“Smart” Renewables for DOD

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Presentation Overview

- Background
- Lessons learned
- Keys to success
- Site requirements
- Typical costs
- Financing options
- “Smart Grid” and renewables
- Q&A

Why do a renewable project?

- Can hold down future power costs
- Can be cheaper than purchase from off-site
  - No land costs
  - Lower transmission costs
- Enhance energy security and reliability
- Meet federal mandates – 7.5% EPAct goal, 25% DOD goal
  - Counts “double” towards federal requirements
- Reduce baseline for EO 13423 greenhouse gas measurements
- Demonstrating federal leadership
- “Good citizen” (doing “our part” for the public good)

Lessons from Projects (not "proposals")

- **DOD isn't a big player in this industry.** It needs to adapt to industry practice, not assume industry will adapt to it.
- **Know and capitalize on State and Local incentives**
  - Mostly tax-based, which means need a private-party owner of the project
  - "Overlooked" incentives, such as sales tax exemptions, can be 10-20% of project costs
- **Know and work within Utility parameters**
  - Size projects to meet utility program rules
  - Stay below 20 MW in size
  - Target utility renewable portfolio standards (RPS) needs
  - Use "real" rates (current and forecast) for economic evaluations (NPV)
- **Understand market for "sites."** For EUL DOD land competes with other land owners (including BLM), so THEY set land value, not DOD.
- **Alternative financing mechanisms (ESPC, UESC) typically too costly for renewable projects.** Okay for small ones, but not multi-MW ones.

Keys to Success

- Renewable resource to develop
- Control of the site with the resource
  - No mission or other conflicts (including NEPA)
- Access to transmission/site power grid
- Break even or better financials or justification for price premium such as energy security value
  - Additional incentives often “make or break”
  - Regional need (RPS, etc.) increases value of RECs
- “Cooperative” utility
- Project champion
- Implementation team in place
- Contracting mechanism identified

Site Requirements - Solar

- 2-10 acres of bare land for 1 MW of ground mounted solar PV (rectangular sites best)
- 48-64 acres for CSP (solar thermal power), plus lots of water
- 150,000 – 400,000 square feet of south (or flat) facing roof for 1 MW of PV (“net” PV area may be 40% or less of total)
- 200,000 – 600,000 square feet of flat, “basic” parking lot area for 1 MW of shade structure PV

Site Requirements – Big Wind

- 20-60 acres per “utility-scale” turbine
  - 4 acres for turbine base and buffer area
  - 20-60 acres for turbine “wind shed”
- Class 4 or better wind resource
- Site under 4,000 ft elevation
- Out of line-of-site of radar
- 60-plus miles from commercial airport

Site Requirements – Small Wind

- Class 2 or better resource for vertical axis turbines and some low speed designs (but very low output)
- Class 3 or better resource for most horizontal axis turbines
- Places to locate turbines
  - High point of land or tall building
  - Leading edge of long building
  - Gable ends of buildings

Site Requirements - Geothermal

- High temp geothermal
  - 300+ degree water over a large area (100s of acres) at a depth of 3,000 - 5,000 ft
  - Water to produce steam from hot dry rocks and for cooling
  - Site to reject/recirculate cooled water (probably not a domestic well field or aquifer)
- Low temp geothermal (PureCycle)
  - 200+ degree water (180+ temperature delta)
- Away from active faults and populated areas

Requirements - Biomass

- Access to bio-fuel locally (and sustainably)
- Thermal demand (year round?) - Fire/co-fire central plant for thermal energy or co-generation
- If new plant, 20 plus MW of power requirement (minimum). Bigger is better, but…
- Space requirement
  - Plant area 2-10 acres depending on size/complexity
  - Access roads for fuel deliveries
  - Storage area for 3-5 days of fuel (5-10 acres)
- Water for steam and cooling
- Air emission capacity
- “Cooperative” utility

Requirements – Waste Energy

- Daily waste from equivalent of 30,000 people/day minimum; 100,000 people is better
- Space requirement
  - Plant area 2-10 acres depending on size/complexity
  - Access roads for fuel deliveries
  - Storage area for 3-5 days of fuel (5-10 acres)
- Water for steam and cooling
- Air emission capacity
- “Cooperative” utility
- “Cooperative” waste management entity and community (new landfill capacity need, etc.)

Typical Costs ("Prices" may vary)

- Solar PV: 20-35 cents/kWh, before incentives
- Wind
  - Big: 7-12 cents/kWh depending on wind class
  - Small: 10 cents/kWh minimum due to lower wind class
- Geothermal/biomass/WTE: 6-10 cents/kWh for 20 MW or larger project

- Cost/price/net present value <u>not the same</u>!
  - Price is what is bid based on "net" costs (after incentives) and market price (opportunity cost)
  - NPV is utility costs avoided <u>over life of the contract</u> (Gov't cost estimate for PPA or purchase)

Funding with ECIP (for DOD only)

- Project developed with appropriated funds
- Limited funds means few or small projects
- For renewables - Bigger IS better, a lot better! (So, not a good match with ECIP.)
- DOD owns project and has to operate as well (or find budget to contract for O&M)
- Can be used for any renewable project
- Limited funding for resource assessment/planning
- High cost of renewable projects + limited ECIP funding restricts projects to small scale (single turbine, not a wind farm)
- Government ownership negates value of most renewable incentives
- Lag between project design and funding can result in budget or savings shortfalls (project costs more two years after it was proposed)
- 10 year payback requirement too short for renewables given long life of assets

Financing Options: PPA (Power Purchase Agreement)

- Power is purchased from project on-site, owned and operated by third party.
- Project risks shifted to owner/operator. Design and construction costs, annual O&M, etc. Plus, banks won't lend on bad projects, gives us peace of mind.
- Some performance risk remains with the site.
  - What are "make-up" power consequences if project under-performs or has outages?
  - Liability for interference with project performance (shading PV arrays, hitting with ammo, etc.)
- Actual PPA contract needs to be acceptable to agency/site.
  - End of contract term issues (removal versus contract extension)
  - Take or pay terms
  - Early termination penalties
  - Force Majeure

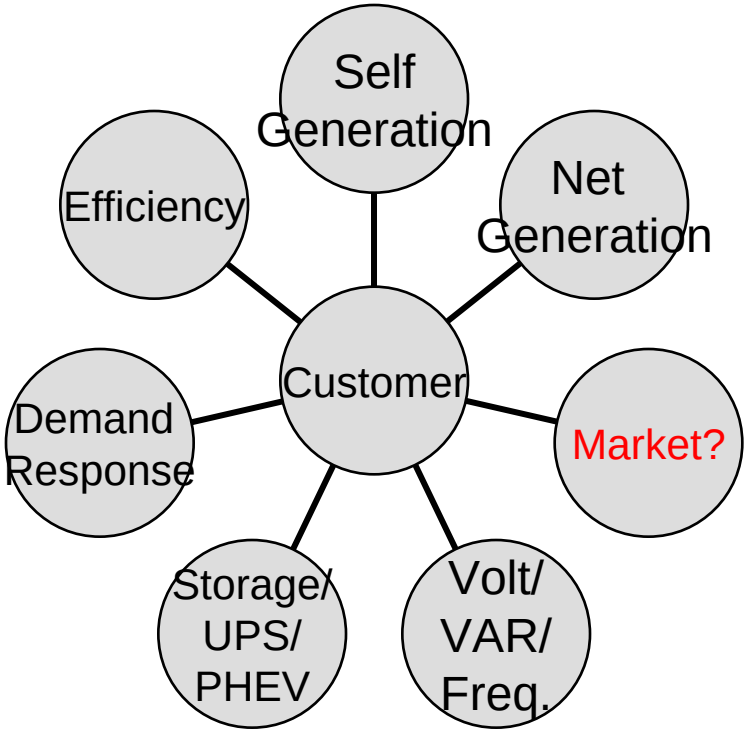
Renewables and the Smart Grid

Everybody is talkin’ about it…

Premise of the Smart Grid

- Customers can provide services to:
  - Generators
    - Peak relief, load leveling, lower-cost “excess” power
  - Grid operators (RTOs and ISOs)
    - Demand response
    - Frequency regulation
    - Volt/VAR support
  - Distribution utilities
    - All of the above, plus outage reporting, remote metering and potentially “islanding” capability=increased reliability
  - Neighbors (via “micro grid”)
    - Lower cost power
    - “Spare” capacity
    - UPS/Storage in emergencies
- Cost of delivered energy service will be reduced due to capital investment savings/higher asset utilization
- Dependent on two-way, multi-party transactions between/among customers and “the grid”

Balkanization of Benefits
Primary Barrier to the Smart Grid



- Although customers could provide benefits to grid operators, distribution companies, power suppliers, and potentially other generators, unfortunately…
  - Organized markets don't allow "bundling" of benefits to multiple parties or transaction economies (no one-stop market)
  - Utility regulations prohibit development of some markets; retail wheeling, creation of "neighborhood" microgrids/markets, etc.
  - Rate structures don't capture distribution savings: efficiency, storage, regulation, etc. In fact, "de-coupling" does the opposite.
- In deregulated markets each entity has "selfish" goals instead of customer service.
  - Generators – maximize sales
  - Transmission – cover costs
  - Distribution – minimize costs

Lessons from the Smart Grid for DOD Renewable Projects

- Capturing full value requires full-time attention – Someone needs to interact with the various markets (could be contracted out). *Integrating with Smart Grid demand response program would share these costs.*
- Most renewables intermittent, thus of less value to the market. Can only sell "as available" rather than as a "firm" or "dispatchable" resource.
- Renewables used on-site are "conservation" not "generation" from perspective of the grid. Only equals generation if production is "in excess" of need (and only for that portion).
- Market value in the Smart Grid doesn't recognize "renewable" features (no extra pay for that).
- Grid integration for dynamic operations requires additional (significant) investment.

Key Lessons for DOD Renewable Projects

- Contracting, especially PPAs, difficult (still in learning curve phase)
  - Gov't cost est. for award
  - PPA contract terms
  - Contract length concerns
- Economics subject to utility policies regarding:
  - Standby/back-up power charges
  - Interconnection fees
  - Net-metering limits
  - Ownership restrictions (40 USC 591)
- Most renewables a) intermittent, b) subject to utility disconnection requirements "for safety" – so "energy security" contribution is limited (They don't work if disconnected)
- Integration into "micro-grid" more complicated and expensive than you think
- Market for renewable credits very narrow
- Market for carbon off-sets uncertain

Still Want to do a Renewable Project?

- Keys to Success
  - A resource that is economic to develop
  - No land use conflicts (mission or NEPA)
  - Clear objectives
    - Own use
    - Energy price certainty
    - EO compliance
    - Energy security
  - A good grasp of future avoided costs (predicting the future for 20-30 years isn't easy, just look at EIA's gas price forecasts)
  - A procurement plan/contract path that works (typically long-term contract or open-ended term)
  - Procurement documents that "work" for industry
  - A good project team (contracts, legal, utilities, champion, management support, consultant/experts, etc.)
  - Avoiding utility entanglements (wheeling, formal interconnections, etc.)

Q & A

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