

Innovation and cost reduction in offshore wind

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Agenda

Innovations and cost reduction in offshore wind

Contents

- Recent trends in offshore wind LCOE
- Time is money – how the speed of installation influences cost of energy
- Scale versus cost – can we get the balance right?

Selected clients



BVG Associates

Business advisory

- Analysis and forecasting
- Strategic advice
- Business and supply chain development

Economics

- Socioeconomics and local benefits
- Technology and project economic modelling
- Policy and local content assessment

Technology

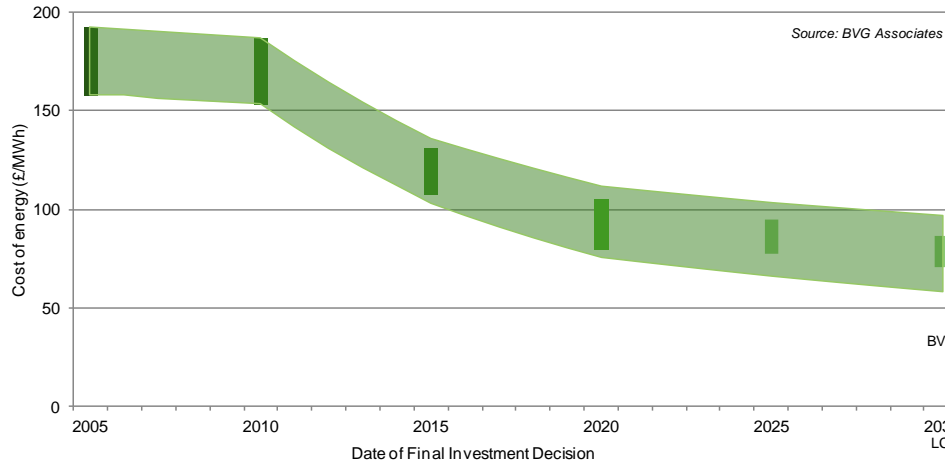
- Engineering services
- Due diligence
- Strategy and R&D support



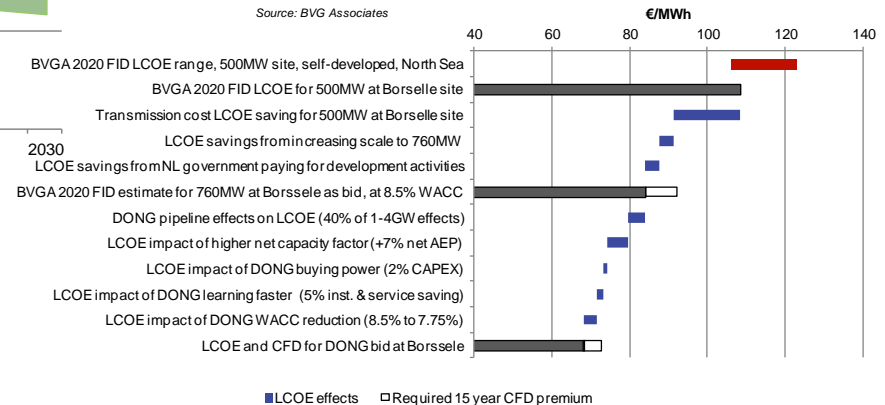
1. Recent trends in offshore wind LCOE

Costs are plummeting

Recent auctions have given very low LCOE



- LCOE projection from 2015 already had steep drops
- Auctions in 2016 show significant cost saving

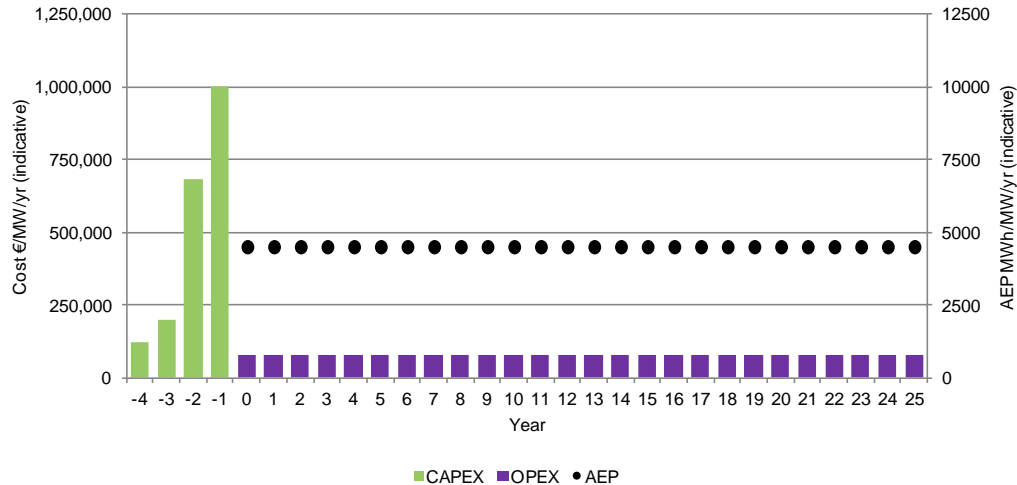


2. Time is money

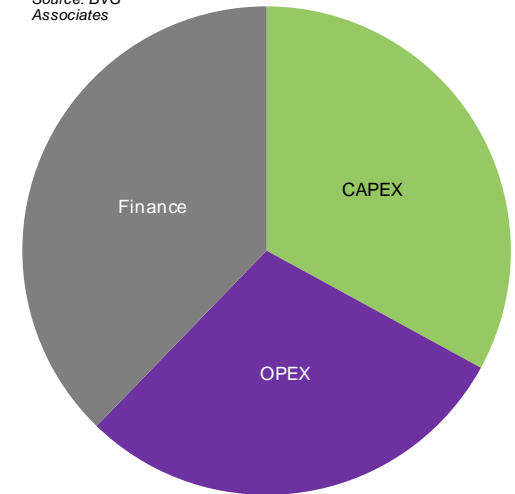
How speed of installation influences cost

What is LCOE?

- CAPEX spend and OPEX spend including the finance contribution divided by the energy
- Servicing of finance cost is a large part of this.



Source: BVG Associates

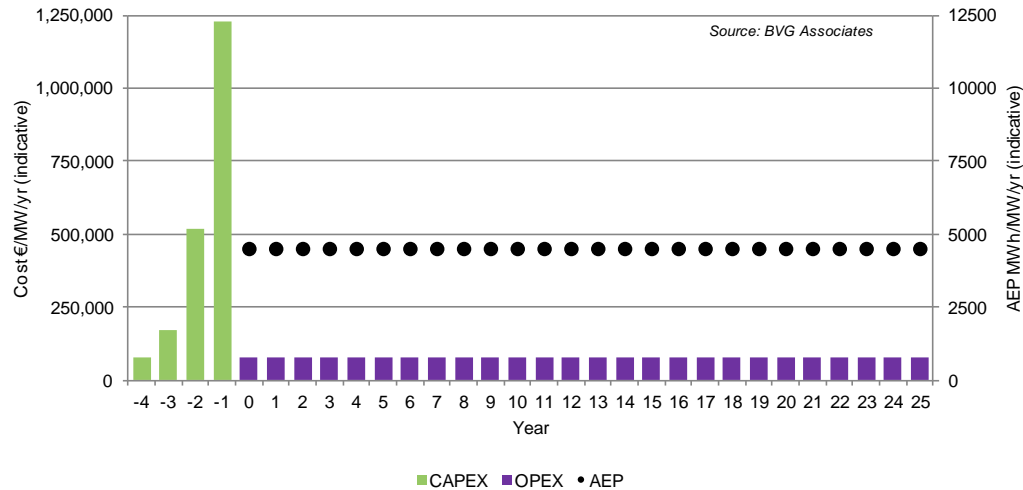


2. Time is money

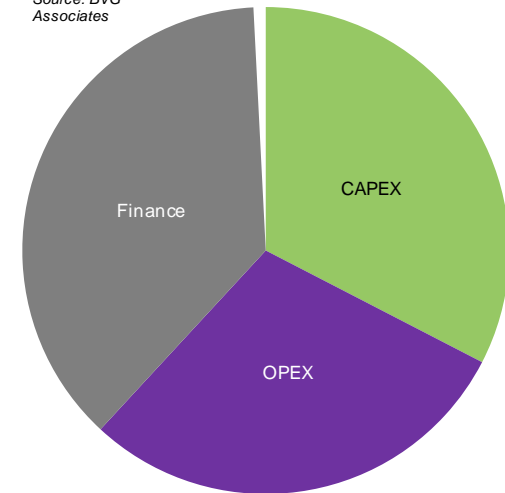
How speed of installation influences cost

What does installation speed do to LCOE?

- Move CAPEX closer to time at which you pay off the debt
- Brings servicing of finance cost down (even without cheaper vessel charters)



Source: BVG Associates



3. Scale versus cost

Can we get the balance right?

From a simple cost of energy position, bigger is better

- Fewer sites to build and connect
- Fewer turbines to block the wind flow for the others
- Fewer pieces of equipment to go wrong

BUT

- Need bigger vessels that can handle the large structures
- Move from tried and tested machines to less proven (and first of a kind) technologies
- When a single turbine goes down, a larger fraction of the wind farm energy is being lost

Look at the site-by-site saving of moving from 8MW to 10MW. If everything else costs the same, you would have a saving of 20% in CAPEX and 20% in OPEX.

In AEP, the saving from array interactions using a similarly MW/km² density is around 0.2%.

Collaboration is vital

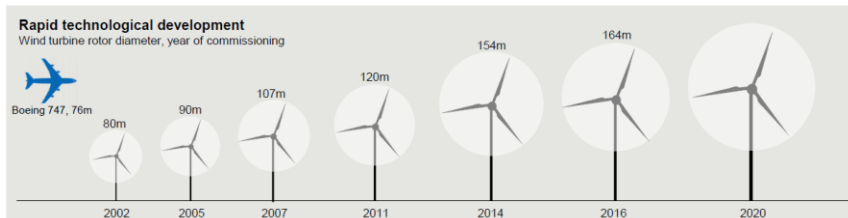
- Too many were surprised by the rapid introduction of 8MW turbines
- A lot of investment in turbine installation vessels but the fleet no longer looks fit for purpose
- Upgrades to vessels (legs and cranes) can plug the gap in the short term
- Are there any vessels that can install a 10MW+
- When vessel investments were committed in 2010-12, the forecast market was a lot larger
- Is there a business case for a new vessel?

3. Scale versus cost

Can we get the balance right?

Projection of what the industry will be installing five years from now

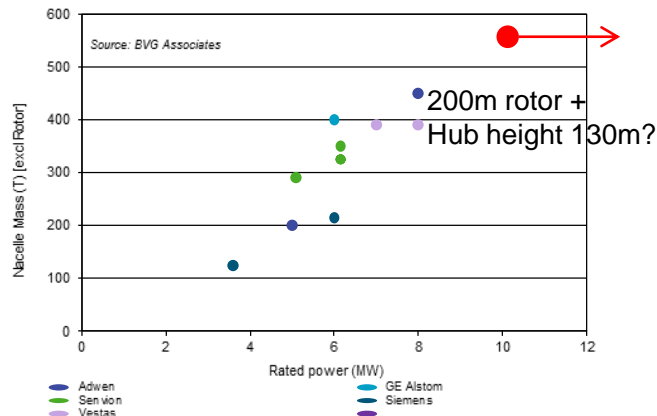
- 9-11MW machines



Source: DONG

Projection of where the industry will be ten years from now

- 10-13MW machines



4. Conclusions

So what?

Prepare for the future

- The recent cost reductions will cause project developers to focus on those areas where they can reduce cost. You are going to see hard bargaining.
- Speed of installation as well as overall cost of installation can help reduce cost. Anything that you can do to have slicker processes will help. Anything that you can do to avoid weather downtime will help.
- Turbines are going to get a lot bigger. Project developers are banking on this and are banking on being able to handle them.

Thank you

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