIs in practice. And though such judgement is certainly tempting, ultimately a more nuanced expression of IEI-environmental interaction helps to envision improved dynamics for future mutual understanding. To this end, each of the following IEIs seeks to support understanding of the four key areas outlined above.

TRANS-ASEAN GAS PIPELINE (TAGP) PROJECT

MISSION

▪ To secure natural gas supply through an integrated natural gas pipeline network in the ASEAN region

MECHANISMS

▪ Working programs and mechanisms used to implement the TAGP project are guided by the ASEAN Plan of Action for Energy Cooperation (1999-2004) & (2004-2009).
▪ Natural gas pipeline interconnection is expected to integrate new bilateral or multilateral natural gas pipeline connections as well as existing domestic grids in the ASEAN region into a single regional gas pipeline network.

1988	ASCOPE begins study *Potential of natural gas pipeline connection in the ASEAN region*
1990	ASCOPE publishes study *Potential of natural gas pipeline connection in the ASEAN region*
1991	Commission of the 1st cross-border gas pipeline under TAGP Project – Malaysia to Singapore
1996	14th ASEAN Ministers of Energy Meeting Endorses the first *Master plan on natural gas development and utilization in the ASEAN region*
1997	Declaration of ASEAN Vision 2020 calls for cooperation to establish interconnected natural gas grid through the TAGP Project
1998	Hanoi Plan of Action stipulates institution of a policy framework by 2004 to speed TAGP Project
1999	ASCOPE creates the TAGP Task Force (TAGP-TF)
	Approval of the *ASEAN plan of action on energy cooperation (1999-2004)*, which includes a working plan for the TAGP Project and modifies the first *Master Plan (1996)*
	Commission of the cross-border gas pipeline – Myanmar (Yadana) to Thailand (Ratchaburi)
2000	Commission of the cross-border gas pipeline – Myanmar (Yetagun) to Thailand (Ratchaburi)
2001	Release of new *Master plan on TAGP Proje*ct, which identifies seven gas pipeline interconnections for implementation
	Proposal for an ASEAN *MOU on TAGP* based on the completion of a conceptual project feasibility study and the resolution of relevant institutional, legal, financial, commercial, and technical issues
	Commission of the cross-border gas pipeline – Indonesia (West Natuna) to Singapore
	Commission of the cross-border gas pipeline – Indonesia (West Natuna) to Malaysia (Duyong)
2002	19th AMEM signs the ASEAN *MOU on TAGP*
2003	Establishment of ASCOPE Gas Center to provide technical assistance to ASCOPE in TAGP implementation
	Establishment of ASCOPE Gas Consultative Council to serve as legal advisory body to ASCOPE in TAGP implementation
	Commission of the cross-border gas pipeline – Indonesia (South Sumatra) to Singapore
2004	Approval of the *ASEAN plan of action for energy cooperation (2004-2009,)* which re-routes some proposed pipelines
2005	Commission of the cross-border gas pipeline – Thai-Malaysia JDA pipeline
2006	Commission of the cross-border gas pipeline – Malaysia and Singapore
2007	*Cebu declaration on East Asian energy security* supports investment in regional energy infrastructure such as the TAGP and ASEAN Power Grid
	East Asia summit agreement supports renewed TAGP efforts to support the ASEAN Economic Community of 2015

20.1 **TAGP milestones**

IEI secretariat and APERC 2008

BACKGROUND

The TAGP Project was conceived to benefit both natural gas consumers and suppliers by providing an opportunity for natural gas trade within ASEAN region.

From the point of view of consuming economies, natural gas is an attractive fuel for power generation, petrochemical industries, as well as the residential and commercial sectors. Increasing the use of regionally-sourced natural gas can reduce pressure on oil demand and help diversify the overall fuel mix for primary energy demand. For ASEAN, this could also theoretically reduce oil import dependence from the Middle East, though the project sets no reduction target in this regard, nor does it specify incremental growth in natural gas consumption.

From the perspective of natural gas suppliers, the TAGP Project offered potential for better access to the ASEAN natural gas market along with improved competitiveness against natural gas sources outside the region. It was also hoped that the project might accelerate the development of untapped gas fields, such as the East Natuna gas field in Indonesia, as well as stranded gas fields that had not been considered for exploration and production. [a]

[a] *US embassy at Jakarta 2001*

ACTORS

As the TAGP Project was created under the ASEAN framework, all ASEAN members are regarded as members, namely, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam. Seven out of ten ASEAN members are also member economies of APEC.

The TAGP Project is led by the ASEAN Council of Petroleum (ASCOPE), which formed under ASEAN to facilitate the development of the petroleum and natural gas industries in ASEAN region. Most ASCOPE council members are representatives from state-owned energy companies or government bodies, and include the Brunei National Petroleum Company Sendirian Berhad (PetroleumBRUNEI), Cambodian National Petroleum Authority, Pertamina (Indonesia), Ministry of Energy and Mines (Lao PDR), Petroliam Nasional Berhad PETRONAS (Malaysia), Myanmar Oil and Gas Enterprise (MOGE), Philippines National Oil Company (PNOC), Singapore Petroleum Company Limited (SPC), PTT Public Company Limited (PTT) (Thailand), and Petrovietnam (Vietnam). PETRONAS has been the ASCOPE secretariat since 1999. The TAGP Task Force was formed as a working level entity under the ASCOPE framework to implement the actual TAGP Project.

Private sector participation in the TAGP Project is highly encouraged by ASEAN energy ministers, particularly with regard to financing of natural gas pipeline infrastructure. To make the project more understandable for the private sector, ASCOPE organises forums, such as the Forum on Trans-ASEAN Pipeline and Power Grids, inviting participants from both public and private sectors within or outside the ASEAN region. Furthermore, a cooperative framework for public-private partnership on natural gas pipeline development in the ASEAN region was built in 2002.

Apart from these forums which are directly related to the TAGP Project, the private sector is also encouraged to attend the ASEAN Energy Business Forum (AEBF) to share concerns with government bodies regarding development of the

broader natural gas industry in ASEAN region. In addition, the AEBF provides a platform to exchange technical information among ASEAN members so as to identify opportunities for project financing from the private sector.

PROGRESS

ASEAN began discussing natural gas pipeline interconnection in 1988, and the first cross-border gas pipeline between Malaysia and Singapore was commissioned in 1991. The most recent segment was a 4 kilometre pipeline between Singapore and Malaysia, commissioned in 2006. As of 2008, ASEAN has a total of eight cross-border gas pipelines in operation, extending over 5,000 kilometres. If the TAGP Project were completed based on the current proposed pipelines, the network would link gas supply and demand regions in Indonesia, Malaysia, Brunei Darussalam, Singapore, the Philippines, Myanmar, Vietnam, and Thailand. In this proposal, Lao PDR and Cambodia would not be connected by this regional gas pipeline network.

The TAGP Project has been operating more than nineteen years. However, progress is slow despite strong political support from ASEAN governments, including the Declaration of ASEAN Vision 2020 (1997), Hanoi Plan of Action (1998), ASEAN MOU on TAGP under 19th AMEM (2001), Cebu Declaration (early of 2007), and the latest East Asia Summit (November 2007). Reasons for this slow pace include modifications to the project master plan and other segment-specific project delays, such as a two year delay in construction of the Thai-Malaysian pipeline owing to opposition from civil society interest groups over environmental and other local social issues. [b]

[b] *Limthongkul 2000*

Although the TAGP master plan has been formally modified only once, in 2001, proposed interconnections have actually changed steadily over time throughout both the first and the second master plan (1991, 2001) periods and following the 2004 ASEAN Plan of Action on Energy Cooperation (2004-2009). For instance, the natural gas pipeline between Indonesia's Natuna and Thailand was removed from the second master plan due to budget cuts by the Thai government following the 1998 Asian financial crisis. Moreover, from a broader perspective, the objective of the TAGP project was extended from ensuring greater gas supply security to include ensuring greater economic value. This consequently increased the burden of designing and selecting an appropriate pipeline route between ASEAN members.

Segment-specific delays have also arisen in this multilateral project. Pipeline commission in the Malaysia-Thailand Joint Development Area was delayed due partly to technical and environmental issues. [c] Furthermore, much of the TAGP Project seems currently to be on hold as Indonesia – the major natural gas supplier under the project– has changed its gas utilisation policy to increase the use of natural gas domestically in its power and industrial sectors. There has been no construction since the last commissioned pipeline between Singapore and Malaysia in 2006.

[c] *Roberts and Cull 2003*

More generally, the project also faces the challenges of synchronising technical standards and regulatory frameworks among ASEAN members; reaching consensus on adapting contractual arrangements for gas supply, distribution and transportation of natural gas, gas pipeline network management procedures, and cost sharing, and; addressing environmental concerns.

GOVERNMENT

The joint ministerial statement released after each ASEAN Ministers on Energy Meeting (AMEM) could provides useful insights into how ASEAN governments support the implementation of the TAGP Project. This document gives the vision of ASEAN energy ministers, the future direction for ASEAN energy cooperation, and the progress of key ASEAN energy projects. In the 10th AMEM *Joint Ministerial Statement* (1991), the ministers expressed their satisfaction on the initial feasibility study for the TAGP. Two years later in the 11th AMEM, they noted the proposed study for the master plan on natural gas development and utilisation. This study was conducted by the ASEAN-EC Energy Management Training and Research Center (AEEMTRC), itself an energy cooperation between ASEAN and the European Council. AEEMTRC spent around four years to complete the first master plan on natural gas development and utilisation in the ASEAN region, which was endorsed by ASEAN energy ministers in 1996. At the master plan's completion, ASEAN members were encouraged to study its implications for their own domestic natural gas development plans.

Since the endorsement of this first master plan in 1996, the TAGP Project had been mentioned in each of the joint ministerial statements up through 2005. In the 17th AMEM (1999), for example, ministers noted the substantial impacts of the Asian financial crisis on joint collaborative projects in energy sector, particularly the TAGP. In the 20th AMEM (2002), they signed the ASEAN Memorandum of Understanding on the TAGP Project, which provided the cooperative framework for a public-private partnership and collaboration on project implementation. In the 23rd AMEM (2003), they welcomed the establishment of the ASEAN Gas Consultative Council (AGCC) and the ASCOPE Gas Centre (AGC) and explained how the establishments support the implementation of TAGP Project. However, the last two ministerial statements (2006 and 2007) indicate that the energy ministers had shifted their discussion of the TAGP Project into a general project development review under the energy cooperation and integration section. This suggests that the priority has fallen at the ASEAN ministerial level for development of a multinational natural gas pipeline network.

Though ASEAN energy ministers may have faltered in their support for TAPG in recent years, the ASEAN leaders themselves seem to have strengthened their recognition of the project. According to the ASEAN's plan for economic integration by 2015 from the 13th ASEAN summit in November 2007, ASEAN leaders agreed to push for TAGP in order to bring the project back on track. [d]

[d] *Krismantari 2007*

Support from individual member governments is another key to the implementation of specific TAGP projects. As the TAGP has up to now been built upon bilateral agreements between just two ASEAN members at a time, domestic government plays an important role in coordinating the natural gas pipeline projects within its own economy. The bilateral agreement for the Thai-Malaysian gas pipeline project, described below, is a good example of how determined domestic government action has rescued projects that faced extensive delays.

ECONOMY

In order to bring economic benefits to both the natural gas supplying and consuming economies, each segment of the proposed natural gas pipeline network undergoes a detailed feasibility study to analyse both benefits and negative impacts. Such studies generally examine the current and future economic situation and natural gas demand, presenting the possible outcomes if

the proposed pipeline segment were constructed based on these macro-level forecasts. However, such forecasts are notoriously difficult, especially given economic or political instability.

For example, following the Asian financial crisis, the proposed natural gas pipeline between Indonesia's Natuna field and Thailand was cut from the second master plan (2001) in part because the Thai government expected a slowdown in natural gas demand growth. [e] Nevertheless, natural gas demand in the ASEAN region has actually increased robustly in recent years, so much so that regional natural gas resources are not expected to be sufficient to fully support natural gas demand; the ASEAN region as a whole is now expected to become a net gas importer by 2030. [f]

[e] *Alexander's Gas and Oil 2001*

[f] *based on ASEAN statistical yearbook 2006 and APERC estimates*

Another economic challenge faced by the TAGP Project are the long project cycles required. By the time construction is scheduled to begin, the original economic feasibility studies might already be out of date in regard to energy market and technology development. For example, the ASEAN Plan of Action on Energy Cooperation (APAEC), covering the period 2004-2009, identified seven potential natural gas pipelines. Excepting the proposed Indonesia-Malaysia-Philippines pipeline and the proposed Malaysia-Thailand Joint Development Area pipeline, the remaining five proposed pipelines have completed detailed feasibility studies and are scheduled to be currently engaged in construction. However, there is little evidence of progress in construction for these projects, though PETAMINA and PSC Partners have been asked to conduct a detailed feasibility study for development of the East Natuna Gas Field, an area linked to four of the proposed seven pipelines in the TAGP Project. [g]

[g] *US embassy at Jakarta 2001*

ENERGY INDUSTRY AND TECHNOLOGY

From a technical perspective, natural gas transportation for regional trading is largely done either through pipelines or by ship as liquefied natural gas (LNG), and therefore pipeline natural gas must compete with LNG for investment and technology development. At the inception of the TAGP Project, LNG transportation was relatively unattractive at its stage of technology development; it was mainly economically feasible for natural gas transportation over distances of roughly 2000 kilometres. However, recently, the economic range of transportation for LNG has fallen enough to be competitive with pipeline natural gas over the shorter distances required by some segments of the TAGP Project. Therefore, the economic viability and the competitiveness of the proposed natural gas pipelines are questionable as some of the feasibility studies were completed more than five years ago. For example, the feasibility study of the natural gas pipeline between Indonesia's West Natuna and Malaysia's Duyong was commenced in 2000 and the project was expected to commence the development in 2001 and come into operation in 2002. However, there has been little tangible progress on this segment since completion of the feasibility study. [h]

[h] *Mohd. 2005*

At this point, questions regarding the economic attractiveness of the TAGP Project could be answered through substantial private sector participation. However, up to now, private sector participation has been largely limited to attendance of TAGP workshops or forums and has not included substantial investment on the past eight cross-border pipelines. Instead, investment in these pipelines came primarily from state-owned energy companies, which in some cases hold monopolies on distribution in their own economy.

To address this, the TAPG Project has tried to encourage private company involved in the infrastructure projects. According to the working program of TAGP Project under APAEC for the period 1999-2004, a joint venture company was supposed to be created in order to provide equity investment for implementation of the TAGP Project. This joint venture was also expected to help build a more transparent and competitive gas market environment in ASEAN region by providing assurance for private sector investments in the TAGP Project. However, as of 2008, no such public-private joint venture company has been established under the TAPG Project. The total investment requirement for the TAGP Project is estimated to be USD 7 billion. [i] With such a substantial investment requirement, project organisers hope that the private sector will contribute to finance and implementation of the pipeline infrastructure projects.

[i] Yunus 2003

SOCIETY AND THE NATURAL ENVIRONMENT

Elements of the TAGP Project have faced social opposition in the past, in part based on local natural environment concerns. Past experience in this area suggests that if domestic governments and other project stakeholders consider civil society concerns and act promptly and accordingly, the project will have a greater chance of successful implementation. An example of this is the bilaterally-based Thai-Malaysian gas pipeline project.

This project, which involved the construction of a 270 kilometre natural gas pipeline and a gas separation plant, was to be developed by Trans Thai-Malaysia Limited (TTM), a joint venture company between Thailand's state-run Petroleum Authority of Thailand (PPT) and Malaysia's Petroliam Nasional Berhad (PETRONAS). However, due to the strong opposition from environmental activists and affected villagers in Thailand, the project did not start construction in 2001 as originally scheduled. Members of civil society were opposed to the project, as it would damage the local natural environment, in particular destroying some food sources. After a two-year demonstration, the Thai government requested TTM to submit additional environmental impact assessment report information to the affected villages in southern Thailand. Ultimately, the Thai government intervened to re-route the natural gas pipeline in order to lessen opposition. Construction on the project eventually began in the second half of 2003 and the pipeline itself was commissioned in 2005.

ORGANISATIONAL STRUCTURE

One TAGP-specific task force and two broader supporting centres are responsible for easing the implementation of the TAGP Project: the TAGP Task Force (TAGP-TF), the ASEAN Gas Center (AGC), and ASEAN Gas Consultative Council (AGCC), respectively. The operation and management of TAGP-TF and AGC is lead by Malaysia's PETRONAS.

TAGP-TF carries out administrative activities related to the TAGP Project, such as preparing the ASEAN memorandum of understanding on TAGP, organising meetings, and holding forums and workshops. TAGF-TF cooperates with AGC on TAGP Project implementation, receiving technical advice related to natural gas development in ASEAN region, strengthening the exchange of information and experience among ASCOPE members, and facilitating technology transfer as appropriate. The AGCC, in turn, acts as an advisory body to facilitate and assist AGC in its duties, particularly with regard to regulatory and institutional frameworks for cross-border supply, transportation, and

distribution of natural gas in ASEAN region. In this sense, TAGP organisational responsibility is somewhat diffused across various related entities.

Structurally, though the TAPG Project is carried out under ASEAN, individual proposed natural gas pipeline segments are actually generally implemented based upon bilateral agreement between two members. TAPG, then, seeks to integrate these existing or proposed natural gas pipelines among ASEAN members into a single regional gas pipeline network. Considering this, it is difficult to assess the additionality of the TAPG IEI itself versus segment-by-segment bilateral infrastructure construction projects, as both activities are closely related. Future plans, however, do call for the construction of cross-border pipeline infrastructure on a truly multilateral basis, which will bring the TAGP Project's approach more in line with the aims of other infrastructure cooperation projects around the APEC region, such as the Northeast Asian Gas and Pipeline Forum (NAGPF), which hopes to standardise cooperation agreement among China, Japan, Korea, and Russia.

OBSERVATIONS ON IEI EXPERIENCE

The TAGP Project has historically had sufficient support from ASEAN governments, including financial support for construction of the cross-border pipelines through the state-owned energy companies and political support in settling environmental conflicts on natural gas pipeline routing. ASEAN governments are continuing to cooperate to harmonise and standardise domestic legal and regulatory frameworks, operation and maintenance guidelines, safety standards, and environmental guidelines. In fact, with such support from ASEAN governments, and considering the value of this ancillary work which goes into the project, TAGP could conceivably continue into the future even without further construction of natural gas pipelines. So while the existence of the IEI itself is not in question, it will be important for TAGP to adapt to the changing market environment of the ASEAN region if the planned infrastructure is actually to be built. This will require the project to shift from being largely politically-driven to becoming more economically-driven.

In the past nineteen years, the eight completed cross-border pipelines were built with financial support from ASEAN's state-owned energy companies. However, now, the continuation of financial support from these state-owned energy companies is uncertain due in part to natural gas market liberalisation in some ASEAN markets such as Singapore and Indonesia. With a liberalised market, there will be increased pressure to select projects based on their economic merits instead of government directives. Moreover, once energy companies become privatised, they are free to develop their own investment strategies according to the market situation. Therefore, the proposed natural gas pipelines in the TAGP Project will need to have more attractive economic returns so as to encourage private investment from these and other entities.

NORTHEAST ASIAN GAS AND PIPELINE FORUM (NAGPF)

MISSION

▪ To promote the construction of a natural gas pipeline network in the Northeast Asian region

MECHANISMS

▪ Organises the annual International Conference on Northeast Asian Natural Gas and Pipeline with sponsoring organisations
▪ Conducts collaborative R&D in order to facilitate discussions on barriers and problems for international natural gas pipeline development in the Northeast Asian region
▪ Provides policy recommendations on natural gas development to international organisations and governments

1995, MARCH	1st International Conference on Northeast Asian Natural Gas Pipeline (NANGP) held in Tokyo, Japan
1996, SEPTEMBER	2nd International Conference on the NANGP held in Beijing, China – adoption of proposal to form the "Northeast Asian Gas & Pipeline Forum (NAGPF)"
1997, NOVEMBER	3rd International Conference on the NANGP held in Seoul, Korea – formal establishment of NAGPF
1998, AUGUST	4th International Conference on the NANGP held in Ulaanbaatar, Mongolia
1999, JULY	5th International Conference on the NANGP held in Yakutsk, Russia
	Decision to begin international collaborative research activities
2000, SEPTEMBER	6th International Conference on the NANGP held in Irkutsk, Russia
	First NAGPF international joint research theme, *A long-term vision of natural gas trunkline in Northeast Asia*, is published
2001, DECEMBER	7th International Conference on the NANGP held in Tokyo, Japan
2004, MARCH	8th International Conference on the NANGP held in Shanghai, China
	Second NAGPF international joint research theme, *Analysis on natural gas market, resource, and pipeline in Northeast Asia*, is published
2005, SEPTEMBER	9th International Conference on the NANGP held in Seoul, Korea
	Third NAGPF international joint research theme, *A long-term vision of natural gas infrastructure in Northeast Asia*, is published
2007, SEPTEMBER	10th International Conference on the NANGP held in Novosibirsk, Russia
	Fourth NAGPF international joint research theme, *A long-term vision of natural gas infrastructure in Northeast Asia, 2007 version*, is published

27.1 **NAGPF milestones**

IEI secretariat and APERC 2008

ACTORS

The NAGPF is a civil society "non-governmental" organisation with financial support derived mainly from its members, categorised as "ordinary" and "sustaining" members. Ordinary membership is open to government and other civil society organisations in Asia, while sustaining membership is restricted to the private sector. Members pay annual membership fees of USD 100 (ordinary) or USD 1000 (sustaining). As of 2008, ordinary members include the Asia Gas & Pipeline Cooperation Research Centre of China (AGPRCC), Mineral Resources and Petroleum Authority of Mongolia (MRPAM), Korea Pan-Asian Natural Gas & Pipeline Association (KPGA), Asian Pipeline Research Society of Japan (APRSJ), and the Asian Pipeline Research Society of the Russian Federation (ROSASIAGAS) (a cooperation of JSC Sakhaneftegaz in Sakha Republic, and the Siberian Branch of the Russian Academy of Sciences' Energy Systems Institute in Irkutsk, Russia). Sustaining membership is freely open to any private organisation.

The IEI hosts the International Conference on Northeast Asian Natural Gas Pipeline every 1-2 years to facilitate information sharing on natural gas policies, market and technology development, and other discussion on issues related to a regional pipeline network. Since the fourth conference in 1998, the event has been hosted as a collaboration between the NAGPF and its members. Conference participation is open to NAGPF members as well as any other interested members of society, though there is a fee to attend.

NAGPF members are generally characterised by a shared view that the proposed international natural gas network would have positive socio-economic impacts among Northeast Asian economies in terms of global and local environments, energy market competition, energy security, the diversification of energy demand structure, and the creation of mutually dependent relationship among involved economies. [j]

[j] Abe 2001

PROGRESS

In 1993, interest arose among energy industry representatives in Japan and Korea for pipelined natural gas from Russian resources to supply economies in Northeast Asia. Pipeline gas development was expected to foster regional economic development across Northeast Asia and to enhance energy supply security in its role as a complement to the existing liquefied natural gas (LNG) trade. This interest instigated discussion on construction of a "trans-Asian" natural gas pipeline network. The first International Conference on Northeast Asian Natural Gas Pipeline was held in Tokyo in 1995 with around 120 participants drawn primarily from Japan, China, Korea, and Sakha Republic of the Russian Federation. This conference was hosted by the National Pipeline Research Society of Japan, a body originally established under the Mitsubishi Research Institute to promote a Japan-Asia natural gas pipeline network. In 1997, the NAGPF was established as a not-for-profit civil society organisation to promote the construction of the network and to provide a channel for capacity building and research.

Between 1993 and 2007, ten international conferences were organised around the Northeast Asian cities, included Yakutsk, Irkutsk, and Novosibirsk in Russia, Beijing and Shanghai in China, Ulaanbaatar in Mongolia, Seoul in Korea, and Tokyo in Japan. In addition, four research reports were published by the NAGPF focusing on historical and future energy trends of each participating Northeast

Asian economy, regional natural gas supply and demand, and the long-term vision for natural gas infrastructure.

GOVERNMENT

Over the past fourteen years, the NAGPF has tried to induce government involvement in the pipeline project. Members had hoped that the APEC Natural Gas Initiative, established by APEC energy ministers in 1998 to foster investment in natural gas supplies, infrastructure, and trading networks, might propose feasibility studies on pipeline projects in the APEC region.[k] However, no such cross-border natural gas pipeline feasibility study was proposed for Northeast Asia.

[k] *APEC EMM 1998*

Although there is no direct involvement from Northeast Asian governments on the NAGPF, there have been some indirect governmental actions in promoting discussion. For example, the Korea Energy Economics Institute, established as the economy's principal energy policy research organisation, organised a symposium on "Energy Cooperation in Northeast Asia" in 2001 and a conference on "New Partnership on Energy Cooperation in Northeast Asia" in 2005 to promote energy cooperation in the region.[l] The two meetings were supported by the Korean Ministry of Commerce, Industry and Energy.

[l] *KEEI 2007*

ECONOMY

The economic viability of the proposed natural gas trunklines from a single supplier in Northeast Asia under the NANGP is often criticised by energy experts, particularly if compared to LNG supplied on the global market. However, the NAGPF recognised this issue, declaring that while evaluating the position of pipelined natural gas in Northeast Asia, LNG and other energy resources should also be considered. Natural gas trading in the Japanese and Korean markets is dominated by LNG; Japan is the largest LNG importer in the world, and Korea is the second largest. Therefore, in the third and forth NAGPF joint research projects, the theme of study was broadened to cover all natural gas infrastructure in Northeast Asia instead of focusing exclusively on natural gas pipelines.

ENERGY INDUSTRY AND TECHNOLOGY

Under the NAGPF, discussions and feasibility studies on the natural gas infrastructure in Northeast Asia have helped to increase the transparency of the broader natural gas market in each Northeast Asian economy with regard to the economic development, energy policies, natural gas market development trend, and natural gas supply and demand prospects. This information has helped the private sector to identify investment opportunities in the region's natural gas market. However, a number of outside factors still limit private sector investment in the Northeast Asian gas market. For example, Russia does not allow private sector investment for export natural gas pipeline construction, and China's natural gas market is heavily publicly regulated with major oil and gas companies remaining largely state-owned.

SOCIETY AND THE NATURAL ENVIRONMENT

As NANGP is still in the early stages of development, social involvement is quite limited.

ORGANISATIONAL STRUCTURE

The NAGPF is operated under an executive committee which consists of representatives from the five ordinary members and is currently chaired by the president of the APRSJ. The APRSJ also acts as NAGPF secretariat. Its major duties in this position are to organise the annual international conference, manage the membership of NAFPF as well as provided information to any interested party, and document the exchange information on the conferences and research studies.

OBSERVATIONS ON IEI EXPERIENCE

The NAGPF has been a valuable platform over the past fourteen years for information sharing and capacity building through its organised conferences, participation in other international conferences and meetings, and its joint research publications. To this end, the NAGPF will likely continue to operate, achieving its mission to *promote* the construction of a natural gas pipeline network in the Northeast Asian region, even though there is little political support from the region's governments. Tangible realisation of an actual Northeast Asian pipeline network, however, is a different matter.

INTERNATIONAL PROJECT ON INNOVATIVE NUCLEAR REACTORS AND FUEL CYCLES (INPRO)

MISSION

▪ To support the safe, sustainable, economic and proliferation-resistant use of nuclear technology to meet the global energy needs of the 21st century on the basis of advanced nuclear technology and closed nuclear fuel cycle.

MECHANISMS

▪ Individual and collaborative research activity to develop methodology for assessing innovative nuclear systems (INS) and establish a set of recommendations for such assessments
▪ Cooperation with GIF, GNEP, and other international initiatives on nuclear technology development
▪ Leveraging IAEA's facilities with an aim to avoid duplication of other activities within IAEA

2000, SEPTEMBER	Initiated and supported by IAEA General Conference Resolution
2000, NOVEMBER	Preparatory meeting, terms of reference adopted
2001, MAY	Launch by steering committee
2003, JULY	INPRO inclusion into the regular budget of IAEA
2006, JULY	Approval for phase 2 terms of reference by INPRO Steering Committee
2007, JULY	INPRO manual for the assessment of innovative nuclear systems is published

31.1 **INPRO milestones**
IEI secretariat and APERC 2008

BACKGROUND

On a threshold of the 21st century nuclear energy was poorly regarded by civil society, largely out of scope for policy makers, and suffered from industry stagnation. Lack of political long-term vision for global nuclear energy use and social support drove leading nuclear economies in 2000 to make proposals to significantly improve international cooperation over long term nuclear industry development. Examples include GIF, proposed by leading technology holders and the US Department of Energy in early 2000, and INPRO, Russia's call to develop an international strategy for future nuclear energy systems on a global scale at the UN General Assembly in September 2000.

In fact, there were few pressing economic, social, or political reasons for changing the role of the nuclear industry at that time, apart from expert understanding of the nuclear industry's potential to meet long-term future energy and environment requirements. The need for improved concepts of environmentally safe, technologically reliable, and economically affordable nuclear energy among developed or developing economies had not become evident by 2000-2002. INPRO began in late 2000, only one year after international oil prices fell below USD 10 per barrel, and at a time when the average crude price band fluctuated between USD 23-28 per barrel under the strong influence of OPEC. Safety-related issues plagued the nuclear industry alongside a significantly diminished military nuclear industry in Russia and USA. In Denmark, Germany, and Sweden, debates over nuclear energy led to government decisions to eventually eliminate nuclear facilities. Development of the global nuclear industry nearly ceased. Non-proliferation and security measures were already in place in 2000; however, terrorism-related fears were not yet ignited by September 11, 2001 World Trade Centre attacks. As Kyoto Protocol ratification progress proceeded, and international discussions took place on climate change issues, further development of nuclear power seemed one of the most valuable alternatives to support sustainable development. There was the potential for nuclear industry that such an acknowledgement could promote financing and recognition of its importance as key source for domestic energy supply. However it was decided that inclusion of the nuclear industry under Kyoto's CDM was not viable due to the short binding commitment period of the Kyoto Protocol, proliferation and social concerns, and the carbon market incompatibility for traditional nuclear power facilities measured in gigawatts, on one hand, with renewable and energy efficiency technologies, which hardly reach megawatts scale, on the other hand.

OVERVIEW

The major reasons for establishing INPRO were discrepancies between the technological potential of nuclear energy utilisation and its perception in the civil and public sectors. To this end, INPRO is a multilateral international cooperation to reduce risks for future nuclear industry development by improving social support and political willingness through transparency and international uniformity of the methodology to assessment safety, security and proliferation resistance of innovative nuclear systems. Additionally, it included capacity building objectives for policy makers and academia, especially for developing technology using economies. Future user requirements developed with the participation of technology end users are another essential element of INPRO.

ACTORS

In May 2001, ten IAEA member states joined the INPRO initiative, three of them from the APEC region (China, Korea, and Russia). As of December 2007, 28 IAEA member states or entities had become members of INPRO, eight of them from the APEC region (Canada, Chile, China, Indonesia, Japan, Korea, Russia, and USA). This growing participant list suggests strong global interest in this IEI and its approach.

INPRO was intended to create a coalition of energy consumers who consider nuclear energy as an important option in the future energy supply. One important feature of the IEI is the participation of all relevant stakeholders, including both technology users and technology holders. Technology users are interested in broad-based assessments of the ways that innovative nuclear systems should be introduced. Technology holders, on the other hand, seek both to improve understanding of user requirements and to synchronise their own technological and policy approaches towards future nuclear systems within the vision of the international framework.

The results of INPRO activity are available for any interested IAEA Member, without discrimination. In this sense, formal participation in this initiative is not compulsory in order to access information and results obtained. However, direct participation in collaborative research and the technology dialogue is nevertheless valuable, as this effort will be reflected in decreasing decision making risks among interested parties and in improving social and political confidence in future nuclear energy industry designs. Since 2003, the IAEA has included INPRO in its regular budget, though the major cost of collaborative projects continues to be funded by member governments.

Being under the IAEA brings advantages to INPRO stakeholders. Specifically, inter-department assistance within IAEA and its capacity building facilities strengthens INPRO methodologies developed to deal with safety, security, and proliferation issues. INPRO explicitly acknowledges the work of other contemporaneous IEIs which deal with nuclear technology development such as the Generation IV International Forum (GIF) and Global Nuclear Energy Partnership (GNEP) and seeks to avoid duplication of their efforts. This is monitored by IAEA's political and organisational institutions, including the general assembly, and through operational management.

PROGRESS

INPRO had a quick start after the Millennium Summit of the United Nations in September 2000. At that time, the IAEA general conference invited, "all interested Member States to combine their efforts under the aegis of the Agency in considering the issues of the nuclear fuel cycle, in particular by examining innovative and proliferation-resistant nuclear technology." In response, the IAEA in November adopted the INPRO terms of reference, and in May 2001 the IEI was formally launched by the steering committee.

INPRO's initial activity during phase 1 in 2001-2006 was focused on the development of assessment methodology for an "Innovative Nuclear Energy System" (INS). This activity adopted a holistic approach to compare different INS in order to find a preferred configuration consistent with the sustainable development of a given economy. Key considerations in determining the appropriate INS included: improvements to safety; security; proliferation

resistance; economics, and; specific requirements of potential nuclear power users. The advantage of this methodology was seen to be its user requirement focus and applicability for either developed or developing economies. The resulting documents describing INPRO's draft methodology were published in 2006-2007.

INPRO's phase 2, active since 2006, concentrates on incorporation of this draft methodology to explore scenarios for INS development on a national, regional, and global scale. This phase also involves the incorporation of INPRO member feedback regarding the assessment methodology as a result of other collaborative member studies. Special emphasis is put on the needs of developing economies and the provision of support to INPRO members in capacity building and decision making.

GOVERNMENT

The changing political and economic landscape has led to increased public-sector interest in INPRO, and five more APEC economies have joined since IEI inception, bringing APEC participation in INPRO to eight among other twenty-eight entities as of 2008. The most important political factors for such increased interest have been the growing concerns over terrorism and proliferation, energy security, and the social shift towards prioritising global climate change over other nuclear power-related local environmental or safety concerns.

These factors have significantly increased their weight and priority in the political decision-making procedure since the inception of INPRO in 2000. Indonesia, Thailand, Vietnam and potentially other APEC economies have expressed their intent to introduce nuclear power alongside the gradual expansion plans being implemented in economies such as China and India. For these economies, INPRO could facilitate understanding and development of internationally accepted assessment methodology for nuclear energy systems, as well as offer input towards technological, financial, human resource, and regulatory aspects of the issue. The INPRO format, which emphasises cooperation among nuclear technology holders and developing economies, also helps to build trust within international political community over nuclear power development issues. To this end, the annual consensus on the positive role of INPRO reflected in proceedings of the annual IAEA general conference is one indicator of high-level political support for the INPRO initiative.[m]

[m] *IAEA news centre 2007*

ECONOMY

Major economic factors affecting INPRO progress include soaring energy prices and carbon markets or other potential GHG regulation. In so much that these phenomenon alter the international energy landscape, and that INPRO seeks to support more widespread development of the nuclear power by building a shared nuclear systems assessment framework, these economic factors therefore affect the progress and interest in INPRO itself.

Nominal oil prices have grown nearly tenfold, from less than USD 10 per barrel in 1999 to more than USD 100 per barrel in early 2008, inducing growth in the global energy supply as well as fuel diversification pressure. In addition to direct fuel costs, it has become clear in recent years that many economies now do or will soon face further sustained economic penalty on GHG emitting fuels through the adoption of international or domestic regulation. Simply put, already high primary energy cost combined with expectations for penalty on GHG

emissions in the power sector makes the nuclear energy option more economically attractive, even considering the cost of fuel cycle management.

Moreover, these conventional fuel price gains, along with other geopolitical factors, have heightened concerns for energy security internationally. As nuclear power is considered to be largely a domestic energy source, this increases its attractiveness among economies for whom energy security is a concern and encourages their participation in INPRO's activities.

ENERGY INDUSTRY AND TECHNOLOGY

From a technological perspective, the nuclear industry is currently concerned with the international vision towards development of: (1) a more efficient closed nuclear fuel cycle, and; (2) small-scale nuclear facilities.

A closed nuclear fuel cycle presents the opportunity to increase energy security while simultaneously improving sustainability of the nuclear industry. Introduction of a closed fuel cycle would effectively increase the nuclear resource base over time by allowing more efficient utilisation of energy contained in nuclear materials. Recycling of highly radioactive materials also significantly reduces their negative environmental impact. Therefore, development of such technology has potential to improve attractiveness of nuclear power to policymakers.

Small and intermediate sized reactors will be essential if nuclear power is to be a feasible option for economies or regions with small electrical grids. The average capacity of current nuclear reactors is in the hundreds of megawatts, while many designs for new third and forth generation reactors aim for even higher installed capacities. These large scales, however, are incompatible with small power grids, and inhibit the use of nuclear power in such areas. Achieving small capacity nuclear power technologies improves attractiveness for nuclear utilisation in developing economies in particular, and for nuclear industry it potentially opens broad new markets. It also offers the prospect of new, non-traditional applications of nuclear energy, including that of distributed hydrogen fuel production and water desalinisation.

INPRO provides a forum for nuclear industry technology holders to discuss with policy makers and technology user how these technological issues will be implemented in the long-term timeframe of the initiative. In turn, INPRO also supports coordination among economy-level policy makers to synchronise their visions for nuclear technology requirements and development over a broader international framework. This helps the nuclear industry as a whole, and, indirectly, individual technology holders, by improving the global prospects for all nuclear power development—and in particular among developing economies.

SOCIETY AND THE NATURAL ENVIRONMENT

Society continues to harbour concerns over the environmental and human health consequences of nuclear industry development, along with nuclear proliferation fears. One major purpose of INPRO is to address such fears by increasing transparency into nuclear industry evaluation methodologies and other issues. As INPRO adopts a "user requirement"-focused approach, and civil society "general public" is considered to be an indirect user of nuclear technologies, the INPRO process allows for social feedback to be incorporated into the development of assessment methodologies through two-way interaction between nuclear industry and civil institutions. Social factors are the background

onto which political will on domestic and international levels is based, thus INPRO can be viewed as an international undertaking to create favourable social and political context for nuclear industry development.

ORGANISATIONAL STRUCTURE

INPRO's organisational arrangement influences the tenor of the IEI's activities. Organised under IAEA, and with numerous IAEA nuclear experts available under its inter-departmental support umbrella, INPRO has a unique opportunity to incorporate the issue of proliferation resistance throughout its project activities. This, along with the open-access nature of IEI outputs, has given INPRO participation added value for technology holders and especially for technology users. Moreover, IAEA oversight adds authority to INPRO activities in the eyes of civil society and policymakers, and is an efficient means through which to establish senior level commitment and proper financial resources.

As INPRO's mission, objectives, and even members are related to both IAEA activities as well as other nuclear industry development IEIs such as GIF or GNEP, it is necessary to ensure that its mechanisms establish for itself a unique identity. Different IEI approaches to a similar problem are still valuable to the international energy community provided that related IEIs avoid duplication of efforts. INPRO has attempted to address this by focusing activities specifically on the development of a *comprehensive assessment methodology* for innovative nuclear systems. This focus was initially chosen because IAEA found its other nuclear research activities to be lacking such a unified evaluation tool. INPRO therefore compliments other IAEA pursuits while avoiding overlap. And externally, by refining its approach to being largely based on capacity building, rather than employing technical R&D or regulatory and infrastructure mechanisms, INPRO remains relevant alongside GIF, GNEP, and other nuclear IEIs. This is supported by regular assessment of IEI objectives and mechanisms in the form of establishing new terms of reference for different phases, amended and approved by member governments on the steering committee. This allows the IEI to reaffirm the suitability of its approach with regard to both other technology/ infrastructure-based IEIs as well as other international developments in the needs of its stakeholders.

OBSERVATIONS ON IEI EXPERIENCE

INPRO can be regarded as demand-side nuclear development IEI owing to its focus on nuclear user requirements. In this sense it complements market-internal activities by addressing the full social costs of nuclear power development. This is a model approach for other issue-focused capacity building IEIs in that INPRO does not attempt to duplicate or further private sector pursuits but rather supports market development over the long-term by addressing those issues which are difficult for the market incorporate on its own. This approach has also helped INPRO to retain a unique identity and value with respect to other, largely supply- or politically-driven, nuclear power IEI activity.

THE GENERATION IV INTERNATIONAL FORUM (GIF)

MISSION

▪ Lead the collaborative efforts of the world's leading nuclear technology nations to develop next generation nuclear energy systems to meet the world's future energy needs.

MECHANISMS

▪ Collaborative R&D projects on six identified future nuclear energy systems

2000, JANUARY	First meeting of the Generation IV International Forum (GIF) policy group
2000, APRIL	First experts group meeting
2001, JULY	GIF charter adoption
2002, DECEMBER	Technology road map adoption
2005, JANUARY	NEA/OECD support as technical secretariat begins
2005	Framework agreement adoption
2007, MARCH	First project arrangement signing

37.1 **GIF milestones**
IEI secretariat and APERC 2008

BACKGROUND

GIF is a technology-oriented long-term R&D collaboration taken by nuclear technology holders to preserve their international market positions. Many energy concerns faced by today's policymakers and energy industry are similar to those which drove the first wave of nuclear power development in the 1970s: the finite nature of fossil energy resources and access to them; growing energy demand; low overall efficiency in energy consumption; high energy prices. However, what has changed is the geopolitical context; today's approach to the development of future nuclear energy systems is more pragmatic. This shift is reflected in the evolution of GIF membership. At the early stages of the IEI, an anachronistic political outlook precluded Russian and Chinese participation. However, both these economies joined GIF in 2006, with China becoming a full member in early 2008. This new geopolitical environment has allowed closer international cooperation among nuclear industry technology holders.

ACTORS

Of the thirteen current GIF members (signatories to the GIF Charter) six are APEC economies – Canada, China, Japan, Korea, Russia, and USA. Russia and China were invited to join GIF in 2006, though Russia has not yet signed the framework agreement. By sector, members include both government nuclear agency officials and private/state-owned nuclear industry representatives.

The Nuclear Energy Agency of the OECD replaced the US Department of Energy as secretariat to GIF in 2005.

PROGRESS

In January 2000, the US Department of Energy Office of Nuclear Energy, Science and Technology, "convened a group of senior governmental representatives from… nine countries to begin discussions on international collaboration in the development of Generation IV nuclear energy systems."[n] The initial step for what would become a public-private partnership was to develop a technology roadmap to identify the concepts for advanced nuclear energy systems technologies for partners to work around. Six technology options were identified through this roadmap in December 2002 on the basis of economic, proliferation resistance and physical security attributes.

[n] GIF 2008

The basis for research cooperation established, the GIF framework agreement was signed by five of the then nine members in 2005. This framework agreement specifies the collaborative research mechanisms of the IEI and specifies the treatment of intellectual property generated under such cooperation.

The first project arrangement under GIF focuses on research of advanced fuels for sodium fast reactor (SFR) systems. This project began in March 2007, with collaborating partners from Euratom, France, Japan, Korea, and USA. Since then, two other project arrangements have been signed in the area of component design and balance-of-plant (CD&BOP) as well as a global actinide cycle international demonstration (GACID). Other projects arrangements have been proposed but have not yet begun activity.

GOVERNMENT

Since its inception, GIF has been strongly affected by political issues, namely a historical rivalry with INPRO. Initial GIF membership did not include "non-Western" economies such as Russia, India, and China, as they instead

participated in the Russian-led INPRO initiative under IAEA. Even today, GIF retains some distance from IAEA activities, with a secretariat based at the Nuclear Energy Agency of OECD (though NEA itself is an IAEA member). However, somewhat of a breakthrough occurred in 2006, which lead to mutual acceding of both initiatives' members; China and Russia joined GIF, and Canada, Japan, and USA joined INPRO (Korea was already member to both).

There could however be an element of political cost for membership in GIF in that there may arise misunderstandings of the nature and scope of this group's activities with respect to other international nuclear power development pursuits, such as those under IAEA. For technology users or civil groups concerned with nuclear power externality issues, GIF's approach may seem unwarranted given IAEA's internationally-established framework for nuclear cooperation.

ECONOMY

At a macro level, GIF by design most immediately benefits nuclear technology holding economies, though it is expected to also indirectly benefit nuclear technology users.

For technology holders, development of new nuclear power technologies is expensive. And though some economies have the ability and facilities to develop such technologies on their own, it is nevertheless economically attractive to then broaden the global market potential for such technologies. It is also attractive to reduce research cost itself by sharing responsibilities and experience under a multilateral cooperation framework protected by intellectual property controls. Both these points are exemplified by the development of advanced nuclear fuel cycles, where investment requirements will be equal to or exceed the total existing value of the nuclear power industry.[o] GIF addresses both these issues.

[o] *proatom 2007*

Technology users, though not directly involved in GIF activity, could nevertheless benefit by this initiative as well in that they will be able to employ more advanced nuclear technologies.

ENERGY INDUSTRY AND TECHNOLOGY

For the nuclear power industry, the long-term research objectives of GIF can be viewed as a welcome attempt to ensure the industry's relevance in comparison to other power generation alternatives, particularly with respect to environmental sustainability and energy security. The need to preserve or increase market share of nuclear power is reflected in the idling manufacturing and engineering capacities of the nuclear industry which could be utilised given the realisation of a closed nuclear fuel cycle at a global scale.

SOCIETY AND THE NATURAL ENVIRONMENT

Civil society has limited involvement in GIF activities. The initiative does not have specific social implications apart from the usual environmental, safety and security effects of nuclear energy utilisation. GIF's mission and objectives seek to directly address many such issues through its research designs.

ORGANISATIONAL STRUCTURE

As described above, the OECD Nuclear Energy Agency acts as technical secretariat to GIF, while initiative members contribute staff time and the use of facilities for events such as taskforce workshops and policy group meetings. The decision-making body for the initiative is a "policy group", supported by an

"experts group". This advisory body is able to rapidly assess changes in the international economic, political, social, and technological environments which affect the initiative and then recommend necessary policy-level amendments to the initiative's mechanisms, such as a change in stakeholders, projects structure, or implementation timetable. The effectiveness of this initiative's coordination and its ability to amend to a changing environment was demonstrated by its shift from a rival to complimentarily relationship with INPRO since 2006.

OBSERVATIONS ON IEI EXPERIENCE

GIF is driven both by public-business partnership in nuclear industry and international political cooperation to address energy security and environment issues. By maintaining a focused identity and flexible organisational structure, GIF was able to expand its reach by incorporating new members who had been involved in other related IEI activity. This unique identity was further strengthened by the adoption of mechanisms which ensured intellectual property protection of research outcomes. Both of these developments have helped to increase GIF robustness and international relevance in solving nuclear energy development problems over the long-term.

THE ENERGY CHARTER TREATY (ECT) PROCESS

MISSION

▪ "To promote energy security through the operation of more open and competitive energy markets, while respecting the principles of sustainable development and sovereignty over energy resources"

MECHANISMS

▪ Under the Energy Charter process the Energy Charter Treaty implementation is reviewed and new instruments and joint activities within the Energy Charter framework are considered.

▪ Provides a binding regulatory framework for energy investment and transit along the whole energy supplying chain

▪ Incorporates biding dispute settlement mechanisms among different stakeholder levels

▪ Establishes a process for amendments and expansion of such regulation, including an internal mechanism for peer review

1990, JUNE	Proposal for a "European energy community" at a European Council meeting in Dublin by Dutch Prime Minister Ruud Lubbers
1991, DECEMBER	Adoption and signing of the *[European] Energy Charter*, a political declaration on international energy cooperation
1994, DECEMBER	The *Energy charter treaty* (ECT) and the *Protocol on energy efficiency and related environmental aspects* (PEEREA) signed in Lisbon
1998, APRIL	ECT and PEEREA entry into full legal force, following the completion of ratification by the first thirty members
1998	Trade Amendment protocol aligns ECT trade provisions with those of the newly-established World Trade Organisation (WTO)
2004	First review of the Energy Charter process by the ECT Conference

41.1 **ECT milestones**

IEI secretariat and APERC 2008

BACKGROUND

The formation of the ECT is closely related to the geopolitical and economic context of the final days of the Cold War. The opportunity to secure energy supply from the former Soviet Union and thus lessen reliance on OPEC economies was attractive to West European economies. Transition of the then centrally-planned economies in Eastern Europe and the Soviet Union to a market economy had already begun, and flow of capital into emerging markets provided opportunities for investors from developed economies. The major energy-related issues were to secure sorely needed foreign investments in the resource-rich former Soviet Union and to develop energy transportation appropriate to the geographic circumstances of the region. Apart from these economic drivers, regional political stabilisation and mitigation of environmentally negative anthropogenic impacts were also important drivers for multilateral cooperation within these formerly antagonistic economic-political blocks. The leading approach to address such issues was recognised to be the establishment of principles and basic regulation on the most promising area for regional cooperation – energy supply from East to West Eurasia.

OVERVIEW

The Energy Charter Treaty (ECT) Process is the mechanism to implement and amend the ECT, an international binding regulatory framework for economic activity in the energy sector, addressing, "exploration, extraction, refining, production, storage, land transport, transmission, distribution, trade, marketing, or sale of energy materials and products." [P] International cooperation is based on the shared interest of governments and energy business to secure energy supply over the long-term. The basic objectives of the ECT are:

[P] ETC 2008

- protection and encouragement of foreign investments into energy sector along the whole energy supplying chain
- free trade in energy materials
- freedom of inland energy transit through fixed infrastructure such as oil and gas pipelines or power transmission lines
- increase of energy efficiency and environment protection
- creation of mechanisms for disputes resolution between economies or between investors and economies

Due to historical circumstances, the ECT focuses on the West Eurasian energy market, including the North Africa and the Middle East. However, potential ECT scope is not limited by this particular region, as it is an international regime without any specific geographical propositions.

The ECT Process is a bold case to illustrate the general established elements of IEIs; ECT aims to improve energy security by building confidence and trust among parties through binding regulation. The history of the ECT process is also well aligned with the general scheme of IEI life cycle. Establishing binding regulation on economic/ financial issues is one of the most complex tasks for multilateral cooperation but also one of the most effective, as it provides legal boundaries for business activity within the thus established market. Building trust among actors by reducing investment and energy transit risks through such regulatory framework allows a shift from politically motivated discussions to the more concrete economic realm.

ACTORS

The ECT process enables its participants to enhance multilateral regulation for energy-related activity, however the status of each participant depends on its obligations. The first step for participation in the process is signature of the *Energy charter* [political] *declaration*, "a mechanism for facilitating association and familiarity with the Charter process," which results in observer status for newcomers. The next step, membership, which allows participation in decision-making, describes those original signatories to the ECT or other entities to have since been invited to accede. Two out of seven ECT-involved APEC economies, Australia and Russia, have a special position among current ECT members. These economies, involved in the ECT process since the very beginning in 1991, have signed the ECT but not ratified it. Nevertheless, they are treated as ECT members and participate in negotiations. The table below presents the status of APEC economies with regard to participation in both the ECT and WTO. Note the status of Russia as ECT member (with provisional implementation) and WTO observer, while the regional entity EU is both ECT and WTO member.

Currently fifty one economies have signed the ECT, including three from the APEC region. All EU states are individual signatories, and the ECT has also been signed collectively by the European Union. Japan ratified the Treaty in 2002, and remains the only APEC economy to have done so. Australia, Belarus, Iceland, Norway, and the Russian Federation have not ratified the ECT, however Belarus and the Russian Federation have accepted provisional application in that "they have agreed to apply the Treaty to the extent that it is consistent with their own constitutions, laws and regulations." [q] Although the Treaty was conceived as a European initiative with a focus on "East-West" cooperation, the scope of the Energy Charter is now considerably broader. USA, Canada, China, Korea, and ASEAN from the APEC region now have observer status to the ECT process.

[q] *ETC 2008*

ENTITY	ECT MEMBER STATUS	WTO MEMBER STATUS
Australia	signatory member, not ratified	member
Canada	observer	member
China	observer	member
Japan	member, ratified ("contracting party")	member
Russia	signatory member, not ratified	observer
USA	observer	member
Korea	observer	member
EU	member, ratified ("contracting party")	
ASEAN, IEA, OECD, UN-ECE, World Bank, WTO	observers	
IEF	*Letter of understanding on cooperative activities* with the secretariat	

43.1 **APEC and major non-APEC international organisations with APEC economy membership involved in the ECT process**

ECT and WTO websites, Mar 2008

In general, the benefits of ECT for stakeholders are reduced risks of energy sector investments, a regulatory framework on energy trading for non-WTO members which is similar to that of the WTO, and regulation on inland energy transit. Additionally, experience with ECT provisions reduces development cost for domestic regulation as well as international bilateral investment agreements, which is particularly valuable to developing economies and those under

transition from centrally planned to a more liberal market economy. Associated costs for ECT adoption include the need to harmonise investment regulation on the domestic and sub-national levels among ECT stakeholders, including the reform of existing contradictory domestic legislation as necessary. This strong requirement to make important legal changes in order to reap the benefits of ECT implementation make membership unappealing for some economies on political grounds, and it has become a major obstacle for major energy producers to join ECT.

Many new observers who join the ECT process are interested in ECT's transit regulation provisions and the implications for their own regions. Before new truly multilateral integrated natural gas or power networks can be realised in the APEC region, the existing approach based on bilateral agreements may benefit from reconsideration. This is particularly true in Southeast and East Asia, where transit issues are at least no less important then investment risks.

GOVERNMENT

Government involvement in ECT is driven by the priority given by both energy importers and exporters to energy security and environment concerns. In fact, drivers for public sector involvement in the ECT are similar to those of the Kyoto Protocol: both IEIs seek to respond to the abuse of common resources in the *laissez-faire* status quo, lack of international accountability, and the limited reach of a single actor's (or coalition of actors') agenda on the international stage. Addressing energy security and environmental concerns by reducing investment and transit risks through establishment of a robust binding multilateral regime (in the case of ECT) or developing financial mechanisms (Kyoto protocol case) provides a better environment for international relationships and contributes to trust building among partners. Thus energy cooperation itself becomes a geopolitical factor.

Like the Kyoto Protocol, ECT has faced the need to balance the strength and reach of its legally binding provisions with actors' willingness to participate so as to maximise impact. In 1977, then de-facto president of USSR Brezhnev proposed an extension of the Helsinki political process for Europe to the economic sphere by leveraging waste energy resources in order to secure West European energy supply. This proposal, however, was mainly focused on the construction of infrastructure; political prerequisites for establishing a more ambitious regulatory regime for energy cooperation in Europe were not favourable at that time. The window of political opportunity for introduction of a legal framework to secure energy supply from Central Eurasia appeared only by the early 1990s. With the understanding by ECT process actors that this window of opportunity could soon close, serious compromises were made to preserve the rapid pace of negotiations.

However such compromises were so important that have to this day prevented some actors from signing or ratifying the ECT. The most important compromise was (and still is) the decision to postpone agreement on the pre-investment regime*, an issue which is still unresolved and which somewhat handicaps the final result but which, on the other hand, allowed the treaty to be signed in the first place. Other unresolved issues include agreement to an extended protocol on energy transit by means of fixed infrastructure.†

And though there continues to be hesitation over elements of the ECT itself, international political support to the ECT process has nevertheless been demonstrated at the very highest political levels. For example, the formulation of

* *The "Supplementary Treaty", prepared for signatures but shelved indefinitely*

† *The "Transit Protocol"*

the principles for energy cooperation of the G8 *St. Petersburg Plan of Action* is practically unchanged from those used by the *Energy Charter Declaration*. [r] Moreover, the ongoing ECT process is supported by interaction with other global and regional undertakings on energy cooperation (such as ASEAN, IEA, IEF, OECD, and WB), and the number of members and observers is steadily increasing. This should help improve general international understanding and effectiveness of regulation on energy-related economic activity.

[r] G8 2006

ECONOMY

The ECT is a compromise between the desire to establish binding multilateral agreements in the energy sector and the complexity of economic issues that can be raised. Before implementation of the ECT, there already existed sophisticated and rather harmonised domestic investment regulation among developed economies, complimented by a dense set of bilateral agreements as well as international borrowing and dispute settling institutions. The early ECT process, then, was focused on the transition to a market-oriented approach for the former centrally-planned East European economies which lacked private investment regulation.

In order to soften sharp differences on fundamental issues among participants to the ECT negotiation process, an early compromise was reached to postpone the pre-investment regime to the later stages in the ECT process so as to speed the pace of negotiation and gain political momentum. Thus, binding regulation was restricted to investments which were already made. A decade later, however, this decision returned to vex the ongoing ECT process with sluggish negotiations over gas transit, nuclear fuel trade, and visions of energy industry liberalisation between the EU and Russia.

ECT members – whether WTO members or not, whether energy supplying, transit, or consuming economies – have benefited from the uniform application of rules governing the multilateral energy trading system after ECT amendments were adopted in 1998 to harmonise the Treaty with the WTO regime. In this sense, the ECT can be viewed as a "soft" version of WTO as it deals with a narrower scope than the WTO coverage of legally binding tariff commitments and trade-related intellectual property rights issues, while replicating WTO provisions for trade of energy.

Currently there are many fewer concerns over investment risks for East European economies due to their accession to the WTO (and subsequently to the EU), along with further synchronisation of domestic regulation within the EU. Despite this, energy transit and investment issues are still important in the current environment of growing energy demand, resource nationalism, political turbulence, and financial vulnerability.

ENERGY INDUSTRY AND TECHNOLOGY

ECT addresses two major issues apart from energy trading rules (which are now harmonised with WTO provisions): (1) investments, and; (2) transboundary energy deliveries through specialised inland infrastructure.

Investments

Energy sector projects are capital-intensive and often have strategic importance, thus investment risks have to be assessed over the long-term. A key factor to reduce such investment risks and pave the way to the smooth energy

business development is binding regulation considered at both pre- and post-investment stages. This is true on a domestic level, and it has proven to be important on the international stage.

As the ECT is a multilateral regime, some might suggest that it is thus most suitable for small- and medium-sized business entities. From a "realist" perspective, multilateral regulation provides less flexibility for more powerful actors comparable to bilateral agreements, where their power could be more strongly leveraged. Most capital intensive energy infrastructure projects are in primary energy extraction, transformation, and transportation, thus requiring powerful private or public business entities like ExxonMobil, Shell, Gazprom, or PetroChina. Distribution and consumption of final energy, however, is much less capital intensive, thus attracting more small- and medium-sized companies. Additionally, those from developed economies will have advantages over similar companies from developing economies simply due to their body of accumulated experience of operating in the international liberalised market.

Evidence for this is clearly seen in ECT. Thomas Walde, editor of *The Energy Charter Treaty: an East-West Gateway for Investments and Trade*, suggests, "…the ECT is not for major companies but small- and middle-sized companies, which have much weaker political influence and thus less capability to deal with political risks." [5] This opinion is reflected by the behaviour of the USA on a political level and Russia's Gazprom on a business level. Both actors prefer to rely on bilateral agreements which contain individual preferences, rather then on multilateral regimes, where their leverage is diminished. The table below gives status of ECT membership, energy export position, and energy industry advantages for various related economies. Note that major energy producers and exporters are less enthusiastic for the ECT regime then net energy importers or economies with important energy transit through their territory.

[5] *Walde 1996*

ECONOMY	ECT MEMBER STATUS	NET ENERGY IMPORT AS PERCENT OF TPED (2005)	COMMENTS
Australia	signed, not ratified	(122)	Not dependant on energy transit
Canada	not signed	(49)	Natural energy exporter to USA, not dependant on energy transit
Denmark	signed and ratified	(56)	EU member
Netherlands	signed and ratified	26	EU member
Norway	signed, not ratified	(628)	Natural energy exporter to EU
Russia	signed, not ratified	(82)	Natural energy exporter to EU, heavy reliant on energy transit
Turkmenistan	signed and ratified	(276)	Landlocked, heavy reliant on energy transit
Ukraine	signed and ratified	42	Provides 70 percent of Russia's natural gas transit
UK	signed and ratified	13	EU member
USA	not signed	30	Has other investment arrangements through bilateral trade and investment agreements
Uzbekistan	signed and ratified	(20)	Landlocked, heavy reliant on energy transit

46.1 **Major energy producers and exporters involved in the ECT process**

ECT secretariat and IEA energy balances for OECD and non-OECD countries, 2008

The current global economic environment, much changed since the 1994 signing of the ECT, brings new facets to the investment issue. Changes in political (former East European economies' accession to the EU) and economic (growth of energy production and general high rate of economic development in former USSR economies) frameworks have amended the priorities for major ECT actors such as EU and Russia. Due to soaring oil prices since 2003, investments are now made on the basis of extensive windfall capital in the former USSR. The issue has became even more complicated in that "oil money" accumulated in state-owned sovereign funds now targeting investment in developed economies requires its own protection against political, expropriation, and other risks.

Energy Transit

The increasing role of energy transit highlights the need for appropriate regulation. ECT is the only binding multilateral agreement that directly addresses the complex political, economic, and legal problems associated with energy transit. The importance of energy transit tariff regulation in ECT was emphasised in January 2006 and again in December 2007, when disputes over Russian natural gas transit to the EU through Ukraine and Belarus emerged, despite all involved economies being ECT members (though, again, with Russia and Belarus applying the ECT only "provisionally"). Energy demand is growing and possible new sources of energy supply are geographically distributed, with much remaining untapped oil and natural gas situated in remote and landlocked areas like the Caspian region and Siberia. The average distance for energy transportation toward consumers in Europe will rise. Sustained growth in international energy trade will lead to an increasing role for capital-intensive pipelines and power transmission lines, which, due to the geography of energy supply and demand in Europe, must cross multiple national borders and jurisdictions. Understanding the rising importance for energy transit regulation is also important for the rest of Eurasia outside Europe, including Southeast and East Asia.

However, the changed political map of the European continent and expansion of the EU to the East has driven questions of the definition of energy transit, with special regard to double membership of EU economies under ECT. The former East-West border has shifted farther to the East and thus the destination point for Russian gas now falls within the middle of EU territory. However, EU and its major business partner in gas supply, namely Gazprom, have different interpretations regarding this transit issue, and particularly how to reconcile the application of transit regulations for the EU as a whole versus individual EU economies. EU has the same membership representation in the ECT process as ordinary EU economies, and transit disputes have eventually come to a confrontation over industry liberalisation between the EU and Russian Federation. Different approaches to structuring the gas industry by the EU and Russia lead to disagreement on the applicability of regulation within EU territory, thus postponing adoption of the transit protocol and Russian ratification of the ECT in general.

SOCIETY AND THE NATURAL ENVIRONMENT

The ECT process of bringing former centrally planned economies into the market facilitates significant changes in the political, social, and economic environment within these "transitional" economies. The purpose of the ECT process to achieve secure energy supply, "through the operation of more open and competitive energy markets, while respecting the principles of sustainable

development and sovereignty over energy resources" contributes to a broader social desire for a healthy and wealthy life. The social factor of the ECT process thus could be seen as important tool for progress assessment, mediated through the political sphere. This indirect input is absorbed by ECT member governments and consequently affects decisions throughout the whole ECT process.

Initial discussion on the ETC sought to explicitly expand the regulatory framework to include environmental issues alongside those for investment and trade. However, with adoption of the Kyoto Protocol, environmental provisions were diminished to essentially information sharing and capacity building activities. Nevertheless, the fundamentals for these environmental provisions are still encapsulated within the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) and could be enhanced over the course of the ECT process.

ORGANISATIONAL STRUCTURE

The organisation and institutional structure of the ECT process is prescribed in Part VII, Articles 33-37 of the ECT, which define elements of the ECT process and its implementation mechanisms. Such mechanisms include: negotiations on additional protocols or declarations to the ECT; the ECT Conference, a decision making body which reviews the whole ECT process on a regular basis; the ECT secretariat, which is in charge of ECT implementation management, and; voting and funding principles.

An important feature of the ECT is a built-in procedure for self review. This establishes a regular review of the ECT process whereby at intervals of not more than five years, "the Charter Conference shall thoroughly review the functions provided for in this Treaty in the light of the extent to which the provisions of the Treaty and Protocols have been implemented. At the conclusion of each review the Charter Conference may amend or abolish the functions (of the Charter Conference itself) and may discharge the Secretariat." Such review helps to ensure the efficiency of the ECT process by considering the adequacy of ECT mechanisms and objectives with respect to their changing environment. The review's recommendations provide the ECT Conference with insights on incompliance and the actions needed to persevere towards the original ECT process mission.

Active coordination is undertaken to keep the ECT process moving forward. Fulfilling its charge to provide, "all necessary assistance for the performance of ECT Conference's duties," the ECT secretariat conducts research activity, particularly on international oil and gas pricing mechanisms. To assist in the drafting of model agreements for cross-border oil and gas pipelines, the ECT secretariat set up a legal advisory task force in 2001. In 2004 an industry advisory panel was established by the ECT Conference to strengthen the dialogue with the private sector to act, "as a consultative board to the Energy Charter Conference and to the various Working Groups, and provide advice on relevant issues related to energy investments, cross-border flows and energy efficiency."

The institutional principles of ECT are important in keeping the ECT process in motion while allowing agreement to be reached through negotiations. Allowing interested economies to become a participant in discussions over the ECT provisions once adopting the political principles of the Energy Charter seems to work well as it encourage the participation of both energy exporters and importers in the negotiation process, without the need to take binding obligations.

Of course, consensus is compulsory to achieve the legally binding agreement. However, to reach such consensuses great political willingness and additional time are needed to finalise negotiations, as they become exponentially complicated with an increasing number of actors. The ECT process has dealt with this problem pragmatically in the past by, for example, detaching Russian-EU reconciliation over uranium trade from the umbrella of the ECT process. This helped to keep the whole ECT process alive despite this significant obstacle. Doing so reduces the number of participants involved in negotiation, while keeping the stakes high for reaching a sound and useful compromise.

A long list of international organisations are observers to the Energy Charter Conference, including ASEAN, EBRD, OECD (+IEA), UN-ECE, WB, and WTO. Such wide range of political, trade, and investment international institutions demonstrates the importance of the ECT process mission within the international energy community.

OBSERVATIONS ON IEI EXPERIENCE

Political and energy industry drivers for the initiative

As described above, documents of the 2006 G8 Summit which tie political goals to market characteristics of energy industry quote principles of the Energy Charter political declaration almost directly. Given this recognition, the ECT process can be viewed as a market-external collaborative activity where the mission is to create, (re)shape, and guide energy market development toward energy security. It is an international multilateral effort to build a binding foundation for such objectives, based on principles of open, competitive markets for energy-related activity and sustainable development. However, the experience of the ECT process shows that the bridge between adoption of political principles and agreeing to binding obligations is a long one.

The West Eurasian region is a good case to deal with the types of issues raised in the ECT process – from resource access, through energy transit, to energy consumption emphasising the shift from political engagements to economic priorities. Energy industry economic fundamentals for energy suppliers, energy consumers, and transit economies in West Eurasia demand a reshuffling of political factors in favour of transparent economic and preferably binding regulation to secure long-term energy supply, particularly with regard to the cost of energy infrastructure construction to bring energy from major production centres to consumers. The ECT regime establishes unique core principles protecting long-term investment and trade decisions. It is the only multilateral international agreement to create a favourable international framework for energy infrastructure development aiming at secure energy supply, where energy producers, consumers, and transit economies participate as shareholders. The increasing number of members and observers to the ECT process, including global and regional economic organisations, as well as other IEIs, confirms the political and economic value of this unique undertaking in the energy sector.

A major attractiveness of the ECT process is that it can shift political discussions into economic implementation due to its binding regulatory provisions. The fundamental aim of the whole ECT process is to strengthen the rule of law on energy issues for all participating economies, and, for energy industry, to mitigate political risks associated with investments and trade by establishing a neutral regulatory framework.

Identity and overlap

Though concentrated on the European energy market, particularly natural gas supply, the ECT process nevertheless provides a reference point for other regions in dealing with issues over the whole energy supply chain in collaborative and non-politically engaging manner, and which is based on legally binding approach. Gas production in the North Sea is now at its peak, and new gas fields should be connected to the EU gas pipeline grid in order to feed its growing demand. Natural sources for future gas supply, apart from Norwegian and Greenland Seas, are Northern Africa and Russia. In the EU, concerns have been raised to develop routes for new gas pipelines, adding to the discussions on gas pricing policy changes for East Europe, which currently depends heavily on existing pipelines from Russia and Central Asia. The issue at hand is whether political or economic considerations should be prevail as a basis for long-term policy. The ECT process is in centre of such intensive discussions around transit issues and energy pricing policies, and thus attracts the attention of actors in other Eurasian regions, such as Southwest, East, South, and Southeast Asia, where a boom in international energy transportation infrastructure construction is expected in the near future.

The ECT is only one international investment regime, although in the very specific and important sphere of energy supply. This is a solid foundation around which multilateral cooperation could evolve to solve future problems of securing energy needs in an environmentally compatible, economically viable, and politically correct way. There are grains of issues encapsulated in the *Declaration*, ECT and the ECT process itself around which further momentum could gather towards progress in multilateral regulation of energy activity. Next steps of the ECT process might include acceptance of the pre-investment regime, as well as postulation of an exhaustive set of pricing policies. Moreover, geographic expansion to other regions suggest the scalability of the ECT process.

Evaluation and amendment

The ECT process began some twenty years ago as a West-East dialogue in Europe, to facilitate the process of political *détente* through energy cooperation. All OECD members initially took part in this process, as prospect for access to energy resources and, more generally, doing energy business, in former centrally planned East European and former USSR economies provided great political and economic opportunities. These economies, on the other hand, expected that ECT participation would help them to adapt to the market economy environment and insure access for foreign investments. And while these driving forces for the ECT participants are still relevant, the accents have shifted since the 1990s. Economic regulation in most East European has synchronised with the former "West" Europe to the degree that they are now WTO members and part of the EU. Meanwhile, the investment environment for former "East" Europe has improved significantly. Acknowledging this, the 2004 internal review of the ECT placed energy trade and transit issues in front of investments, thus prioritising energy industry liberalisation policy as a major tool to secure energy supply in the long-term. However, pre-investment regime negotiations continue to be a stumbling block for the ECT process, while transit and liberalisation provisions have encountered strong opposition from both energy producers and consumers. With these issues dominating the forefront, it is unclear how the ECT process' characteristic arbitrage approach will be able to sustain negotiation momentum. The ECT process' mandated internal mechanism for formal peer review will

certainly be instrumental in encouraging members to reflect the principles of the *Energy charter declaration* with appropriate progressive implementation.

Effective implementation

While effective management of ECT implementation is important, the current state of this IEI is concentrated on policy discussions. Senior level officials are involved in the process on an irregular basis, and the progress of ECT process seems to be dependent on political negotiations rather than the secretariat's efforts to arrange *ad hoc* task forces and ancillary research. The ECT process mission is nevertheless important both for governments and business, and there is a sound political affect of being an ECT process member. The ECT process continues to cooperate with other key economic and energy-related international institutions, while filling its own important niche. Maybe most importantly, being an ECT process member helps to create alliances on a regional basis, enforcing a climate of trust and cooperation among participants.

THE IEI AS A TOOL

Here, the IEI is viewed as a problem solving tool. But it is only one among many. Certain tools work well for certain problems, some may be useable but not ideal, while others are simply not suitable for the job. Recognising this, the following section examines the nature of current IEI coverage and potential to address future energy problems in the APEC region.

Four categories of future energy problems have been selected for the international, shared, APEC-wide nature of their character and for the directness of their impact on the energy industry, without regard for their particular suitability to IEI-led intervention. These seemingly intractable phenomena are expected to continue to challenge energy development in the APEC region over the next 20-30 years. Issues and sub-issues include:

- Energy efficiency (technology penetration, market development, consumer behaviour, information)
- Renewable energy (hard costs, soft costs, external benefits)
- Nuclear power (financing, fuel cycle management and waste, non-proliferation, physical security, guarantee of social responsibility, human capital)
- Energy transportation (energy market reforms and institutional framework, political risk)

For each issue, examples are provided of current and recent IEI activity in the APEC region which attempts to address such issues today; however, the purpose of providing these examples is to characterise the general approach and perspective taken as a group by the IEIs as a whole, and is not intended to evaluate or single out particular IEI actions. In the examples, special attention is given to understanding the concrete actions actually pursued or planned, with less emphasis on the often lofty mission statements or list of objectives. Drawing from this description, a concluding section explores the nature of coverage and potential for further IEI action as a tool to address these problems.

It must be emphasised that the following section attempts to characterise only the approach of IEIs as a whole in addressing these energy problems. The examples listed in each category include, in alphabetical order, major APEC region IEIs and those which are otherwise representative. They are not exhaustive. Furthermore, non-IEI activity in addressing these future energy problems is not discussed. This is important, and it speaks to the point of the exercise: because of their special characteristics, IEIs may simply be a poor tool to deal with some energy problems, no matter how well managed or executed; likewise IEIs may be naturally suited to help solve other problems. In either case, however, other tool choices exist. Domestic laws and regulations, business-led market activity, government-to-government bilateral agreements, local or grass-roots initiatives—all of these are tools as well, and they can complement , replace, or otherwise compete with IEIs in their activities. So, for example, a lack of IEI activity in addressing the physical security of nuclear power facilities does not necessarily mean that this problem is not being adequately addressed—it simply means that IEIs, as one tool among many, are not deeply involved. The important question is, if not, should they be?

ENERGY EFFICIENCY

- Technology penetration
- Market development
- Consumer behaviour
- Information

54.1 **Energy efficiency sub-issues**

> Improving energy efficiency is a cost-effective way to enhance energy security and address greenhouse gas emissions while promoting economic growth and development. Without prejudice to commitments in other fora, we therefore:
>
> ▪ agree to work towards achieving an APEC-wide regional aspirational goal of a reduction in energy intensity of at least 25 per cent by 2030 (with 2005 as the base year).
>
> ▪ encourage all APEC economies to set individual goals and action plans for improving energy efficiency, taking into account this aspirational goal, and reflecting the individual circumstances of different economies.
>
> *Sydney APEC leaders' declaration on climate change, energy security and clean development*[a]

[a] *APEC Leaders meeting 2007*

International attention may be periodic, but the pursuit of energy efficiency (EE) is timeless—progress is measured only against past expectations, and absolute success is unachievable. Moreover, considering projections for high energy costs and energy-related environmental concerns to persist into the future, energy efficiency will remain on the lips and in the minds of the international energy community.

Energy efficiency is about doing more with less, on both supply and demand side—more power from less coal, more comfort from less electricity, more kilometres from fewer litres. Because this pursuit is fundamentally broad—with opportunities for leverage from start to end—energy efficiency can be approached as a technological problem, as an economic problem, as a social problem. Each area has the potential, on its own, for great advances, and each area, on its own, also can hold back the progress achieved elsewhere. Both because of this complexity across the chain of energy production, distribution, and consumption and because of the potential in strengthening the weak links which may lie hidden, an overarching energy efficiency information system itself is another important issue.

TECHNOLOGY PENETRATION

In a region such as APEC with a broad diversity in development levels, the energy efficiency problem is less a need to invent novel technologies and more a need to spread the implementation of existing efficient technologies and practices. This is often true even within a single economy. Technology penetration is a vexing issue as it includes such diverse components as technological suitability, infrastructure lifecycles, legal and regulatory regimes, international trade, and economic viability. A key element in spreading the use of energy efficient products or practices is to demonstrate the potential and suitability of a technology within a particular sector for a particular economy.

ADB-EEI	Asian Development Bank Energy Efficiency Initiative
APP	Asia Pacific Partnership on Clean Development and Climate
EE&CSSN	[ASEAN] Energy Efficiency and Conservation Sub-Sector Network
-	[APEC EWG] Measuring the Impacts of the Application of New Technologies on the Energy Sector in APEC Economies
GEF	Global Environment Facility – Climate Change Module
IEA-ECBCS	IEA Energy Conservation in Buildings and Community Systems
REEEP	Renewable Energy and Energy Efficiency Partnership
SEFI	[UNEP/ BASE] Sustainable Energy Finance Initiative
WB-ASTAE	World Bank Asia Alternative Energy Program

55.1 **Current and recent energy efficiency technology penetration initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING IN THE PRIVATE SECTOR	organising site visits and training sessions, EE implementation pilot projects, publishing collaborative industrial best practices handbooks
EDUCATION AND CAPACITY BUILDING IN THE PUBLIC SECTOR	developing EE implementation strategies for particular sectors, training workshops for bank lending staff for EE projects
FINANCIAL MECHANISMS	providing loan guarantees to banks financing supply-side EE projects, establishing EE lending businesses within domestic banks by leveraging project loans

55.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

APP Power Generation and Transmission Task Force "Combustion optimisation in coal-based power plants"

Aims to, "provide India essential information that could potentially be adopted for the use of steam generators to burn Indian coal proven to be highly efficient in applications in Japan and the United States." This three year project involves 2 site visits by Indian utility operators to coal power plants in the US and Japan to study the software, hardware, and instrumentation used in these plants (and presumably available for later purchase) and to then report on what was seen. Travel expenses are paid for by the travellers themselves. Later, in the final year of the project, one Indian utility is to be selected as a pilot project to implement (and pay for) the combustion optimisation technologies presented during the site visits.*

* *This project lacks progress as of February 2008 and may be abandoned*

APP Steel Task Force "State-of-the-art clean technology handbook"

An APP flagship project, aims to, "provide steel decision makers with access to accurate descriptions of technology options." The final product, a 356 page document available on the APP website, is an agglomeration of one-page English descriptions, advertisements, and presentation slides describing steel-making

technologies or processes individually submitted by five of the six taskforce members (US, Japan, Korea, India, and Australia) and prepared for the US State Department by Lawrence Berkeley National Laboratory. To avoid intellectual property concerns among manufacturers, the descriptions either focus on processes which are well-established among manufacturers in developed economies but not as widely used in developing economies or on overviews of proprietary processes commercially available for purchase.

REEEP "Performance and Credit Risk Guarantees and Financing Mechanisms for ESCO-structured Energy Projects"

Aims to, "encourage local banks in Mexico to provide long term financing to [energy service company] ESCO-structured energy efficiency projects and accept Nacional Financiera, SNC (NAFIN) guarantees with the project's cash flows as collateral." This two year, USD 200,000 donation-funded project will use NAFIN financing mechanism to develop and guarantee three small- to medium-sized ESCO-structured projects in Mexico and will later evaluate the process to determine "lessons learned".

WB-ASTAE "China, Energy Efficiency Financing Project (P084874)"

Aims to, "improve energy efficiency in medium-and large-scale Chinese industries by developing lending programs for sustainable, energy efficiency projects in selected banks to support energy-efficiency investments in these industries." This USD 597 million (total cost) project of unspecified timeframe (but which began in 2006), will establish a USD 200 million line of credit through the IBRD for five or more domestic Chinese commercial banks to leverage in their own energy-efficiency lending businesses aimed at medium- and large-scale industries in China. Up to USD 15 million is also provided through GEF for "technical assistance" to these lending banks.

IEI nature, coverage, and potential

Current energy efficiency technology penetration IEIs tend to focus on capacity building or ESCO-related activities, with multiple major IEIs operating in each area.

Capacity building projects in this area which target industry or other business actors are likely good values in terms of resource outlays in that they skip the public-sector middleman and aim directly at the audience whom they wish to influence, such as factory equipment buyers. However, the scale is too small. Despite how successful individual projects such as APP's site visits may be, it is unlikely that even the sum of such activities could have widespread effect unless systematically implemented across an economy or sector; duplicating the projects outlined above by orders of magnitude. Business-targeted capacity building activities also beg the question of how much the targeted participants actually value the IEI's effort. From a market perspective, if participants have not already taken it upon themselves to build capacity, then it is reasonable to assume that either such capacity building activity cannot deliver a sufficient economic return, or that there is some market failure which prevents would-be capacity builders from capturing that return; if such a market failure does indeed exist, it is not explicitly addressed in most current IEI capacity building activities.

ESCO development and other lending-related activities by IEIs in this area seem to have the most potential for broad impact on energy efficient technology penetration, as they are designed to be self-sustained through market forces once

IEI interventions have concluded. Moreover, ongoing IEIs demonstrate that ESCO lending activities can organically excel at capacity building as well—maybe more so than capacity building-only activities even– as learning by doing becomes an effective if unintended pedagogical device. However the scale of existing activities appears dispersed, with either very large projects from multilateral lending banks such as WB or ADB, or very small projects such as those carried out by REEEP. In this sense, impacts are either limited at one end by project scope, or at the other by extent. Replication of existing smaller finance-related projects across different geographic areas—such as REEEP's capacity-building activity in Mexico—is one way to fill the middle of the scale.

MARKET DEVELOPMENT

The energy efficiency market in the APEC region is diverse. Numerous vendors offer even more numerous products and practices and certify them against different standards set by different economies. And the pace of innovation is fast. Against this backdrop, it is difficult for consumers and producers to come together with right EE product, at the right time, and for the right price.

ADB-EEI	Asian Development Bank Energy Efficiency Initiative
APP	Asia Pacific Partnership on Clean Development and Climate
EAEF	EC-ASEAN Energy Facility
EE&CSSN	[ASEAN] Energy Efficiency and Conservation Sub-Sector Network
EERE FINANCING	[APEC EWG] Energy Efficiency and Renewable Energy Financing
-	[APEC EWG] Energy Standards and Labelling Cooperation Initiative
-	[APEC EWG] Framework for Cooperation on Energy Efficiency Testing Standards
GEF	Global Environment Facility – Climate Change Module (GEF)
-	International CFL Harmonisation Initiative

57.1 **Current and recent energy efficiency market development initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING AMONG THE GENERAL PUBLIC AND OTHER CONSUMERS	EE product brand development and labelling, EE product catalogues and supplier databases
INFORMATION SHARING AMONG MANUFACTURERS	establishing common performance guidelines for EE products, compliance certification
RESEARCH AND DEVELOPMENT	establishing common laboratory testing procedures for EE products

57.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

GEF/UNDP "Vietnam: energy efficiency public lighting (VEEPL) project"

Broadly, aims to improve, "lighting energy utilisation efficiency through the removal of barriers to the widespread application of energy efficient lighting systems in the public sector in Vietnam." In particular, project components number two, "public lighting technical support," and number five, "information

dissemination and awareness raising," focus on market development aspects of USD 15.3 million public-private-NGO project, of which GEF funding covers roughly 20 percent. In the five year project, GEF works together with Vietnamese lighting manufacturers and local governments to: on the supply side, provide technical assistance on EE lighting design, international manufacturer networking, standards, product testing, and labelling; on demand side (in this case local governments purchasing public lighting), establishing a data facility for public lighting products, improving recognition of the project brand, and capacity building for local lighting-related consultancies.

International CFL Harmonisation Initiative "Performance specifications" focus area

This open-membership collaborative effort seeks to, "establish suitable criteria to be measured to enable the performance of CFLs to be rated and to reach consensus on these criteria with a number of market stakeholders," through development of a tiered set of CFL performance criteria with products designated according to a standard marking system. Work began in 2005 across an informal, diverse group of approximately 130 participants, including individual experts and CFL- related NGO or businesses representatives to develop CFL performance specifications with the spirit of supporting other such efforts around, primarily, the Asia Pacific. Through an iterative process, draft specification proposals are developed according to proposals received at international workshops organised by the initiative and are then posted to the initiative website (in English and occasionally Chinese as well) to receive and incorporate comments from other members. The Australian Greenhouse Office is instrumental in coordinating the association's activities, which also include the establishment of CFL testing protocols, verification testing, and compliance using similar styles of implementation across interested parties.

IEI nature, coverage, and potential

Many current energy efficiency market development-oriented IEIs have chosen standardisation and labelling schemes as tools of choice. By sector, consumer products, particularly lighting, particularly CFLs, seem to receive the most IEI attention. Consumer lighting is an appealing target for which to develop standards; the potential for energy savings though efficiency improvement is large, the effect is visible downstream in people's daily lives, attaining this efficiency improvement supports development of an international market with premium unit values compared to incandescent alternatives, and the timing is appropriate in relation to industrial and regulatory proliferation. Moreover, international standard development is a good area for IEI activity, as the issue is naturally cross-boundary. It is unlikely that further IEI activity is needed for this area in the APEC region, however, as already a number of major IEIs must balance inter-IEI coordination to prevent competing (and self-defeating) labels with each IEI's own vision. Yet the issue of standardisation is cross-border, and there is dispute as to whether cross-border standardisation is in fact desirable in the APEC region; given disparity in cultural environments, economic development, and producer technology, any standard agreed upon by IEI economy or industry representatives might be so diluted as to be less desirable than one tailored for domestic needs. A non-IEI alternative in this case might be for economies with smaller markets to voluntarily adopt the "in-house" standards of economies with larger markets as suitable, and when appropriate. This latter approach would echo the *de facto* adoption of US Energy Star labelling conventions for energy efficient appliances in areas outside the US.

Information sharing activities within ongoing IEIs, such as the development of energy efficient product databases by public entities, should make extra effort through IEI design and implementation to avoid engaging in market-internal pursuits. Profit-oriented entities will be most able to develop, maintain, and propagate such product databases if this activity is indeed valued by its users. Examples from outside the energy efficiency market development area demonstrate that IEI-developed information databases often suffer from neglect, scare data, and obscurity as funding is depleted following an initial launch.

CONSUMER BEHAVIOUR

Economists have noted that even where the financial savings are clear, consumers often fail to choose energy efficient products or practices—even with all other variables held equal. This is true across sectors and scales, from the household shopper to the factory manager. Throughout the APEC region, this phenomenon slows theoretical improvement in energy efficiency. Asymmetric time horizons between accrual of costs and benefits, perverse incentive structures that insulate consumer decision makers from the costs born by others as a result of their decisions, and the relatively small cost of energy compared to other expenses contribute to this market failure.

ADB-EEI	Asian Development Bank Energy Efficiency Initiative
EE&CSSN	[ASEAN] Energy Efficiency and Conservation Sub-Sector Network
EERE FINANCING	[APEC EWG] Energy Efficiency and Renewable Energy Financing
EEB	[WBCSD] Energy Efficiency in Buildings
-	[APEC EWG] Energy Literacy Initiative
-	[APEC EWG] Financing Green, High Performance Buildings and Communities in the APEC Region
-	[G8] Gleneagles Plan of Action - Climate Change, Clean Energy and Sustainable Development
GEF	Global Environment Facility – Climate Change Module
IEA-DSM	IEA Demand-Side Management
REEEP	Renewable Energy and Energy Efficiency Partnership

59.1 **Current and recent energy efficiency consumer behaviour initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING IN THE PRIVATE SECTOR, FOCUSING ON BUILDINGS	organising or presenting at international workshops, collaborative report writing
EDUCATION AND CAPACITY BUILDING IN CIVIL SOCIETY	education programs for youths and adults, provision of EE experts at request, building brands or awareness programs to influence consumer preference, networking with other related initiatives
INFORMATION SHARING	establishing international databases of capacity building techniques

59.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

WBCSD-EEB "Business realities and opportunities: facts and trends"

This one-year project, the first of three phases in the initiative, culminated in the release of a 40 page summary report, available on the WBCSD website. The document gives an overview of energy use in buildings, focusing on Brazil, China, Europe, India, Japan, and the United States, and attempts to identify both the important barriers to realising zero net energy buildings and possible "levers for change". Input for the report was received from the ten large energy/technology/engineering companies that are members to the initiative as well as through international workshops and outreach events jointly sponsored or otherwise participated in by WBCSD initiative organisers. Most dialogue focuses on private sector or civil society interaction.

APEC EWG Energy Literacy Initiative "Energy literacy database (target #1)"

Japan, organising entity and sponsor of the initiative, initially planned by the end of 2002 to build a "network for promoting energy education among relevant international organisations," [b] which would be used to later implement energy literacy programs for both children and adults internationally, as well as "dispatch of energy experts to low energy literacy areas based on the need of developing countries." In November 2004, Japan reported to the APEC EWG that such a database, "containing detailed information and web links to energy education programs within Partner Economies," had indeed been established and circulated to EWG members, with an offer to provide further updates. [c] As of 2008, however, this database is not publicly available and records are unavailable concerning the other planned teaching activities.

[b] *UN Johannesburg summit 2002*

[c] *APEP EWG secretariat 2004*

IEI nature, coverage, and potential

Consumer behaviour with regard to making energy efficient choices is a particularly difficult area to address whether using IEIs or other tools. It is unsurprising then that current IEI activity in the area takes a soft approach, relying almost entirely on capacity building projects. A number of projects focus on improving building energy efficiency, which is a reasonable target as the potential for gains is large, misconception or dated information regarding cost and potential of improving building energy efficiency is widespread, and the set of related decision makers– and hence target audience– is relatively small. However, though the appeal for those already involved in IEIs to pursue building efficiency is understandable, the choice of IEIs as a tool to address this topic is less clear. Compared to businesses or domestic regulations and codes, IEIs have less potential to directly influence the decisions made regarding energy efficient building design and construction, as these issues in themselves are not international in nature. Rather, IEIs in this area should recognise that their potential added value is indirect, insomuch that IEI actors can hope to influence their decision-making peers in both the public and the private sectors into taking their own direct actions.

INFORMATION

Considering the separate energy efficiency issues outlined above, policymakers are now and will be increasingly challenged to understand and

identifiably improve economy-wide energy efficiency. Development of novel accounting mechanisms will be essential as communities both within and outside one's economy demand better energy efficiency performance.

ADB-EEI	Asian Development Bank Energy Efficiency Initiative
-	ASEAN-Japan Framework for Comprehensive Economic Partnership- Energy Cooperation
-	[APEC EWG] Energy Standards and Labelling Cooperation Initiative
-	[APEC EWG] Energy Standards Information Development
-	IEA In-depth Review [and other EE activities, see below]
J4 CEBU	Japan Four-Point Initiative (J4 Cebu)
-	[APEC EWG] Measuring the Impacts of the Application of New Technologies on the Energy Sector in APEC Economies
P&R PROGRAM	[APEC EWG] Pledge and Review Program
REEEP	Renewable Energy and Energy Efficiency Partnership
-	[G8] St. Petersburg Plan of Action - Global Energy Security
WB-ESMAP	World Bank Energy Sector Management Assistance Program

61.1 **Current and recent energy efficiency information initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING IN THE PUBLIC SECTOR, FOCUSING ON GOVERNMENT OFFICIALS	voluntary invitation of outside experts to conduct economy-level EE audits/reviews, workshops, summary reports of EE policy experiences and options
INFORMATION SHARING AMONG GOVERNMENT ENERGY AGENCIES AND INTERNATIONAL ENERGY POLICY GROUPS	building web databases of EE policies

61.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

APEC EWG Pledge and Review Program, 2007 EWG cycle

Aims to voluntarily share, "information and experience in achieving improved energy efficiency," and report on EE, "programs developed, their specific objectives and the results achieved," [d] among the 21 member economies of APEC at twice-yearly meeting of that body's energy working group (EWG). In this first meeting of each year, EWG economy representatives select an EE-related topic on which members will table reports at the following meeting of that year. These member economy reports are then consolidated for members to examine at the following meeting, where a new topic will be proposed. In 2007, the EWG33 topic was, "What are your economies' policies and programs to advance energy efficiency and trade and efficient products (appliances)? ... Specifically, what measures are undertaken to align your efforts with other APEC and international economies' standards and procedures." At the EWG34 meeting in September 2007, five economies (Australia, Mexico, New Zealand, Chinese Taipei, and USA) tabled "pledge and review" documents. New Zealand, for example, tabled a three page overview of the economy's current background on EE programs, programs

[d] *APEC EWG secretariat 2007*

to advance trade in EE appliances, EE labelling programs in use, and relevant participation in international standard harmonisation fora. All relevant documents are openly available, in English, on the APEC EWG website.

IEA "Energy efficiency policies and measures database"

This online, openly accessible database hosted by the IEA on its website aims to catalogue, "information on policies and measures taken or planned to improve energy efficiency," across IEA member countries plus Brazil, China, the European Union, India, Mexico, Poland, Russia and South Africa. The searchable database, which is categorised by country, policy type, policy target, and year, provides brief, non-evaluative descriptions of EE-related policies enacted at the national level as updated by IEA or suggested for inclusion by the database users. The database has "over 1000" entries, but coverage is somewhat uneven—the listing of 2006 policies, for example, included twenty-one entries for the United States, nine for China, eight for Canada, two for Korea, and zero for Mexico.

IEI nature, coverage, and potential

Energy efficiency information IEIs are largely initiated by and targeted at public entities, particularly policymakers. The information such IEIs provide is likely good, but there is a targeting problem: are the people who request or get such data the ones who need it? Could they be getting it elsewhere? And, once they have the information, are they passing it on outside of the policy circle of the IEI / organisation, or does it remain obscure?

Part of this difficulty relates to the openness of the energy efficiency information created through audits or peer review. Unlike scientific peer review, the identify of the reviewing organisation cannot be kept anonymous, which might inhibit unfiltered observation. Moreover, energy efficiency information IEI designers must be aware of the final audience. An output which is open to only a small group might contain better and more frank information, but those who will ever see it are limited. On the other hand, an output publicly available to all is likely to be diluted by a reviewing committee or presented in more couched terms to avoid embarrassment of IEI/ organisation members. This phenomenon can also damage the credibility of the information or IEI/ organisation itself if the objective nature of the audit comes into question. Additionally, if the audit or peer review results in critical or otherwise unpleasant observations, it may be rejected or ignored by those who matter, whereas if it is not critical enough, it could be useless. Considering these issues, new IEIs which pursue the collection or propagation of energy efficiency information—particularly those in the public sector—must realise the implicit tradeoffs and structural hazards of such a project—a project which can nevertheless be ultimately valuable to policymakers and the society at large.

RENEWABLE ENERGY

Clean, renewable commercial energies such as wind, solar (concentrating and photovoltaic), geothermal, and small hydro power as well as biofuels are, for many, the most visible and intuitive components of future sustainable energy development. Renewables receive impressive amounts of attention in the public discourse, but often, the same characteristics which make them so attractive also demand special attention. Nevertheless, renewables are extremely valuable for both niche and mass-market applications and will become more visible in the APEC region through the future.

- Hard costs
- Soft costs
- External benefits

63.1 **Renewable energy sub-issues**

Renewables are generally expensive. Though the "renewable" category is broad, and each of wind, solar, geothermal, small hydro, and biofuels has been widely commercialised, there are few instances outside of rural or niche market applications where this has been done more cheaply and without special subsidy than using a conventional alternative. This is not to say that renewables are or will be *too* expensive, but instead to focus on this very real and persistent barrier to wider implementation.

Renewables also face other issues outside of cost. Renewable-specific characteristics such as intermittency or resource dispersion are sometimes described as technological or management barriers. In this study, however, such issues are viewed from a cost perspective, alongside direct infrastructure investment and the un-captured "negative cost" inherent in any clean energy implementation.

HARD COSTS

Though the initial capital cost of renewable energies– such as solar panels or wind turbines—tends to fall over time, direct costs will remain an issue for renewables (albeit a less important one) when compared to traditional, fossil fuel alternatives over the next 20-30 years. Other technology or management-related renewable-specific characteristics such as intermittency, low energy density, and immature industrial supply chains can also be interpreted as "costs": those expenses which must be met in addition to direct costs in order to make a contracted kilowatt-hour (or litre) of renewable energy equivalent to a kilowatt-hour (or litre) of conventional energy.

These costs are of particular concern for large grid-connected renewable implementations, where substitutes are many and have the advantage of a distribution and consumption infrastructure already designed with such conventional supplies in mind. The importance of this problem relative to conventional energy in practice can change overtime as a result of cost changes on both sides, and is influenced by factors including technological progress, material costs, manufacturing scale, financial instruments, labour requirements, and fuel costs.

ADB-EEI	Asian Development Bank Energy Efficiency Initiative
DANISH COOPERATION FUND	[ADB] Danish Cooperation Fund for Renewable Energy and Energy Efficiency in Rural Areas
-	[G8] Gleneagles Plan of Action - Climate Change, Clean Energy and Sustainable Development
GVEP	[WB/UNDP] Global Village Energy Partnership
-	IEA Bioenergy, IEA Geothermal, IEA Photovoltaics, IEA Solar Heating/Cooling, and other specific renewable energy technology-related initiatives from IEA
REEEP	Renewable Energy and Energy Efficiency Partnership

64.1 **Current and recent renewable energy hard cost initiatives in the APEC region**

APERC IEI database 2007/2008

RESEARCH AND DEVELOPMENT	technology performance analysis, establishing focal points to coordinate international research activities, assembling collaborative R&D teams, sharing of research results
FINANCING MECHANISMS	lending projects for renewable energy infrastructure projects—particularly in developing economies and rural areas, creation of micro-credit facilities to support household consumption of renewable energy-powered products

64.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

IEA Photovoltaic Power Systems "Task 3: Use of photovoltaic power systems in stand-alone and island applications"

Aims to "improve the technical quality and cost-effectiveness of PV systems in stand alone and island applications," by processing and distributing, "information on the technical performance and cost structure of PV systems in these applications," as well as publishing best practices guidelines for PV operations and other research-sharing activities. One of sixteen Task 3 reports publicly available on the IEA-PVPS website, "Testing of batteries used in stand-alone PV power supply systems: Test procedures and examples of test results" is a 43 page document from 2002 published by three IEA-PVPS-associated experts under the supervision of Task 3. The document offers an overview of research into testing methodology for the battery bank of a PV-installation, "which is often said to be the weakest component of the system and the highest contributor to its life cycle cost." Recommendations are provided to PV project managers based upon their findings.

ADB Danish Cooperation Fund "TA 4054-INO: Power Welfare Scheme (Piggybacked with Loan 1982)"

This two-year, USD 800,000 project, implemented in Indonesia, is a power welfare scheme aimed at rural island communities. The revolving fund aimed to, "defer the cost of electricity supply and minimise initial expenses" of energy consumption to 10,000 low income households. Phase I of the project began in 2002 and phase II was discussed starting in 2005. Project outcomes and details are not openly available on the project website.

IEI nature, coverage, and potential

Current IEIs with the most direct impact in addressing the "hard costs" of renewable energy in the APEC region seem to be those which focus primarily on rural areas in developing economies.

This is particularly true of those IEIs which use financial mechanisms to reach their goals. Outside of rural or niche implementations, it is difficult for IEIs to reach the scale needed to have a measurable impact in lowering these hard costs which are; (1) primarily internal to normal market activities, and; (2) secondarily addressed by domestic government subsidies or other public finance regimes. Rural applications, however, in addition to being more limited in scale and scope, are already observed to be underserved by normal market activities, and so IEI effort is justified and useful.

Compared to financial mechanism IEIs, R&D IEIs seem to have more broad potential in addressing the hard costs of renewables across the APEC region. But pure R&D IEIs in this field are rare. More common are R&D-supporting IEIs, which organise or otherwise aid existing dispersed R&D activities undertaken by civil society or, less often, the private sector. Organising R&D as opposed to undertaking R&D avoids much of the need for the IEI to handle intellectual property issues, for example, and benefits the involved parties by making their R&D activities more visible to a wide audience. Of course, IEIs can engage in pure R&D activities, but the advantages of using an IEI as the tool of choice for research are less obvious outside of niche, underserved applications.

Considering the limitations described above of IEIs as a tool in this area, the potential for future IEI activity which seek to address the hard costs of renewable energy is weak when compared to market-internal activities or domestic regulation.

SOFT COSTS

In addition to the direct or new technology costs outlined above, renewable energy implementation also faces a number of indirect "costs" associated with its relative novelty and other non-traditional attributes in comparison to fossil-based alternatives. Such additional soft costs include: negative perceptions of cost and reliability; unfamiliarity with technology options and attributes among policy makers, investors and financial institutions; outdated or otherwise incomplete government regulatory frameworks or pricing mechanisms with structural barriers against the use of renewables (such as those which might address resource dispersion or distributed generation patterns), and; non-traditional (front-loaded) cost schedules for capital investment versus fuel and maintenance cost. Of course renewables are not alone in facing such soft costs, but the impact may be most significant here because various market-internal and market-external frameworks have not yet been fully developed to address them.

APEC REDI	Asia Pacific Economic Cooperation 21st Century Renewable Energy Development Initiative
APP	Asia Pacific Partnership on Clean Development and Climate
CSP GMI	Concentrating Solar Power Global Market Initiative
DANISH COOPERATION FUND	[ADB] Danish Cooperation Fund for Renewable Energy and Energy Efficiency in Rural Areas
PREGA	[ADB] Dutch Cooperation Fund for Promotion of Renewable Energy, Energy Efficiency, and Greenhouse Gas Abatement
-	IEA Bioenergy, IEA Geothermal, IEA Photovoltaics, IEA Solar Heating/Cooling, IEA SolarPACES, and other specific renewable energy policy and market-related initiatives from IEA
GEF	Global Environment Facility – Climate Change Module
NRSE SSN	[ASEAN] New and Renewable Sources of Energy Sub-Sector Network
REEEP	Renewable Energy and Energy Efficiency Partnership
REED	[UNEP/UNF] Rural Energy Enterprise Development
SEFI	[UNEP/ BASE] Sustainable Energy Finance Initiative
WB-ASTAE	World Bank Asia Alternative Energy Program

66.1 **Current and recent renewable energy soft cost initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING IN THE PUBLIC SECTOR	developing renewable energy policy and implementation strategies, publishing policy reviews and summaries of past experience with renewable energy market development
EDUCATION AND CAPACITY BUILDING IN THE FINANCE SECTOR	training workshops for bank lending staff for renewable energy projects
FINANCIAL MECHANISM AND MARKET DEVELOPMENT	undertaking of feasibility studies, international development bank lending for identified renewable energy projects

66.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

REEEP "National Action Plan for Rural Biomass Renewable Energy Development in China"

Aimed to, "develop a National Action Plan for rural biomass renewable energy in China with supporting documentation… [and] provide detailed measures to enable China to achieve its biomass development target in mid-term and long-term set in the National Strategy." This one year, USD 250,000 project, sponsored by the government of Norway and co-funded by ADB and the Chinese Ministry of Agriculture, completed a review of rural biomass development in Europe and China in order to set, "detailed objectives and targets in the 11th Five-Year and 12th Five-Year Plan," and offered an implementation strategy to meet such target. Related project activities included capacity building-type activities such as "institutional building" and "awareness improvement" in the public sector [capacity building terminology as used by REEEP].

Dutch Fund/ PREGA "Philippines" project component

PREGA, as a whole, aims to, "promote investments in renewable energy, energy efficiency and greenhouse gas abatement technologies." The Philippines project component of PREGA (one of approximately fifteen Asian developing

economy projects) resulted in four main outputs across two project phases which ran from 2001 to 2006: (1) publishing a report to review economy-specific experience and background with renewables and energy efficient projects, identifying elements such as current status, potential, institutional environment, and prioritisation; (2) "pre-feasibility" identification of possible renewable energy or energy efficiency projects and formal feasibility studies of projects for subsequent bank lending; (3) publishing of policy reports, such as "Utilisation of alternative fuels for industries in the Philippines," approximately 50 pages, with specific conclusions and recommendations for different actors, including private sector ESCOs, government energy departments, financial institutions, academic bodies, and international development banks; (4) seven capacity-building workshops in the Philippines and elsewhere in Asia, focusing on training/ planning as well as specific project development goals and attended by government officials, local private sector energy industry representatives and consultants, local academicians, and local bank lending staff. Many, but not all, related materials (such as workshop presentations and participant lists, project feasibility studies, project executive summaries) are publicly available on the ADB website.

IEI nature, coverage, and potential

As such "soft costs" of renewable energy are less an issue of physical or financial capital and more a need for human capital—time, expertise, organisation—IEIs are well suited to addressing this issue. Such suitability is witnessed by the proliferation of IEI activities which deal with these issues.

A number of current IEIs in this area use education and capacity building to achieve their goals, either alone or associated with the lending activities of multilateral banks or other development funds. Because soft costs include a suite of interrelated barriers, the issue is well-suited to the large, vertically-integrated IEIs, such as those led by ADB or WB, which incorporate public capacity building alongside revisions in government policy, private capacity building with domestic banks alongside the guarantee of loans, and building awareness of activities among civil society and the general public.

As this area is not easily saturated by IEI activity, and is a perennial favourite among the IEI community, further activity into the future can be expected. It could be useful, however, for new IEIs in this area to focus on understanding the impact of their activities, particularly for capacity building exercises. Have workshops with domestic bank staff led to more, sustained, renewable-friendly loans? Have policy makers adopted – or even read– the recommendations presented to them? It is easy to feel that capacity building activities succeed just because they have been executed, or because the impact is hard or expensive to measure in comparison to the relative ease and affordability of the activity itself – but more robust and more open evaluation is nevertheless important to improving the credibility of such IEIs over the longer term.

EXTERNAL BENEFITS

One element which makes renewable energies attractive despite their costs are the non-monetary benefits they provide in terms of energy resource security or local and global environmental sustainability. In fact, these external benefits are such that many renewable energies become economically attractive, even

with today's hard and soft costs, when this value can be captured. However, renewables compete in a market which undervalue both their own positive (or neutral) external effects and the negative external affects of traditional energy substitutes. Considering this, realising this economic benefit requires outside regulatory schemes— and doing so introduces added risk and complexity into commercial renewable energy development.

Most of the current APEC region IEI activity in this area revolves around the Kyoto Protocol and its Clean Development Mechanism and Joint Implementation schemes, as this is the primary multilateral regulatory framework which directly addresses the externalities most pertinent to renewable energy. Into the future, it is reasonable to expect this current framework to evolve, and to be joined by others.

ADB-CMI	ADB Carbon Market Initiative (ADB-CMI)
ADC-CDM FACILITY	ADB Clean Development Mechanism Facility (ADB-CDM Facility)
ADB-REACH	ADB Renewable Energy, Energy Efficiency, and Climate Change (ADB-REACH)
-	[ADB] Canadian Cooperation Fund on Climate Change
GEF	Global Environment Facility – Climate Change Module (GEF)
GS	Gold Standard (GS)
KYOTO PROTOCOL	Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto Protocol)
WB-CFU	World Bank Carbon Finance Unit (WB-CFU)

68.1 **Current and recent renewable energy external benefit initiatives in the APEC region**

APERC IEI database 2007/2008

REGULATORY FRAMEWORKS	Kyoto Protocol carbon cost internalisation and its supporting mechanisms– particularly CDM and JI
FINANCIAL MECHANISMS	CDM overhead financing, granting up-front loans based on future CDM income streams
EDUCATION AND CAPACITY BUILDING AMONG PROJECT DEVELOPERS, HOST ECONOMY GOVERNMENTS, AND CARBON OFFSET BUYERS	project preparation, technical assistance on CDM certification and approval processes, risk identification and offset, speeding project implementation
EDUCATION AND CAPACITY BUILDING WITHIN INTERNATIONAL LENDING ORGANISATIONS	learning-by-doing identification and incorporation of CDM-compatible projects into normal lending cycles for enhanced financial viability
INFORMATION SHARING	matching carbon credit buyers and sellers—"seller's agent", third-party monitoring and certification of CDM/JI projects

68.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

ADB-CMI "Asia Pacific Carbon Fund"

The Asia Pacific Carbon Fund, one of three elements of the ADB-CMI, provides, "upfront cofinancing to CDM projects in ADB's DMCs [developing member countries] for future delivery of certified emission reductions." This USD 152 million European government-funded financial mechanism became operational in 2007. The fund applies to projects that are already receiving ADB financing or other technical assistance and which fall into at least one of three categories: methane capture/ use; energy efficiency, and; renewable energy, which includes, "small to medium-sized run-of-river hydropower, biomass (e.g., biogas and biofuels), wind power, solar power, and geothermal power." Under the fund, ADB acquires, upfront, between 25-50 percent of certified emission reductions (CERs) to be generated through the project, giving the project developer access to upfront liquidity to improve project viability and splitting project risks with ADB. The project developer may freely sell remaining project CERs. ADB, as trustee of the fund, claims approximately one percent per year plus one percent total overhead to cover management costs.

Gold Standard "Te Apiti Wind Farm (New Zealand)"

The project is a privately financed, commercial 90 MW wind farm on the North Island of New Zealand, developed by Meridian Energy and validated for CERs under JI in 2004. The Gold Standard IEI was not directly involved in the planning or implementation of the project; instead to qualify as a GS project, the developers indicated that they wished to apply for GS certification by filling out a special Gold Standard CDM project design document (PDD) rather than the standard CDM PDD. This GS CDM PDD allows for both GS and UNFCCC certification through the same document, and differs from the standard CDM PDD in that it requires projects to be: (1) specifically renewable energy, energy efficiency, or methane capture/use in nature; (2) "sustainable" environmentally, socially, and economically/ technologically; (3) additional (from development baselines), with requirements exceeding standard UNFCCC CDM guidelines. Once approved by a third party GS/UNFCCC-certified designated operational entity (DOE) (who, later, also conducted further validation of project self-reporting during the operational phase, in this example, DET NORSKE VERITAS, AS), the Te Apiti project was added to the GS database and awarded GS-certified JI CERs for the offset of approximately 980 kt CO_2 over five years (2008-2012). One of the main attractions for project developers to meet GS certification requirements during the CDM application process are "premium" CERs which have historically sold for 25 percent higher than those of typical CDM projects, an attractive way to generate both goodwill and profit. Many GS-related project development documents for the Te Apiti wind farm are publicly available following user registration on the GS website.

IEI nature, coverage, and potential

This area is dominated by the Kyoto Protocol's carbon valuation mechanisms and demonstrates the exceptionalism of that particular IEI; almost every other major IEI addressing the external benefits of renewable energy depends on the unique regulatory frameworks developed through the Kyoto Protocol alone. The Kyoto Protocol built an environment to support a number of related IEIs and allowed them to do so following a number of different modes and approaches. It is possible that without the Kyoto Protocol and CDM/ JI, similar IEIs might have

developed in this area, but, operating individually, they would have faced far higher transaction costs and the scales and scope of their activities would have been much more limited. In turn, these current IEIs have also done much to strengthen the mechanisms of the Kyoto Protocol by extending the reach of activities and smoothing over barriers to implementation—creating a mutually supporting web of IEI activity.

This sort of activity is not necessarily limited to the Kyoto Protocol, however. In the future, such enabling IEIs could also complement other international regulatory frameworks that address energy market externalities or even related domestic energy externality initiatives, to be supported, in turn, by their own domestic regulations. And while much of the current focus of such IEI activity is in developing economies, there is potential to expand into developed economies as well, such as Gold Standard has done.

Most important, though, it is to recognise the significant mutual role that IEIs in this area exhibit. Future international regulatory framework negotiations should consider and anticipate the system effects created as a result of developing something like the Kyoto Protocol, and therefore allow for offloading of activities to those IEIs which have the experience and capacity to efficiently deliver the desired results while simultaneously adding their own value.

NUCLEAR POWER

> There is a renewed interest in nuclear power worldwide. The number of nuclear power plants in Asia has been increasing in recent years. In North America and Europe, their safety record and the improvement in their generation costs have placed nuclear plants in a new light.... In view of the world's rapidly increasing energy demand... nuclear power stands as a viable option.
>
> *Nuclear power generation in the APEC region* [e]

> Demand for nuclear energy in electricity generation is expected to grow at 1.9 percent per year from 1,488 TWh in 2002 to 2,526 TWh in 2030; owed mainly to the growing concerns for energy supply security and activity to mitigate negative environmental effects of electricity generation....The share of nuclear energy in total primary energy demand in [the] APEC region is expected to remain stable at 6 percent between 2002 and 2030.
>
> *APEC energy demand and supply outlook 2006* [f]

- Financing
- Fuel cycle management and waste
- Non-proliferation
- Physical security
- Guarantee of social responsibility
- Human capital

71.1 **Nuclear power sub-issues**

Nuclear energy remains controversial both within and among APEC economies. However, in developed economies where civilian nuclear power generation is generally accepted, such as Korea, momentum is strengthening for the construction of new plants. Moreover, in developing non-nuclear economies, such as Viet Nam, interest in civilian nuclear power development is robust. Considering this, it is reasonable to expect heightened international attention given to this area over the next 20-30 years—including calls for international cooperation.

[e] *APERC Nuclear power 2004*

[f] *APERC Outlook 2006*

Unsurprisingly for an energy sector which itself is so contestable, there is substantial polarisation surrounding the discussion of current and potential issues that must be dealt with in order for nuclear energy to be generally satisfactory. The May 2007 *Darwin declaration* of the 8th meeting of APEC energy ministers offered a rather broad, externality-focused list of issues to be acted upon when it encouraged interested economies:

> ...to ensure that the safety, security, seismic, health and waste handling aspects, including trans-border effects, of civilian nuclear energy are adequately addressed. [g]

[g] *APEC EMM 2007*

Economic, technologic, resource, and geopolitical concerns could be also added to a list of ongoing issues facing the nuclear industry. And, of course, social concern surrounding the externality issues, in particular, can be conceived of as focus area in itself which could benefit from direct action.

FINANCING

One persistent barrier to the spread of nuclear power is the high cost, both upfront (including the time associated with regulatory approval, siting, and construction) and end-of-life, when compared to conventional power generation alternatives. In the APEC region, capital requirements are perhaps most significant for developing Southeast Asian economies which aim to develop new nuclear power infrastructure, as well as for developed APEC economies where aging nuclear infrastructure may soon require expensive decommissioning. And while enhanced tools for nuclear financing would be beneficial in both areas, the need for satisfactory access to capital is most pressing in developing economies.

GIF	Generation IV International Forum
GNEP	Global Nuclear Energy Partnership
NEA	OECD Nuclear Energy Agency

72.1 Current and recent nuclear power cost and capital financing initiatives in the APEC region

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING/ R&D AMONG NUCLEAR DEVELOPERS, OPERATORS, AND REGULATORS	publishing insider-focused *ad hoc* issue-based reports, development and upgrade of economic models for various nuclear technologies
INFORMATION SHARING AMONG NUCLEAR DEVELOPERS AND OPERATORS	establishment of supply chain and cost databases

72.2 Current IEI approach

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

GIF "Integrated Nuclear Energy Economics Model"

GIF identifies regularly-updated nuclear economics as a key cross-cutting issue in realising Generation IV nuclear technologies. "The innovative nuclear systems considered within Generation IV require new tools for their economic assessment, since their characteristics differ significantly from those of current Generation II & III nuclear power plants," particularly with regard to conventional fossil-fuelled energy alternatives in an increasingly deregulated energy environment. To address these new cost structures, the GIF economic modelling working group, composed of experts from the public, private, and civil (academic) sectors, has developed and continues to update a software model that integrates four component of development and operation: (1) capital/production cost; (2) nuclear fuel cycle; (3) optimal scale; and, (4) energy products. An output of this work, the G4-ECONS software model, is accompanied by, "cost estimating guidelines for Generation IV nuclear energy systems," a technical background and reference document which provides "a uniform set of assumptions, a uniform Code of Accounts (COA) and cost-estimating guidelines to be used in developing cost estimates for advanced nuclear energy systems." The 180 page document is openly available from the GIF website (last revision 4.2 published September 2007), though lacks the G4-ECONS model itself.

NEA Nuclear Development Committee "Ad hoc Expert Group on the Impact of Nuclear Power Plant Life Extension"

This expert group, and its resulting published report, aimed to, "identify and analyse the technical, economic and strategic issues raised by lifetime extension in different member country contexts," exploring both technical and economic issues. The economic module focused on, "the impacts of lifetime extension versus early shut-down followed (or not) by the construction of a new nuclear power plant on capital requirements, future financial liabilities and levelised electricity generation costs." It aimed to draw best practices based upon examination of "country statements" provided by experts from relevant OECD member economies—where ageing nuclear infrastructure prompts consideration of such plant life extension and decommissioning issues. The report, "Nuclear

power plant life management and longer-term operation," a 60 page document which is the result of three group meetings over 2005-2006, is available from the OECD online bookshop as a crippled electronic file or for purchase in physical format.

IEI nature, coverage, and potential

Existing IEIs address the problem of capital finance for nuclear power projects through a soft approach: education, capacity building, and information sharing. And while such activities are focused and well done, even the best efforts in this area can only bring marginal relief to the larger issue. Considering this, it is clear that the roles of nuclear industry businesses and domestic government regulation are better suited to directly reducing this barrier to nuclear power development.

However, in the future, there is nevertheless potential in this area for intensified IEI effort of a different nature: a fund for nuclear power development in developing economies could be launched as an IEI through multilateral banks or other *ad hoc* lending groups. Such a fund would operate similar to other lending operations for the construction of major infrastructure in developing economies, but with a nuclear power/ small-nuclear power focus. Adopting a vertically integrated approach, a nuclear development fund would also be well suited to provide project coordination and capacity building in public, private, and civil stakeholders (for example, aiding in the regulatory process or civil society siting concerns, or tying lending to plant achievement targets in physical security, non-proliferation, or human capital development). Doing this, one IEI process could organically address, as they arise, many of the anticipated future problems in the nuclear power sector discussed below.

And though such a development fund could be launched through an existing multilateral lending association, due to the sensitivity of nuclear power development, activity might be most efficient if a new IEI body or organisation were formed independently among willing partners only. Building on this coalition of lending members, a nuclear development fund could go even further by establishing an international regulatory or voluntary framework to explicitly incorporate nuclear power development into global climate change targets. One way to achieve this might be to fill in the gap left by the Kyoto Protocol's rejection of nuclear power in CDM and JI by developing a parallel system of carbon emission credits, subsidies, or tax breaks, thereby recognising the potential of nuclear power to reduce carbon dependency in the energy sector.

FUEL CYCLE MANAGEMENT AND WASTE

Though problems associated with waste disposal are generally overstated in the civil (media) discourse, large scale whole-cycle management experience is limited and international frameworks and markets which might handle this issue are immature. Fuel cycle and waste management will become more important into the future as the total amount of spent nuclear fuel and radioactive waste continues to grow and more actors from around the world are involved in nuclear fuel management.

GIF	Generation IV International Forum
GNEP	Global Nuclear Energy Partnership
IAEA	International Atomic Energy Agency
INPRO	International Project in Innovative Nuclear Reactors and Fuel Cycles
IAEA NFBI	[IAEA] Nuclear Fuel Bank Initiative

74.1 Current and recent nuclear power fuel cycle management and waste initiatives in the APEC region

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING AMONG NUCLEAR SCIENTISTS AND ENGINEERS	publishing of technology-specific fuel cycle handbooks, yearly reports on fuel cycle trends
EDUCATION AND CAPACITY BUILDING AMONG DEVELOPERS, OPERATORS, AND REGULATORS	public joint declarations of issue-specific best practices/ requirements
RESEARCH AND DEVELOPMENT OF ADVANCED FUEL-CYCLE TECHNOLOGIES	joint identification of future R&D priorities, novel joint research on closed-fuel cycle/ low-waste/ recycle-ready plant designs, experimental low-waste technology demonstration reactors
INFORMATION SHARING	international open-access databases of fuel cycle facilities, fuel-cycle market information systems
INFRASTRUCTURE/ REGULATORY FRAMEWORK	international nuclear fuel bank/ reproccesing initiatives

74.2 Current IEI approach

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

GIF Systems "Gas-cooled fast reactor"

The gas-cooled fast reactor (GFR) is one of six nuclear systems pursued under GIF. Four of these systems specifically aim to reduce waste or spent fuel requiring sequestration, and three are "closed cycle". The GFR system features a, "fast-neutron-spectrum, helium-cooled reactor and closed fuel cycle," and current GIF R&D activities are aimed at establishing an experimental technology demonstration reactor for continued research by 2020. Four GIF members jointly chair the GFR system, (JRC/Euratom, CEA/France, JAEA/Japan, and PSI/Switzerland), which began in late 2006. The GFR systems component of GIF is at an early stage; though an R&D and technology roadmap (with timelines and estimated costs) was released in 2002, as of 2008, specific GIF project activities had not been announced, though related research has begun in associated fora such as the European GCFR Consortium.

IAEA "Nuclear fuel cycle information system"

The Nuclear fuel cycle information system (NFCIS) aims to, "provide Member States and the IAEA, with current, consistent, and readily accessible information on existing and planned [civilian] nuclear fuel cycle facilities throughout the world." Updated every few years from 1980-2004 and yearly since, the electronic database relies on self-submitted data in the form of questionnaires presented to IAEA members as well as other information available to IAEA project organisers in the public domain. As of 2008, NFCIS contained 650 cross-referenced entries in 53 global economies and includes basic information about included facilities, such as status, scale, facility type, and process. The database is publicly available online following registration and previously was published in print editions for 1988 and 1996.

IEI nature, coverage, and potential

Similar to current IEI involvement on many other nuclear-power related issues, most activities addressing fuel cycle management and waste are organised under the auspices of just a few large, international organising bodies, such as IAEA, with less activity from smaller actors. This concentration, however, has not prevented a wealth of IEI activity in this area, undertaken through a wide variety of modes (with both soft and hard approaches) and targeting a broad swath of contributors to and other stakeholders in the international nuclear fuel cycle system. Due to the international and multi-faceted nature of the nuclear fuel cycle issue, IEI activity is well-suited to this area; IEIs are good tools for taking advantage of comparative advantages among international economies in fuel resources, technology, infrastructure, human capital, labour and construction cost, civil society opinion, and geography.

As the nuclear fuel cycle and management of nuclear waste is closely aligned with other issues in the nuclear power sector, a number of other IEIs also address the fuel cycle indirectly from the perspectives of non-proliferation, physical security, safety, and civil opinion.

NON-PROLIFERATION

The spread of military nuclear capabilities alongside civilian nuclear energy development is a genuine and persistent geopolitical concern for some APEC economies, particularly with ongoing challenges to existing international frameworks meant to address this very issue, such as the Nuclear Non-Proliferation Treaty. Non-proliferation activities target the undeclared possession or misuse of nuclear materials or technology by states or sub-state groups. Because of the special nature of the nuclear industry, "intrinsic" aspects of non-proliferation activities are often addressed in part through fuel cycle management-related, transportation, or other engineering approaches, while "extrinsic" approaches include trade-related as well as domestic/international regulatory frameworks. [h]

[h] *IAEA/INPRO 2003*

GIF	Generation IV International Forum
INMM	Institute of Nuclear Materials Management
IAEA	International Atomic Energy Agency
INPRO	International Project in Innovative Nuclear Reactors and Fuel Cycles
KEDO	Korean Peninsula Energy Development Organisation
IAEA NFBI	[IAEA] Nuclear Fuel Bank Initiative
NTI	Nuclear Threat Initiative

75.1 **Current and recent nuclear power non-proliferation initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING, BY CIVIL SOCIETY, AMONG CIVIL SOCIETY	producing and releasing films to raise civil awareness of proliferation threats, hosting forums to present research, identifying problem areas, raising funds for other IEIs
EDUCATION AND CAPACITY BUILDING AMONG DEVELOPERS, OPERATORS, AND REGULATORS	public joint declarations of issue-specific best practices/ requirements, joint development of shared indicators, joint publication of current industry status and trends
REGULATORY FRAMEWORK	Nuclear Non-Proliferation Treaty, IAEA Safeguard Agreement with independent verification, other frameworks
INFRASTRUCTURE/ REGULATORY FRAMEWORK/ FINANCIAL MECHANISMS	international nuclear fuel bank initiatives, geopolitical internationally negotiated power plant construction and technology transfer—i.e. KEDO

76.1 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

IEAE NFBI/ NTI "Low-enriched uranium stockpile"

NTI's 2006 proposal and offer to IAEA to create a low-enriched uranium "last-resort" nuclear fuel bank aims to give global economies who wish to develop civilian nuclear energy "incentive to import low-enriched nuclear fuel from one of the current global suppliers, rather than to build their own fuel cycle facilities… [and which] guarantees an assured international supply of nuclear fuel on a non-discriminatory, non-political basis to states that are meeting their non-proliferation obligations." [i] One of five major proposed non-proliferation/fuel cycle-based IEIs or IEI projects (including multilateral initiatives headed by the US, Japan, and Russia, as well as the private sector), [j] the NTI proposal attempts to address the desire of the IAEA (expressed since 2004) to create such an international fuel bank. Currently, the proposal offers no policy requirements of its own, and instead indicates that such agreements should be decided among member economies under the auspices of the IAEA. Instead, it seeks to raise funds to launch such a program, and as of February 2008 had received commitments of USD 50 million from the US government, USD 50 million from US private investor Warren Buffett, and USD 5 million from the Norwegian government, [k] pending achievement of a USD 150 million fundraising target.

[i] *NTI/Sam Nunn 2007*

[j] *US Congressional Research Service 2008*

[k] *NTI 2008*

INPRO Phase 1A "Guidance for the evaluation of innovative nuclear reactors and fuel cycles"

This document, the culmination of INPRO Phase 1A and a result of international summit meetings among INPRO members and other task group consultations, was expected to summarise the members' joint understanding of "prospects and potentials" for nuclear power, "user requirements for innovative nuclear energy systems (INS)," and "methodology for assessment of INS." INPRO identified nuclear non-proliferation issues as one of seven areas of focus for which to develop "user requirements and indicators" among members. "Basic principles", broad indicators, and guidance on future R&D needs are offered to address non-proliferation issues among member economies, but specific activities are not proposed. The 150 page document, published in 2003 by the IAEA, is openly available on the IAEA website.

KEDO "Light water reactor project"

KEDO aimed to directly prevent the uncontrolled proliferation of nuclear technologies to the Democratic People's Republic of Korea (DPRK) by gathering an international consortium of public and private members (including eight

APEC member economies) to construct two 1 gigawatt light water reactor (LWR) nuclear power plants as well as provide fuel oil shipments until commencement of plant operation in return for the DPRK's abandonment of various suspected or acknowledged civilian and military nuclear projects. KEDO was unique among IEIs for its hard, infrastructure-based approach, the focused nature of activity, and its strong overarching geopolitical context. The initiative ran from 1995 to 2006, and though construction began on site in DPRK for both reactors, work was suspended in 2003 among accusations between the DPRK and other KEDO members of breach-of-contract alongside other financing disputes and technical barriers. [l] Workers were completely withdrawn by 2005, and in 2007, DPRK announced the underground detonation of a domestically-produced nuclear warhead. This led to the post-KEDO re-launch of international proliferation-focused negotiations, the "six-party talks", which have again tabled the possibility of providing LWR plants to DPRK.

[l] *APERC UIEI 2007*

IEI nature, coverage, and potential

There is quite a bit of ongoing IEI activity which deals with nuclear non-proliferation. And similar to fuel cycle-focused IEIs, these activities involve a wide variety of actors and adopt a number of modes and approaches, from education and capacity building to actual infrastructure construction—extremely rare for IEIs. Some of this ongoing IEI activity is very much in parallel—if not competing—particularly for international nuclear fuel bank initiatives. Such parallel action demonstrates the broad international interest in collectively addressing the issue of nuclear proliferation and will complement and even support existing bilateral agreements and domestic activities already operating in this area. In this sense, IEIs have an important role to play in this area, and multiple competing IEI approaches should not be discounted as inefficient but rather regarded for their useful redundancy in exploring an array of strategic options to deal with an issue which has great interest but an unclear path for resolution. Here, IEIs have value in their contributions to global nuclear risk management.

Unusually for the nuclear power sector, there are also a number of smaller non-proliferation-focused IEIs dominated by and among members of the civil society in the APEC region. These civil organisations, such as the NTI, have very specific issue-based operational areas – such as to, "reduce towards zero the risk of use, by accident or intention, of a weapon of mass destruction anywhere in the world,"—in contrast to the overarching mission of the IAEA, which includes a number of broad (yet extremely important) responsibilities which cannot easily be condensed into a single message. [m]

[m] *IAEA 2008*

This phenomenon is important to understanding how IEIs will develop in this area into the future, and particularly, if new IEIs will be able to play a role in filling the gap left when economies withdraw or otherwise do not wish to join the NNPT, for example, but may be willing to accept some sort of reduced regulatory oversight with a different structure than that currently offered through the IAEA or other bodies. Should the large, government-led nuclear IEIs reform to address this matter, or will there be space—and demand—for an alternative regulatory scheme situated between the NNPT and a complete lack of international oversight in this area? This question will be become increasingly important as interest in nuclear power grows in previously non-nuclear economies.

PHYSICAL SECURITY

Increasingly so in the past five years, APEC economies have become sensitive to the possibility for terrorists to target civilian nuclear energy facilities or fuel chains for violent ends. Here, "security" focuses on short-term, localised threats, primarily to infrastructure, as opposed to the longer-term broader threat of proliferation.

GIF	Generation IV International Forum
IAEA	International Atomic Energy Agency
INPRO	[G8] Kananaskis Summit / St. Petersburg Plan of Action - Global energy security

78.1 **Current and recent nuclear power physical security initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING AMONG NUCLEAR POWER STAKEHOLDERS	publishing collaborative best practices handbooks and evaluation methodologies
REGULATORY FRAMEWORK/ EDUCATION AND CAPACITY BUILDING IN THE PUBLIC SECTOR	non-binding joint political declarations and codes of conduct

78.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

GIF "Evaluation methodology for proliferation resistance and physical protection of generation IV nuclear energy systems"

This GIF document is aimed at, "system designers, program policy makers, and external stakeholders," and develops an evaluation methodology to identify challenges, system responses, and outcomes related to physical security (and proliferation resistance) of nuclear power plants. The document was prepared with input from over 60 participants in an international ad hoc expert group drawn from public research labs, policy organisations, and academic institutions. Released in 2006, the 88 page document is openly available on the GIF website.

G8 "Nuclear safety and security group "

[n] *G8 2002*

Established following the 2002 G8 summit in Kananaskis, Canada[n], the Nuclear safety and security group (NSSG) issues joint statements at yearly G8 summits regarding shared political views on ensuring the physical security of nuclear power infrastructure, among other related issues. [o] The 2006 G8 St. Petersburg plan of action on global energy security reaffirmed this concern, recognising, "threats and vulnerabilities to critical energy infrastructures," and declaring continued support for the NSSG and other IAEA safety-related measures. [p]

[o] *G8/NSSG 2007*

[p] *G8 2006*

IEI nature, coverage, and potential

There is little current IEI activity which focuses specifically on the physical security of nuclear power, especially when compared to non-proliferation undertakings. Moreover, many of these existing activities are soft in nature. This is reasonable, as physical security of actual nuclear power facilities is largely a local issue and should be addressed by domestic regulation or other discreet

activities specific to local needs. As more nuclear plants are developed in APEC region areas such as Southeast Asia, however, where economies are in close geographic proximity to one another, there may be increased potential for collaborative IEI-type regulatory framework activity to address the physical security of nuclear plants.

GUARANTEE OF SOCIAL RESPONSIBILITY

Encompassing all of the issues listed above, social acceptance of nuclear energy is an issue in itself. For nuclear power to be accepted on a level similar to that of other power sources, those involved are tasked to give extra effort towards regaining the trust of the civil society from fiscal, safety, and security perspectives. Gaining and maintaining social acceptance occurs on two levels: (1) "internally" achieving actual fiscal, safety, and security goals; and, (2) "externally" communicating this achievement to a broader civil society audience, as well as addressing further social concerns. Many such internal goals have already been achieved, and the IEIs described above as well as other tools aim to address those which may remain or arise in the future. The issue presented here, therefore, focuses on the second, "external" level of communication needed for social acceptance.

FNCA	Forum for Nuclear Cooperation in Asia
NEWS	Nuclear Events Web-based System
NEA	OECD Nuclear Energy Agency
WNA	World Nuclear Association
WNU	World Nuclear University

79.1 **Current and recent nuclear power guarantee of social responsibility initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING AMONG NUCLEAR EXPERTS	holding international meetings and workshops to discuss trends and developments in civil society concerns, publishing literature survey-type reports on civil society perspectives of nuclear power, developing best practices based upon case study review for policy recommendations, developing radioactive waste-oriented action roadmaps, publishing manuals for nuclear industry to interface with civil society stakeholders
EDUCATION AND CAPACITY BUILDING AMONG CIVIL SOCIETY	holding international forums between experts and civil society representatives, distributing publications and other non-technical information materials, mass media appearances by nuclear experts
INFORMATION SHARING	online open-access nuclear event reporting

79.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

FNCA "Public information project"

Ongoing since 1991, this project aims to, "develop the applications of nuclear science and technology for the sustainable societal and economic growth," with, "emphasis on information exchange among the FNCA" members and other ad

hoc outreach activities. One of eight project areas under FNCA, project activities are centred around yearly project leader meetings, with workshops, representative reports from ongoing "public information" activities in each economy, and a larger forum of nuclear experts attended by public, private, and civil sector representatives (with approximately 100 attendees). As part of the initiative, member economies are also asked to develop and present "printed materials", such as newsletters or videos, which are aimed at increasing local civil society awareness of nuclear issues (not limited to power generation).

NEWS Event-reporting online database

NEWS is intended as a, "means for promptly communicating to the public in consistent terms the safety significance of [nuclear] events reported." It addresses calls for transparency by providing, "fast, flexible and authoritative information on the occurrence of nuclear events that are of interest to the international community." Jointly managed by IAEA, NEA, and WANO, NEWS provides a two-tiered online database of international nuclear (power and other) events. Reporting officers are nominated at the economy and facility level to send events to the database and can also subscribe to detailed event information, as can other nuclear experts and media representatives, by request. Members of the broader civil society (the general public) can access the database without registration at its website and view reported nuclear event information, including location, facility, time, description of the event, and risk level, for the proceeding six month period. Developed in 2001, NEWS is, "committed to communicate as quickly as possible official information on the consequences of an event," but not necessarily in real-time. As of February 2008, six events were listed in the open-access section of the database, including events related to the July 2007 earthquake at Japan's Kashiwazaki-Kariwa nuclear power plant as well as incidents of potential radiographer overexposure in Spain and the US.

IEI nature, coverage, and potential

Ongoing IEIs which address the issue of guaranteeing social responsibility in the nuclear power industry have only limited activities directed towards members of the broader civil society. Rather, these IEIs more generally focus on capacity building for nuclear representatives to handle civil concerns, and actual interface with civil society is more often left to individual IEI representatives from member economies, for example. Such a meta-approach to guaranteeing social responsibility might promise to reach more members of society with less cost, but it is nevertheless important to verify that interface with society is actually occurring at all as a result of the IEI's actions.

Communication itself can be grouped into two manifestations among current IEIs: those IEIs which attempt to use traditional capacity building and education tools to convince members of the civil society of the advantages of nuclear power while downplaying risks by *telling*; and, those IEIs which attempt to actually *demonstrate* the industry's social responsibility through actions. IEIs and organisations such as WNA fall largely into the first group; WNA, for example, offers, in a largely objective tone, detailed yet accessible information about different aspects of nuclear power. The success of this activity is evident in the number of citations it receives in international mass media. IEIs such as NEWS, on the other hand, fall into the second group outlined above; rather than telling civil society nuclear power is safe, it shows them by transparently reporting major incidents as they happen.

Both approaches are valuable and necessary, but the latter approach may have more future potential and convincing power. It acknowledges the sophistication of the broader civil society and attempts to do more than simply convince them of one position. Future IEIs, therefore, particularly those led by the nuclear industry businesses, might consider how the end of guaranteeing social responsibility could be met through concrete actions such as self-binding regulatory frameworks or even financial mechanisms. Similar techniques could also be valuable to dealing with related issues in other energy industries which must address social responsibility, such as LNG trade or petrochemical refining.

HUMAN CAPITAL

In part because of a failure to achieve full civil society acceptance up to now (including NGOs, the media, general public, and even academics), the availability and competence of the next generation of nuclear industry scientists, technicians, managers, and other workers is questionable. Human capital in the nuclear power industry can be split into three groups: (1) the most educated research-level nuclear scientists who push the upward bounds of nuclear knowledge; (2) trained engineers and PhDs who design and implement nuclear power technologies for reactor firms such as Toshiba, Areva, or General Electric; (3) trained engineers, managers, and power plant operating personnel. Other nuclear power industry-related human capital requirements can also be viewed from a topical perspective, such as those experts needed for power reactors, research reactors, waste handling, or regulation and administration. The issue presented here focuses on the latter tiers of human capital, and specifically those trained engineers and operators for nuclear power reactors. Developed economies with existing nuclear power industries will need to replace an ageing workforce, while developing economies which wish to initiate or expand their nuclear power industries will need to recruit a whole new generation of nuclear manpower.

FNCA	Forum for Nuclear Cooperation in Asia
IAEA	International Atomic Energy Agency
INIS	International Nuclear Information System
NEA	OECD Nuclear Energy Agency
WANO	World Association of Nuclear Operators
WNU	World Nuclear University

81.1 **Current and recent nuclear power human capital initiatives in the APEC region**

APERC IEI database 2007/2008

EDUCATION AND CAPACITY BUILDING AMONG ACTIVE NUCLEAR WORKFORCE	power plant twinning programs, power plant personnel exchange, closed inquiry systems, self-organised topical workshops
EDUCATION AND CAPACITY BUILDING AMONG PROSPECTIVE NUCLEAR WORKFORCE	international summer institutes for young professionals, peer review and networking of nuclear academic institutions, publishing of nuclear power learning aids such as dictionaries
INFORMATION SHARING AMONG ACTIVE NUCLEAR WORKFORCE AND RESEARCHERS	closed online nuclear research material databases, closed event reporting databases

81.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

WANO "Operator exchanges"

This ongoing activity aims for WANO members to, "directly share plant operating experience and ideas for improvement through face-to-face communication." WANO is a professional organisation of nuclear power plant operators with a primary aim of achieving "the highest possible standards of nuclear safety," in part for the collective good of the worldwide nuclear power industry. Program activities such as plant operator exchanges or longer-term plant twinning programs are intended to improve the practices and capacity of nuclear plants and their staff across a wide range of plant operations. Participation and outcomes of WANO activities are generally closed to participation by non-members in part to encourage frank dialogue.

WNU "Summer institute for future leaders"

This project selects a group of approximately 100 young professionals in the nuclear industry from both developed and developing economies to learn from nuclear experts, engage in small-group exercises, self-network, and be introduced to senior nuclear industry mentors. A six-week summer course organised yearly since 2005 and largely supported by IAEA funding, this is the flagship project of the WNU partnership.

IEI nature, coverage, and potential

The issue of building human resources should naturally be addressed through the tool of capacity building and education. IEIs generally excel at this, and so should be suited to the task. However, the human resources needed by the nuclear power industry in the coming decades will require a hard approach—recipients will actually need to show measurable progress and learned skills as a result of such education and the education must be applied comprehensively—a requirement in which IEIs are generally weak. WNU's summer institute is a good example of this phenomenon in that it provides a valuable educational opportunity to participants, as intended, but its coverage is not comprehensive (it cannot enrol as many participants as could benefit from it) and it benefits from not having responsibility for measurable outcomes from its participants.

On one hand, comprehensive, measurable education is something that universities should provide—this is their specialty. But on the other hand, universities do not have direct incentive to solve the nuclear industry's human capacity problems, especially considering the cost and difficulty of maintaining a nuclear education program in the face of low interest from students. There is potential, therefore, to address this "market failure" by combining elements from both. A future IEI in the APEC region might leverage the resources and needs of the nuclear industry itself with the tools of universities through the establishment of a post-graduate level international university of nuclear engineering, for example. Such an international institution could supply the collective critical mass of educational demands from underserved students in prospective nuclear economies alongside those from established nuclear economies. Simultaneously, it cold discourage nuclear proliferation, safety, and security issues in the long-term by increasing international oversight of and networking with newly-trained nuclear scientists and ensuring a satisfactory level of training and certification. Even operating at a small scale, such an institution could be valuable in alleviating fears of human resource shortages to the nuclear industry.

ENERGY TRANSPORTATION

As some APEC economies' energy sectors become increasingly dependent on fuel imports, and others' economic growth is increasingly driven by fuel exports, the region as a whole becomes more dependent on energy transportation. Much of APEC falls into either of these two categories. In 2005, the APEC region hosted four of the top six global energy importers (United States, Japan, Korea, China) and three of the top five energy exporters (Russia, Canada, Australia).[q] Moreover, APERC projects that by 2030, of the fourteen net energy importing APEC economies, seven will have net import dependencies above 75 percent; of the six net exporting economies, three will export at least twice again what they use themselves. [r] Trading of energy resources in regard to regional and international needs will be expanded substantially.

- Energy market reform and institutional framework
- Political risk

83.1 **Energy transportation sub-issues**

Energy transportation infrastructure for moving energy resources between points of production and points of consumption includes ocean tankers, specialised trucks, inland barges, trains, pipelines, and power grid networks. Development of these will require substantial investment and coordination in order to support the fast energy demand and energy trade growth, and trans-boundary or other shared multinational infrastructure can be an appealing way to share investment costs. However, in such multi-economy infrastructure projects, such as natural gas pipelines and power grids, special efforts must be made to address the issues of energy market reforms and political risk.

[q] *IEA 2007*

[r] *APERC Outlook 2006*

ENERGY MARKET REFORM AND INSTITUTIONAL FRAMEWORK

According to the *APERC energy demand and supply outlook 2006*, the international oil and gas trade through pipelines in APEC is expected to reach 10.9 million barrel per day and 530 BCM per year in 2030, and much of this trade is expected to be based on bilateral agreement between energy supplying and consuming economies in the APEC region.

It is difficult to develop multilateral energy transportation projects among APEC economies as the partners must jointly overcome the burdens of financing, regulatory framework issues including transition tariffs, technical problems such as harmonising technology standards, and political risks on the project. In addition, sub-regional energy interconnection networks, such as natural gas pipelines or power grids, in the APEC region must be formed in one of five clusters due to the regions geographic distribution, namely: Southeast Asia, Northeast Asia, North America, Latin America, and Oceania. However, within these five clusters, the economic and energy industrial structure of each economy are generally at different stages of development, which increases the complexity of building trans-boundary energy networks.

Development of trans-boundary energy infrastructure among APEC economies does now and will continue to face technological challenges as each economy has its own regulations and standards in place for the natural gas and electricity industries. Because of these differences, the reliability of trans-boundary energy infrastructure becomes a key concern in the pursuit of energy cooperation as failure of energy supply is costly. For example, the Northeast US summer blackout of 2003 was estimated to have USD 6 billion financial losses and also left one-third of Canadians without power, just as, over a longer distance, the Australian rail bottlenecks of 2007 affected coal shipments to Korean industry.

Financing tools for energy infrastructure investment in many developing APEC economies may not be available from internal sources as domestic capital markets for equity and bonds are immature; in these cases energy project financing relies heavily on public sector bank lending.

Transmission tariffs and transit charges on an energy infrastructure network are other obstacles to multilateral energy transportation not easily agreed upon among cooperating economies, especially since many APEC economies still subsidise their energy sectors through regulated tariffs. Added to this is the concern for unauthorised gas or electricity trade to occur over the transit region or other efforts to illegally avoid transit tariffs.

APGAS	APEC Gas Forum
-	APEC Natural Gas Initiative
ASEAN +3 COOPERATION	ASEAN + 3 Framework for Comprehensive Economic Partnership: Energy Cooperation
ASEAN-JAPAN COOPERATION	ASEAN-Japan Framework for Comprehensive Economic Partnership: Energy Cooperation
APG	ASEAN Power Grid Initiative
ECT	Energy Charter Treaty Process
ERF	[APEC EWG] Energy Regulators Forum Initiative
ERI	[APEC EWG] Energy Security Initiative
GMS	Greater Mekong Subregion Economic Cooperation Program
IAI	Initiative for ASEAN Integration
NAGPF	Northeast Asian Gas & Pipeline Forum
TAGP	Trans-ASEAN Gas Pipeline Project

84.1 **Current and recent energy market reform and institutional framework initiatives in the APEC region**

APERC IEI database 2007/2008

INFRASTRUCTURE DEVELOPMENT	building natural gas and power grid networks
FINANCING MECHANISMS	financing construction through loans
REGULATORY FRAMEWORK	lobbying between the private and public sectors, establishing common legally binding energy infrastructure investment terms
RESEARCH AND DEVELOPMENT	conducting feasibility studies on proposed network development
EDUCATION AND CAPACITY BUILDING IN THE PUBLIC SECTOR	providing forums to discuss programmes and policies related to energy sector, hosting training workshops

84.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

NAGPF

Aims to, provide "a driving force toward the construction of the International Pipeline Network in Northeast Asia". The forum, composed of actors largely from the private and civil society sectors, is held annually to facilitate discussions on barriers and problems for the international gas pipeline projects in the Northeast Asia region. Since its establishment, four international joint research studies on

the long-term vision of natural gas infrastructure in Northeast Asia region were published.

GMS "The power sector"

Aims to, "facilitate sustainable economic growth and reduce poverty in the subregion by strengthening economic linkages among the six member countries." ADB uses a two-level approach to develop the GMS power market, firstly providing the policy and institutional framework for increasing power trading, and then developing the grid interconnection infrastructure through a building block approach. The first (capacity-building) element is undertaken through the Electric Power Forum and the Expert Group on Power Interconnection and Trade. In 2006, two cooperative studies were published, namely "Options for the future GMS power market" and "Regional power trade operating agreement in the GMS". [s]

[s] *Yongping Zhai 2008*

APGAS

Aims to, "achieve a common understanding amongst … APEC economies on the actions necessary to ensure free and unhindered trade in gas and LNG." This forum is held annually and organised by a steering committee comprising key executives drawn by the APEC Energy Business Network from the natural gas industry. The forum is intended to encourage dialogue between government, buyers, sellers, and users of gas to faster understanding the needs and concerns of each.

IEI nature, coverage, and potential

Among current initiatives related to energy market reform and institutional framework, more than half of the projects or programmes are focusing on education and capacity building or information sharing to address the issues of energy market, financing, legal and institutional framework, and harmonisation of regulations and standards. Such activities can be considered a "soft" approach, as their tasks can be relatively easily and cheaply implemented through training and knowledge exchange. Very few current IEIs adopt a "hard" approach in overcoming the key challenges in developing energy transportation infrastructure, such as financing, developing regulatory frameworks, and construction of physical assets.

POLITICAL RISK

An international energy transportation network necessarily involves multiple economies. And if any involved economy were to experience political or other conflict, it could affect energy transport to other economies connected on the same network. For example, in December 2005, Russia and Ukraine could not reach a consensus on natural gas price and consequently Russia reduced natural gas supply to Ukraine. Because of this outside conflict, several European economies whose natural gas supply was normally delivered through the Ukrainian pipeline network experienced a shortage. Moreover, those European economies faced difficulty in quickly securing replacement natural gas supply from alternative sources. [t]

[t] *Morelli 2006*

This kind of political risk threatens those who wish to build a regional energy network with only one supply source. Among APEC economies, Russia is the

only potential source for oil and natural gas supply through pipelines to other Northeast Asian economies, while Indonesia and Malaysia are the primary pipeline natural gas suppliers in Southeast Asia. Therefore, it is valuable for APEC economies interested in pursuing such trans-boundary energy infrastructure development in their regions to learn from such experiences.

APGAS	APEC Gas Forum
APG	ASEAN Power Grid Initiative
ECT	Energy Charter Treaty Process
ERF	[APEC EWG] Energy Regulators Forum Initiative
ERI	[APEC EWG] Energy Security Initiative
-	[G8] St. Petersburg Plan of Action – Global Energy Security
GMS	Greater Mekong Subregion Economic Cooperation Program
NAGPF	Northeast Asian Gas & Pipeline Forum
TAGP	Trans-ASEAN Gas Pipeline Project

86.1 **Current and recent energy market reform and institutional framework initiatives in the APEC region**

APERC IEI database 2007/2008

REGULATORY FRAMEWORK	establishing the legally binding international arbitration panels
EDUCATION AND CAPACITY BUILDING AMONG PRIVATE AND PUBLIC SECTOR ACTORS	yearly joint forums of infrastructure project or energy trade stakeholders, forums for discussion among energy regulators, conducting energy supply disruption response simulations

86.2 **Current IEI approach**

APERC IEI database 2007/2008 and IEI secretariats

Examples of projects

ECT "Dispute settlement"

Aims to, "strengthen the rule of law on energy issues by creating a level playing field of rules to be observed by all participating governments, thereby mitigating risks associated with energy-related investments and trade". The ECT includes five distinct codified dispute mechanisms, addressing economy-economy, investor-economy, transit, trade, and environmental disputes. In the case of such a dispute, arbitrage can be conducted through the World Bank-affiliated International Centre for the Settlement of Investment Disputes, the Arbitration Institute of the Stockholm Chamber of Commerce, or an *ad hoc* arbitration tribunal. Whatever mechanism is employed, parties are bound to the arbitration results. Since the ECT has entered into force, arbitration has been used in 18 party disputes.

IEI nature, coverage, and potential

There is little IEI activity which specifically focuses on the political risk of trans-boundary energy infrastructure development. The dispute mechanisms utilised by ECT are the most prominent activity directly and systemically dealing with political conflicts among participating members. Instead, other current IEIs

in this area generally employ capacity building studies which may include discussions on the political risk of a proposed trans-boundary energy interconnection network. Alternately, IEIs may organise international workshops which have political risk as one of the discussing topics. Therefore, soft approaches are the predominant choice for current IEIs to address political risk—focusing more on *understanding* current political situation and related issues such as investment risk rather than actually *engaging* it.

For those ongoing IEI which are involved in the construction of infrastructure networks, such as TAGP, much of the network is actually developed based on bilateral agreement between two participating members. In these cases, the IEI itself deals primarily with larger multilateral coordination issues. Having a bilateral foundation for actual energy network infrastructure implementation may reduce political or other risk relative to a more complex multilateral agreement. However, many of these IEIs nevertheless aim to move into the next stage of network infrastructure development which will include true multilateral cooperation. Therefore, there is potential to create a political risk-oriented framework in the APEC region, such as that provided by ECT, which could directly address such key issues as dispute resolution or investment framework.

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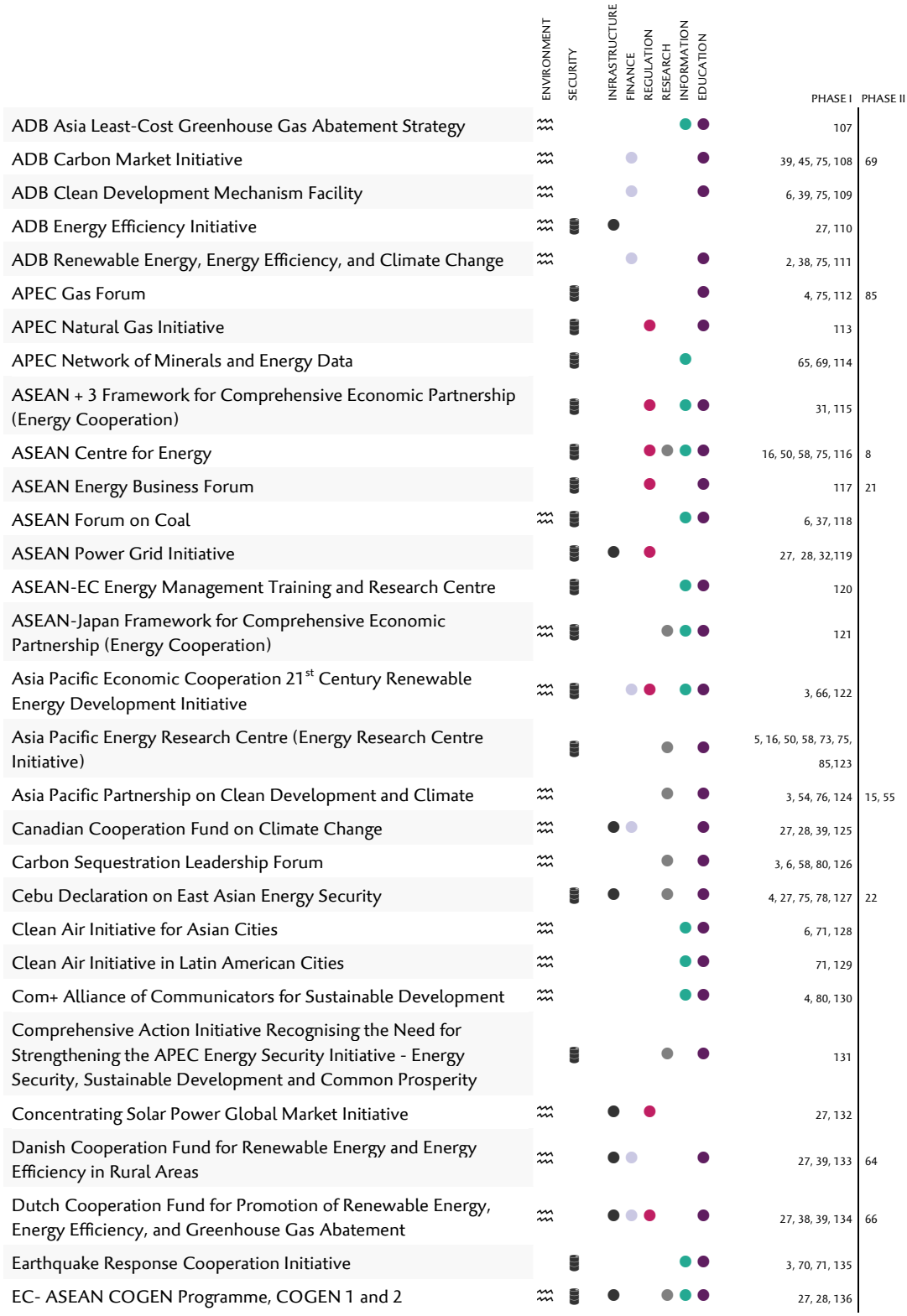
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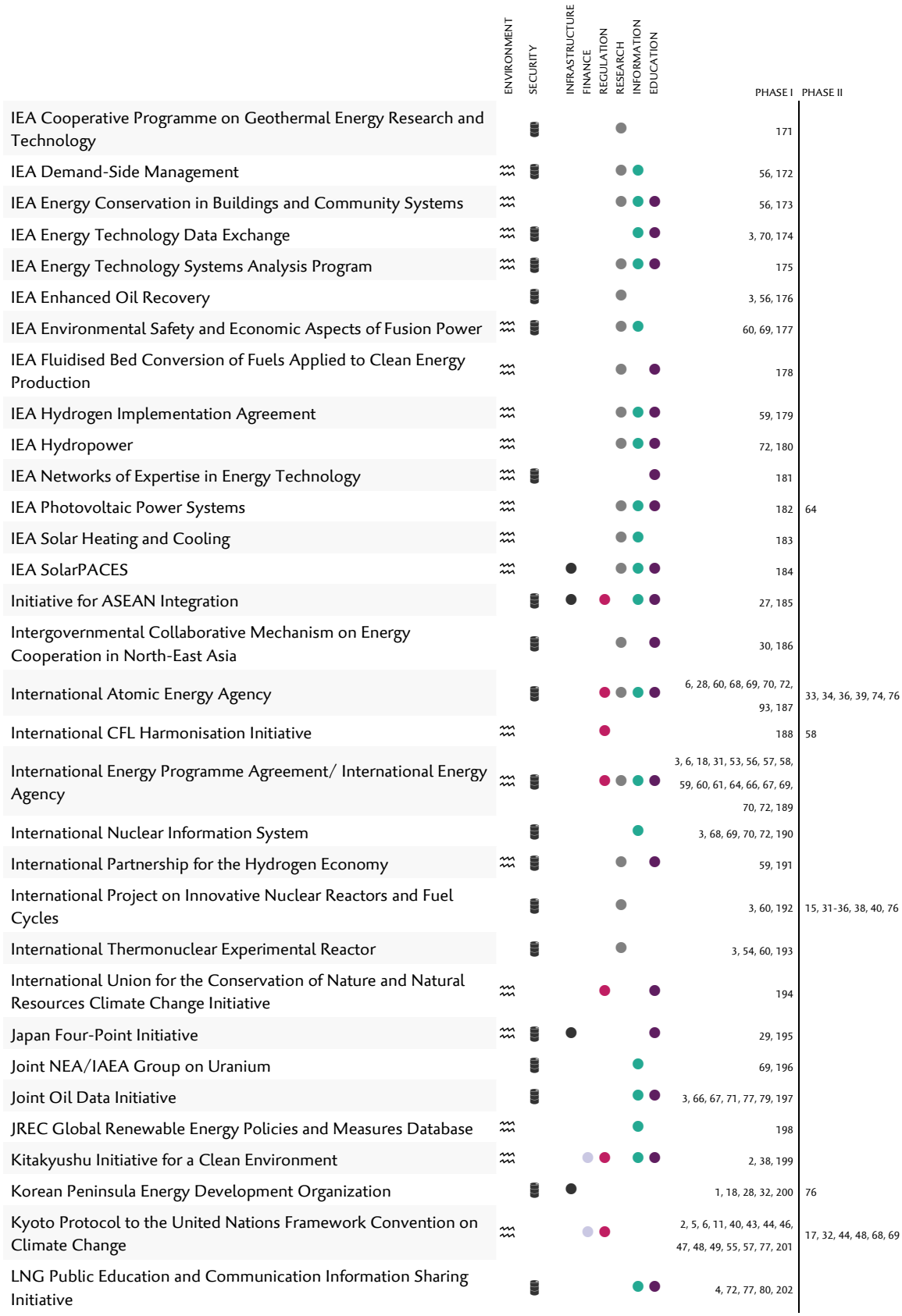
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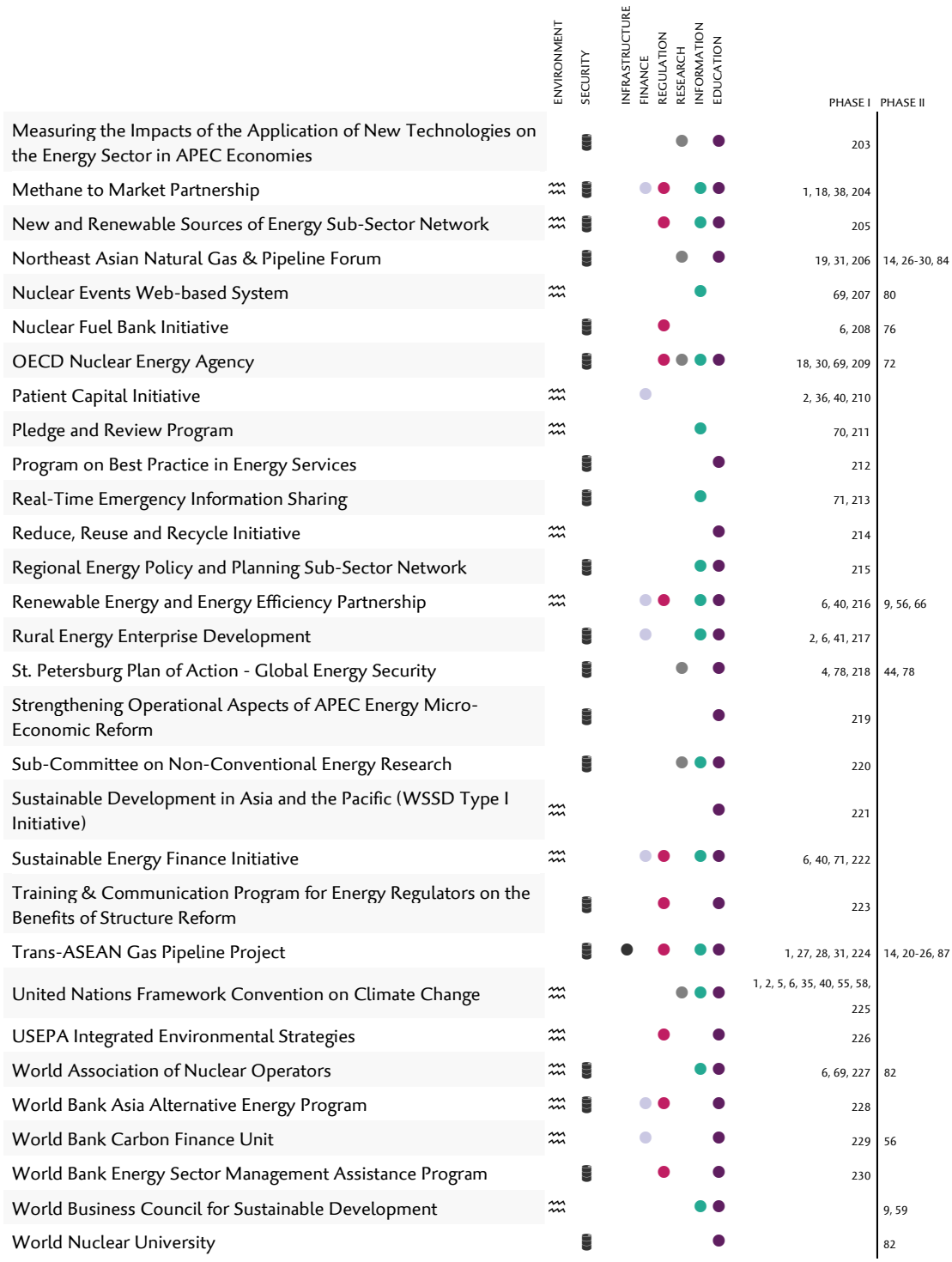
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