Repowering: Thoughts on Technology

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Repowering Conventional Wisdom

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Prime wind resource	Presumably at an early developed site with a prime wind resource	
Leveraging existing infrastructure	Foundations, roads, collection system, interconnection already in place; reduced cost of balance of plant	Likely inadequate for modern turbines; additional cost of removing old infrastructure
Higher efficiencies	Higher aerodynamic, mechanical, and electrical efficiencies → increased capacity factors	Large capital expenditure
Taller hub heights	Taller turbines reach greater winds	RADAR, obstruction evaluation, visual impact (including lighting), birds, larger setbacks
Grid support	New turbines offer VAR support, ZVRT, ramp control	Little award for these services
Reduced O&M	New turbines with higher reliability	Long term experience with old hardware
Birds		
Summary	Extract more energy and profits	Reopen a multi-year Pandora's box permitting process. Exchange a steady sure-thing profit for a risky, large capex.

1. Technology Sufficiency

"…are there barriers or further innovations needed to better take advantage of opportunities from repowering older wind facilities?"

- Technology for repowering not significantly different than that for greenfield development
  - Current turbine R&D also applies to repowering; e.g., innovative blade and tower structures, active aerodynamic load control
- But are there any deviations in the design spaces of repowering and new development?
  - Are there additional constraints? e.g., height, rotor size, capacity, noise
    - There is a dearth of mid-sized (sub-megawatt) turbines
    - Transmission/interconnection upgrade deferral – opportunity for energy storage
  - Ground work needed to survey potential repowering sites and assess novel constraints
    - To provide sufficient economic impetus to technology manufacturers, need to extend beyond California market
  - Are there additional opportunities?
    - Years of SCADA data could better characterize the wind resource of a repowering site than assessments of new sites
    - Opportunities for very low or high turbulence sites?
    - Caveat: SCADA data could be low quality, at defunct hub heights

2 & 3. RD&D

”How can we better deploy new… technology to help repower…? …what research and development is needed to address the cost issues?”

- RD&D of technology products requires:
  - Long term investment to support development stages from proof of concept to commercial deployment
    - CEC could start support at a high TRL threshold, but cannot exit until a very high TRL
  - Appropriate technical monitoring
- Coordinate with other RD&D funding agencies

4. End of Life

”Is the end-of-life perspective included in the design of the current or newer wind technology?”

- No
- Even though wind turbine evolution has been incremental over the last 30 years, wind plant development/installation could/can not be economically future-proofed to anticipate hardware growth/changes
- Hopefully, current installations are bonded for decommissioning
- Steel, copper can be economically reclaimed and recycled. Methods exist for recycling fiberglass, but unsure of economic viability
- Innovative technologies in active development can help
  - e.g., Blade and tower structures currently being explored significantly reduce material utilization and ease transport

References

- Leighty, Wayne and C.P. van Dam, “Repowering California Wind: A Summary of Potential Benefits and Barriers”, manuscript submitted to California Energy Commission, 2009.
- Wiser, Ryan et al., “A Scoping-Level Study of the Economics of Wind-Project Repowering Decisions in California”, CEC-300-2008-004, August 2008.