

***Seminar 2 - From Prototype to Market: Development of marine renewable energy policies and regional cooperation***

**June 24-25, 2014 | Santiago, Chile**

**EXECUTIVE SUMMARY**

**BACKGROUND**

Taking into consideration global needs for new sources of energy to meet the growing industrial and household demands in the midst of rising energy costs and diminishing fossil fuels, it is imperative that PECC economies invest more in developing and optimizing new types of energy. It is one of top priorities for PECC economies to explore the most efficient ways of ensuring a smooth transition from fossil fuels to renewable and sustainable energy. Lessons can be learnt by sharing how PECC economies are transitioning from being high energy consumers to becoming more eco-friendly and energy-efficient.

This project, endorsed by the PECC Standing Committee at its Vancouver meeting in June 2013, aims to design the framework for new economic models that will make way for smooth energy transition, by bringing together the energy-exporting and importing economies, energy producers or distributors as well as energy-related policymakers. It will put into perspective new business initiatives and governments strategies designed to facilitate energy transition that will be critical to achieving a sustainable living environment.

Several PECC economies are more advanced than others in rolling out energy policies, providing funding and implementing environmental regulations conducive to such energy transition. The Victoria seminar has provided forward-thinking into the new age of energy production and consumption where fossil fuels and conventional production methods resulting in high carbon costs would be replaced by more environment-friendly energy and technology. Renewable energies need to move beyond R&D to the stage of becoming more market competitive and commercially viable in efforts to mitigate the adverse effects of potentially increasing prices of depleting fossil fuels and climate change concerns.

The second seminar was organized by FPTPEC and CHILPEC. Four following issues were discussed:

- Renewable energies to meet industrial demands and needs of isolated locations
- Development of marine and renewable energies: Promoting early acceptance
- Setting appropriate policies to develop renewable energies
- Developing cooperation between stakeholders to promote energy transition

	Solar CSP	Wind	Wave	Tidal Current
Development Status	Early Commercial	Commercial	Pre-Commercial	Pre-Commercial
Source	Sun	Uneven solar heating	Wind blowing over water	Gravity of moon & sun
Intermittency	Day-night; clouds, haze, and humidity	Atmospheric fronts and storms (local winds only)	Sea (local winds) and swell (from distant storms)	Diurnal and semi-diurnal (advancing ~50 min./day)
Predictability	Minutes	Hours	Days	Centuries

### Summary of key points and recommendations:

- PECC economies should look for an efficient management of marine energy resources.
- Ocean accumulates thermal energy, and returns it in many forms. Energy demand will weigh increasingly on water resources and emerging countries could soon face a double stress, water and energy.
- Climate change will exacerbate this challenge, with a greater variability in the availability of water resources and intensification of weather events, such as severe floods and prolonged droughts.
- Renewable energy policies are to be welcomed, but governments should pursue incremental and realistic energy transition paths, suited to their respective development stages.
- Multilateral cooperation would be needed for unlocking financial challenges faced by renewable energy sectors including solar and wind powers.
- Successful energy transition is feasible with balanced and realistic international frameworks in place.

### Session 1: Renewable energies to meet industrial demand and needs of isolated locations

*As the global energy demands and costs rise, more pressure is placed on finding solutions to keep the industries running with efficiency with minimal environmental degradation. Economies must find not only technological but policy innovations that can turn the challenges into opportunities for further growth. This becomes a significant challenge in particular for isolated locations where there is scarcity of natural resources and less opportunity for energy autonomy.*

Putting in place efficient and realistic energy policies is an essential ingredient that must go hand-in-hand with economic and social policies. It is also important to ensure that everyone takes ownership and responsibility in tackling the energy challenges, domestically, regionally, and internationally.

For many reasons, developments in marine renewable energies (MRE) are gaining traction and optimism around the world. In contrast to fossil fuels, they are inexhaustible and renewable; they reduce the harmful greenhouse gas emissions; and less likely to incite political tensions which can arise from economies and countries competing to secure more energy sources from fossil fuels. The key challenges of MRE, however, are that they are location-specific and that the generation of energy

can be more unpredictable compared to fossil fuels, and that the upfront costs for setting up infrastructures can be hefty; there is significant risk involved with making financial and policy investments into MRE. Adoption of new technology and policies need to be done incrementally and thus must start now.

Marine renewable energies perceived today as relatively most viable of the lot are: tidal/ current, wave, offshore wind (using floating wind turbines), and ocean thermal energy conversion (OTEC). They are expected to be at pilot farms by 2017 and the target year for them to go commercial is around 2018-2019. To stay on track, the following areas need to be addressed:

- It is important to map the resources and decide where and how to invest in which of the MREs in certain locations;
- Early spatial planning is important as building MRE facilities and equipment require large pieces of land with least obstructions;
- Predictability in rules and regulations including permits for installation and are needed to give reassurance to investors;
- Environmental impact studies are essential to set up framework of rules concerning the environment;
- R&D support is important and open competition should be encouraged with allowance for public bids and tenders.

While MREs remain still very much a niche market, each player has enormous potential to gain by joining in the competition early. Once the MREs take off, those who have joined early have advantage over the latecomers. In this case, it may very well be that being the “first” may be more advantageous than being the “best” but late.

## **Chile**

The shale gas boom has had revolutionary impact on the global energy market; governments and businesses around the world are calibrating to its impact on the economy. Energy transition is critical for a country like Chile in full swing of economic development.

Chile basically needs to double its energy supply capacity in about 20 years. Chile currently has an energy mix of 92.55% conventional energy, and 7.45% non-conventional renewable energy (NCRE). Chile has already surpassed its target of 5% renewable energy by 2013 and is aiming to attain 20% of its power generation to come from renewables by 2025.

Chile is largely dependent on energy generated from large-scale hydro dams. It is however also richly endowed in other energy sources such as solar, wind, and geothermal. Conditions in Chile are highly optimal to solar energy development. It also has long coastlines, rich marine life, and climate, natural conditions that can be optimal to benefit from certain MREs. Chile enjoys political stability and makes an attractive place for investors while it continues to be an active member in global efforts to

mitigate negative impacts from climate change and keeping carbon emissions under control. Altogether there is ample political will and social motivation in furthering the development of renewable energies.

The long stretch of land in Chile is divided into four interconnected systems: SING (Sistema Interconectado del Norte Grande), SIC (Sistema Interconectado Central), Aysen, and Magallanes, of which SIC makes up for 78% and SING for 21.2% of the total megawatts. SIC derives 43.6% of its electricity from hydro and 55% from thermal sources while SING uses 99.7% thermal. However, Chile's energy consumption is expected to grow by 60% during next ten years and the policy-makers are struggling with the challenge of coping with the growing demand. There is insufficient development in place of new generation projects that can increase the base load capacity and this is likely to be the scenario for the next 4-5 years. These challenges are caused by a number of factors including: increasing regulatory measures that make it harder to obtain permits; growing opposition from organized interest groups and local communities; and growing investor uncertainties. While in theory the shortfall in energy supply for increasing future demand could be met by "non-conventional renewable energies" (NCRE); in reality, it will not be sufficient. What is likely to happen is that Chile will continue to depend heavily on conventional base load energy such as coal, LNG and hydro-electricity<sup>1</sup> and the shortage will lead to significant energy price increases in the next 5-6 years.

Chilean government is investing significantly in human capital development while tackling bottlenecks in transport and looking for ways to reduce the logistic costs by economy of scale in their efforts to meet the 2025 NCRE target. The government is also looking to support the incorporation of NCRE by providing support through funding, facilitating supply contract auctions, designing investment portfolios, and offering price stabilization funds. At the same time, this also results in government rejecting some of the large-scale hydro and geothermal plants despite their efficiency, while encouraging more small-scale hydro plants (23% of total NCRE) and biomass (45% of total NCRE).

## **European Union**

In January 2013, the "Santiago Declaration" issued by the heads of state and government of the Community of Latin American and Caribbean States (CELAC) and the EU reiterated their shared commitment to deepen their "strategic partnership" under the theme of "Alliance for Sustainable Development: Promoting investments of social and environmental quality." It recognizes that the dual challenge of tackling energy security and environmental issues is an important agenda for everyone and that this needs to be addressed collectively, requiring international cooperation. The Action Plan proposed two main approaches: 1) to improve energy efficiency and saving as well as

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<sup>1</sup> Large-scale hydro plant-generated electricity is considered part of conventional energy (>20MW) and only smaller scale hydro projects (<20MW) are categorized as non-conventional renewable energy (NCRE) in Chile.

accessibility; 2) to develop and deploy renewable energies and promote energy interconnection networks, ensuring the diversification and complementarity of the energy matrix.

At present, ocean energy covers about 0.02% of EU energy needs and is primarily used for electricity production. Of the various technologies available, wave and tidal/ current energy have been actively explored while research into ocean thermal energy and salinity gradient energy remain still in the early stages. There is also strong potential of synergy between the ocean energy and the offshore wind sector.

The renewable energy can provide a new engine of economic growth through competition and creation of new jobs. The key challenge now is to move from the current phase of testing and demonstration to large-scale production while bringing down costs. While the onus is mainly on the industry, it also requires assistance from the policy-makers of the EU to facilitate cooperation, help to increase regulatory certainties for investors, boost jobs in the sector, and enhance private-public partnerships (PPPs).

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## **Session 2: Development of marine renewable energies and promoting early acceptance**

*One may question why we need to address the issue of renewable energy and think about energy transition when there seems to be ample gas and oil to last us another few hundred years. The objective is to start the energy transition as early as possible and collectively.*

Renewable energy development and its integration into national energy policy is an integral component to ensure successful energy transition. However, renewable energies are specific to each country or locale's unique situation and circumstances, varying from one sector to another (e.g. wind, solar, hydro, wave, etc.) in different stages of development and viability. In small isolated locations such as islands that are remote from the main grid and network, local renewable energies can be much more competitive than on mainland purely out of necessity and in some cases become sufficiently competitive with no need for subsidies (e.g. Salvador PV Merchant plant).

## **Energy and Water**

Another challenge related to renewable energy is its intricate interdependency on water. Energy demand will weigh increasingly on water resources and emerging economies needing increasingly more energy could soon face the dual stress of energy and water shortages. Water and energy are closely interlinked and interdependent. Energy generation and transmission require utilization of water resources, particularly for hydroelectric, but also nuclear, and thermal energy sources which require water as a cooling source.

On top of this, climate changes will exacerbate this situation as well as intensify natural disasters. Not just securing new energy sources but securing more freshwater is of important concern to each country, necessitating diversification and optimization on the ways in which we gain access to, treat,

process, and transport freshwater. Additional freshwater can be obtained by desalinating seawater but this requires high energy consumption and can contribute to raised carbon emissions.

In Chile, particularly in northern regions with its mining operations and agricultural industry, are in great need of water. The demand from Chile's mining industry for desalinated water is expected to increase four-fold over the next four to five years. With water demand exceeding supply in all regions north of Santiago, two options are under debate: desalinate seawater or transfer freshwater from Chile's south. Transfer of water is an important issue, between areas where fresh water is abundant, and arid or desert areas. But the investment costs could run very high, and there may be objections from local communities especially where water is scarce. In some cases, people living in areas with water may perceive that they are dispossessed of their natural resource over which they feel that they have ownership, for the benefit of foreign regions. This can create tension, and even water-related conflicts.

A project is under study in the Atacama Desert of Chile, the driest desert on earth (see <http://www.via-marina.com>). The Atacama highway water project intends to transfer water from central southern region VII to the northern regions using seawater-resistant pipelines for agriculture, mining, and human consumption. It could provide northern Chile with more water using lower energy consumption and costs compared to desalination plants.

Carnegie Wave Energy integrates off-the-shelf reverse osmosis desalination technology into its infrastructure for energy generation in Perth. It receives \$13.1 million Australian government grant for power generation while receiving \$1.25 million grant for desalinated water production. Carnegie Wave expects to generate first revenues from power and water sales starting 2014 and their first commercial sales of CETO units are expected around 2016-2018 to become increasingly self-sufficient.

## **Carbon Emissions**

Approach taken with Kyoto Protocol was highly centralized, top-down, and the targets were more driven by political ambitions rather than science-based. Phasing out fossil fuels and containing the rise of global temperature to not exceed 2 degrees Celsius must be done over a long-term planning. Rather than apportioning the burden of cutting down on the greenhouse gas emissions by percentage across countries, the aim is now to have each country phase out over time to allow each to adapt to national circumstances and resources. With proliferation of national and regional carbon markets, various models of emissions trading scheme being tested worldwide, many experts also share that simply linking national carbon markets is not the solution due to technical difficulties and loss of climate integrity. Delinking becomes inevitable at some point which can raise risks and incur high costs. Creating a single global market with market-based carbon price seems to be the more effective approach in regards to mitigating the carbon emissions.

As renewable energies become more competitively priced, this can contribute to the global aim of cutting down the greenhouse gas emissions and controlling the global warming phenomenon.

## **Best Locations**

Best locations for specific renewable energies are determined by a combination of:

- Resource availability vs. loads on structures
- Energy use at short distance vs. long distance
- Grid connection and energy storage
- Industry and transport infrastructures such as roads and harbors
- Facilities and associated manpower
- Environmental and social acceptability

Of different renewable energies, wind is an intermittent resource and thus much effort is placed on improving the short-term meteorological predictions. Wave energy is also intermittent, which depends on the far wind generation (swell) and close wind generation (wind seas). Tidal and current energies, on the other hand, are predictable as their height and speed can be computed at a fixed place and they occur at regular intervals. OTEC is optimal in inter-tropical zones. It is today at a high price level and is suitable for islands with highest population.

Marine renewable energies are expected to become cheaper and more widely available in the near future but the challenges of strong disparities between locations, unpredictability according to seasons and time of the day need to be taken well into consideration. The development of renewable marine energy can be a way to meet the demand for energy, reduce the energy bill both from private and from the industry and fight pollution in coastal cities and island territories. This would be particularly efficient in economies such as New Caledonia or Chile where almost 30% of the energy used locally goes to mining.

## **Social Acceptance**

It is of critical importance that governments pay great attention to ensure early social acceptance when it comes to implementing or reforming energy policies. Governments should adopt a common strategy that promotes collaboration among industry, government and the research sectors. Proactive communications and community outreach through public education, wide dissemination and sharing of research materials, and collective environment monitoring programs are effective to build confidence and trust from the public-at-large from early stages of new projects or policies. Without continued public support and genuine sense of community ownership, it is difficult for any government to successfully implement these energy policies. Some of the challenges for social acceptability are: a) environmental uncertainties; b) displacement of other industries; c) impact to electricity rates; d) costs versus realizing local industrial benefits; and e) the general “why bother” attitude.

In the case of Canada, energy policies are decentralized and set up by provincial governments and thus efforts to enhance social acceptance are also carried out locally. In the case of British Columbia or the west coastline, focus is on wave; Nova Scotia on the east is looking to take advantage of tidal energy while river is Canada-wide. The Nova Scotia government offers Community Economic Development Investment Funds (CEDIF) to heighten the community ownership.

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### **Session 3: Setting appropriate policies to develop renewable energies**

*Cooperation at all levels and sectors need to take place simultaneously to tackle and overcome the energy challenges. Selecting projects with best potentials with limited budget or financial resources is the most challenging part. Each selection carries a risk that if it fails, one may very easily lose public confidence whereas it is much harder to gain it.*

#### **Decentralized Cooperation**

While there are international collaborations taking place at various multilateral and bilateral platforms, there are also decentralized collaborations as vehicles for technological innovation and diffusion as seen between France and the Southern Cone of Chile or between Finistere and Chiloé. Such approach can enable localized response to communities' specific needs and to promote overall sustainable development. Such form of decentralized collaboration aims to enable strategic alliance by bringing together market actors, research actors, institutions and networks into the dynamics.

#### **Financing and Government Incentives**

At the European Union level, ambitious goals were set collectively to reduce the greenhouse gas emissions while increasing the proportion of renewable energies, and increasing the overall energy efficiency. Some of the challenges seen at the policy level are: a) the need to simplify licensing procedures for projects and entrepreneurs; b) access to electricity grid; c) access to field data; d) promoting domestic market; e) feed-in-tariffs (FIT); f) defining the optimal energy mix for the domestic market; g) high upfront costs of renewable energies; h) insufficient operation experience and skills. In order to provide financial and incentives for MRE development, some of the mechanisms offered are:

- Investment-based mechanisms (e.g. subsidies, credits, and loans)
- Quota systems (e.g. Tradable Green Certificates, tendering)
- Fixed price systems (e.g. feed-in-tariff)

Feed-in-tariff mechanism is designed to accelerate investment in renewable energy technologies. It achieves this by offering long-term contracts to renewable energy producers, typically based on the cost of power generation of each technology. Wind power, for instance, is awarded a lower per kWh price whereas technologies such as solar PV and tidal power are offered higher prices. FITs usually include three key provisions: a) guaranteed grid access; b) long-term contracts for the electricity produced; c) purchase prices based on the cost of generation.

Renewable energy development must be seen as a longer-term but inevitable investment for the future. Given that developing new forms of renewable energies is costly, the key question is how much to finance with public or private funds and when to withdraw the subsidies. Ideally,



government policies in supporting renewable energy need to remain consistent, realistic, and determined, unhindered by changes in governments, political disputes, or lobbying.

### **Location-specific Investments**

In the case of Japan, geographical and topographical challenges exist. The seabed is deep and steep, there are strong wind currents and typhoons blowing in all directions, there are earthquakes in and around the islands of Japan. Such seemingly difficult conditions drive people to innovate and drive towards large-scale offshore structures. Japan is densely populated and it has become increasingly difficult to find onshore locations for wind mills which led the energy policy makers to turn to find solutions in offshore wind. Japan, having the sixth largest exclusive economic zone (EEZ) in the world, there is ample space in the sea to set up floating as well as seabed-fixed structures to generate wind power. By 2050, it is projected that there will be equal amount of wind energy produced between onshore and offshore structures.

### **Confidence in Solar Power**

The cost of solar energy has dropped in the last few years owing to drop in module prices with cost improvements, better pricing strategies and thanks in part to economy of scale. Solar power is increasingly becoming prominent as a viable competitive power source although still intermittent. This is seen by growing confidence in partnership between companies, confidence in technology, in resources, and in the increasing revenues.

The geographic location and climate in Chile offer one of the best conditions for solar energy with the highest irradiance level in the world. SunPower is the second largest in the global market and boasts highest solar panel efficiency at 21.5%. Salvador Project located in the Atacama region of Chile is co-developed by Solventus and Total and is targeted to become the world's largest solar merchant.

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### **Session 4: Developing cooperation between stakeholders to promote energy transition**

*In order for renewable energies to become gradually more integrated into the national energy mix, it is also important to recognize that conventional energies are still essential to back up or spur growth of budding technologies and infrastructures in the renewable energy sector. At the end of the day, the aim is to make available more choices for industrial and household consumers which type of energy mix they wish to use. It is useful to offer transparency and offer explanations using mid to long-term cost-benefit analysis.*

### **Ocean Business Community**

Businesses whether they are using the oceans as transportation routes, as source of raw materials or energy sources, make up a large stakeholder as a whole. Their challenges can be summarized as follows:

- Ocean industries require access and social license to use ocean space and resources
- Many of the critical issues creating impact and affecting access and social licenses are cross-cutting or cumulative
- Sustaining ocean's health and productivity requires responsible use and stewardship by all users.
- Best efforts by a single company or an entire industry sector are not sufficient to secure ocean health.
- Ocean industries will benefit from collaboration with other sectors to create synergies and economies of scale to address impacts and ensure access and social license.
- Need structure and processes for leadership and collaboration

With the importance of leadership in mind, the World Ocean Council conducts leadership programs involving individuals from different stakeholder categories to provide a venue to discuss ocean policy and governance, marine spatial planning, operational environmental issues, smart ocean industries, among others.

Governments cannot work alone to design policies; contributions from industries are indispensable in order to help policy-makers set realistic and feasible targets. Industries are best positioned to inform the governments how to design pragmatic rules and regulations that help to ease the business rather than hinder, regulations that can help to protect the environment and communities from which they derive business. Accumulated industrial know-how and research data from industries that operate from the sea and on land can provide invaluable resource for governments shape and implement relevant policies.

### **Data Collection**

Ensuring that grids become more reliable in the future is an issue of knowledge and know-how rather than that of technology or infrastructure. With continued ICT and digital revolution, it is now cheaper and easier to access data. Today, customers are able to provide valuable user data to utility operators as well. Harnessing energy information in novel ways allows us to produce useful insights or new services. Today, energy data is the source of new economic value. It allows us to reshape the way we manage grids, create new added value and redistribute it among stakeholders.

Collaboration in the areas of data collection and knowledge sharing among different stakeholders – the government, business, civil society, among others – is not only useful for avoiding reinvent of wheel but for finding innovative solutions in addressing energy challenges faced by all economies in the world.