

## PECC Santiago Seminar

*Energy transition Development of marine and Renewable Energies*  
**Santiago Chile 24-25 June 2014**

**Development of marine and renewable energies**  
**The cost of renewable energy today to become competitive**  
**vis-à-vis fossil fuels, Energy and water in the world,**  
**Opportunities for renewable and carbon-free energies**

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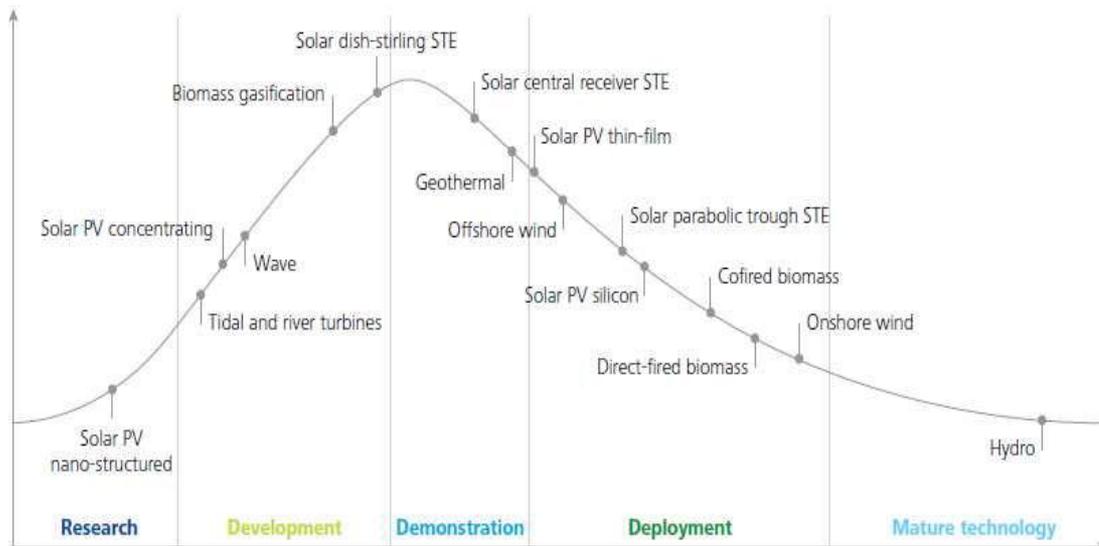


# *The cost of renewable energy today*

- Completing a French ministerial mission on the cost of Electrical Renewable Energy, with Services rendered in full cost; now and the year 2020 2030 with a vision of the future.
- LCOE method *Leverized Cost of Electricity*, Costs en Investment (CAPEX), in operation costs (OPEX) and financing.
- The different technologies for renewable energy are compared in terms of their cost and level of maturity.
- Different results depending on each energy technology, as endowments and potential and geographic situations (Wind, Solar irradiance and DNI, MRE endowment...)

# Technical maturity of different RE technologies

	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



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# ***Renewable energy are specific to each situation***

- In each particular electrical system the situation is different (in hydropower, sun, PV and CSP, wind, onshore, offshore and floating wind mills, MRE, ocean tidal currents, wave energy, OTC Ocean Thermal Conversion,
- In small isolated power systems, as islands and areas remote from electric grid and network, local renewable energy are much more competitive; and in some cases already competitive without any need for subsidy (e.g the Salvador PV Merchant plant)
- *Examples : Hydropower, Solar PV and CSP , Geothermal, Marine renewable Energies.*

# Energy and water intricate needs

- The world is increasingly needing more energy and more water. (the global UN report on the development of water resources, published on the occasion of World Water Day (22 March each year))
- Water and energy are intrinsically sectors increasingly interdependent in the human and economic development.
- Water is needed to produce energy, especially electricity, directly in hydroelectric dams, but also all thermal or nuclear power plants need a cold source for condensators of turbogenerators and ensure the heat sink thermal.
- And also more energy is used to make water accessible - to pump, treat and increasingly desalinate, transport distribute water. About 4 to 5% of the electricity in France and the USA are used for water, and up to 20% in Jordan and arid areas.

# Energy and water management to avoid disaster scenarios

- **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.

# Desalination or water transfer ?

- The global population increases, urbanization being more in coastal strips seaside areas where water resources are limited and overexploited aquifers have their lower level and become increasingly brackish.
- This fresh water of which the thirsty cities have increasingly need, can be obtained by **desalination of sea water**,
- With consumption of energy (3kWh/m<sup>3</sup> in RO desalination)
- or by **long distance water transfer** to better allocate resource

## CO2 EMISSIONS-FREE DESALINATION: IS IT POSSIBLE?

- Not to foster CO2 emissions via this high energy consuming Improvement of energy efficiency in this sector and the recourse to non CO2-emitting energies (renewable and nuclear energy). Solar energy has already been tapped in thermal and photovoltaic facilities; ***The MED CSD project, on Concentrated Solar Power with Desalination in the Mediterranean***
- Wind energy is interesting in windy coastal areas, **In Australia,** in Kwinana (near Perth), a new large-scale desalination plant of 200 000 m<sup>3</sup>/d, commissioned in 2007, is combined with a wind power station which produces, in "green energy", the annual equivalent of the electric energy consumed.
- ***Close to the seashore, huge urbanization, growing needs in energy and needs in freshwater, and availability of MRE.***
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# Water desalination or water transfer ?

- In Chile northern regions are yearning for water, needed for everything from quenching residents' thirst to mining operations and agriculture. The demand from Chile's mining industry for desalinated water is set to increase at least 400% over the next four or five years.
- With water demand already exceeding supply in all the regions north of Santiago, where some of the world's largest copper mines are located, the debate has focused on two main options: **desalination plants** to take advantage of Chile's vast coastline, and the so called "**water highway**" to transfer water from Chile's south.

# Innovative transfer water, Via Marina project

Via-Marina project has created an economical system of water transfer through hoses measuring up to 4 meters in diameter, placed at the bottom of the ocean. Water collected at the mouth of rivers or outcome of treated wastewater can be transported on hundreds of kilometers. At estuaries just before mixing with seawater, fresh water will be lost anyway, and it does not harm anyone (Political acceptability).

In Chile the Aquatacama "water highwaywater, which seeks to transfer water from central southern region VII to the northern regions through a sea-resistant pipeline for agriculture, mining and human consumption." could provide northern Chile with more water than desalination plants with lower energy consumption and costs. <http://www.via-marina.com>

