DCNS roadmap on OTEC

International OTEC Symposium
Sept. 2013

DCNS - Ocean Energy Business Unit
Emmanuel BROCHARD, VP OTEC Programs
The DCNS group: a leading European player on the world market for naval defence systems

2.6 billion euros in revenue
14.8 billion euros on orderbook
12 829 employees
1/3 of revenue from int'l sales & cooperation programmes
(2011 figures)
Strategic positioning for DCNS on Ocean Energy

Provider of added-value

- On Ocean Thermal Energy Conversion, Floating Wind Turbines, Tidal and Waves converters
- Based upon know-how, competencies and industrial outstanding facilities

EPCI prime contractor offering technical and reliable turnkey solutions and services to Utilities

- Experience and know-how in the field of engineering and maintenance of complex naval systems
- Major experience in the management of complex industrial projects and programs
- Large facilities with performing capacities and direct access to the main European seas
- Scientific capabilities with creation of DCNS Research and a large involvement in the “pôle de compétitivité Mer”
- International partnerships
DNCS invests in 4 ocean energy technologies

**OTEC**
- Renewable 24/7 baseload electricity
- Key component of the islands/isolated areas energy mix by 2020
- 2011: Land based prototype La Réunion
- 2016 10MW pilot plant Martinique

**Floating offshore wind turbine**
- Increased wind load factor
- Reduced visual impact
- Easy installation & maintenance
- 2013: 1MW prototype
- 2014: multi-MW prototype
- 2017: 25MW pilot array

**Tidal turbine**
- Advanced maturity
- Accessible potential FR+UK
- Predictable flow of power to the grid
- 2012: commercial size first turbine
- 2017 - 20MW pilot farm project at Raz Blanchard

**Wave converter**
- Outstanding energy potential
- WW market
- 2011: CETO/Carnegie prototype for EDF EN & feasibility study with FORTUM on Waveroller

© DCNS, OTEC roadmap – May 2013
OTEC:
Huge renewable resource delivering baseload flow of power to the grid
OTEC: Huge renewable resource delivering baseload flow of power to the grid

Main market: electricity for isolated areas (mainly islands) with specific technical & economical features:

- Closed & non-interconnected power grid
- Non nuclearized areas
- Highly dependant to fossil fuel
- Land pressure on island
- Renewable potential already highly harvested
- High cost of energy (average up to 250 to 300€ / MWh)
- Tropical storms areas
- Need for industrial local content

OTEC meeting the demand on 3 expectations:

- A new source of renewable energy
- A 24/7 renewable energy delivering baseload electrical flow of power to the grid
- Additional potential by-products offering air-conditioning, fish farming by artificial upwelling, fresh water, irrigation,

Marketplace

- 100+ countries with appropriate Δt° / 55 areas with poor alternatives to fossil fuels
- DCNS Strategic positioning to commit on:
  - **Performances** - as an EPCI on turnkey projects
  - **Availability** - through maintenance services

- Growing demand from customers. DCNS OTEC team currently in discussions with:
  - Public authorities / territories
  - utilities,
  - Project ownership assistant
  - SPVs,
  - capital ventures funds
  - Resorts

- Based on OTEC expertise, DCNS range of turnkey solutions:
  - Offshore OTEC plant
    - 30 MW reference power plant
  - Onshore OTEC plant
    - Electric : Small power range up to 4/5 MW
    - Combined cycle systems: OTEC / SWAC
Ambitious development budget since 2008
Up to 30 team members @ peak charge. A dedicated team with experts in every critical fields (Thermodynamical engineering & system engineering, Naval architects, Heat exchangers, Risers, Mooring system, Ocean survey, ...)

- 2008: self-funded pre-feasibility study: Martinique case study
- 2009: feasibility study contract with French Région "La Réunion"
- 2010: Tahiti Feasability studies with Pacific Otec local utility
- 2010 - 2011: contract with French state and French région "La Réunion" for optimisation process and risk mitigation, including land based prototype
- 2011/2012: MoU’s with export utilities and SPV’s
- 2012-2016: contract with French region Martinique for the pre-dimensioning of a 10MW pilot (submission to NER300 European funding program)
- 2013: Onshore electric + OTEC / SWAC combined cycle project developments
- 2013: first onshore full scale OTEC project to be announced
- 2014: first offshore full scale OTEC project to be announced
DCNS is turning OTEC to a bankable turnkey industrial reality

DCNS on the right tracks to mitigate risks and monitor all key success factors & meet customers’ demand on:

• Competitive Cost Of Energy
  - 250€/MWh target

• Risk management / risk mitigation
  - Bankability of projects

• Technological readiness
  - Patents on all critical sub-equipments
  - Reference plant designed
  - Technological optimization process in place

• Tailor made industrial competitiveness
  - Dedicated industrial organization
  - Including local content

• Acceptability of projects
  - Both social and environmental positive acceptability

• Partners bankability

• Strong support from both local and national authorities
DCNS. A world leader in naval defence,
An innovative player in energy.