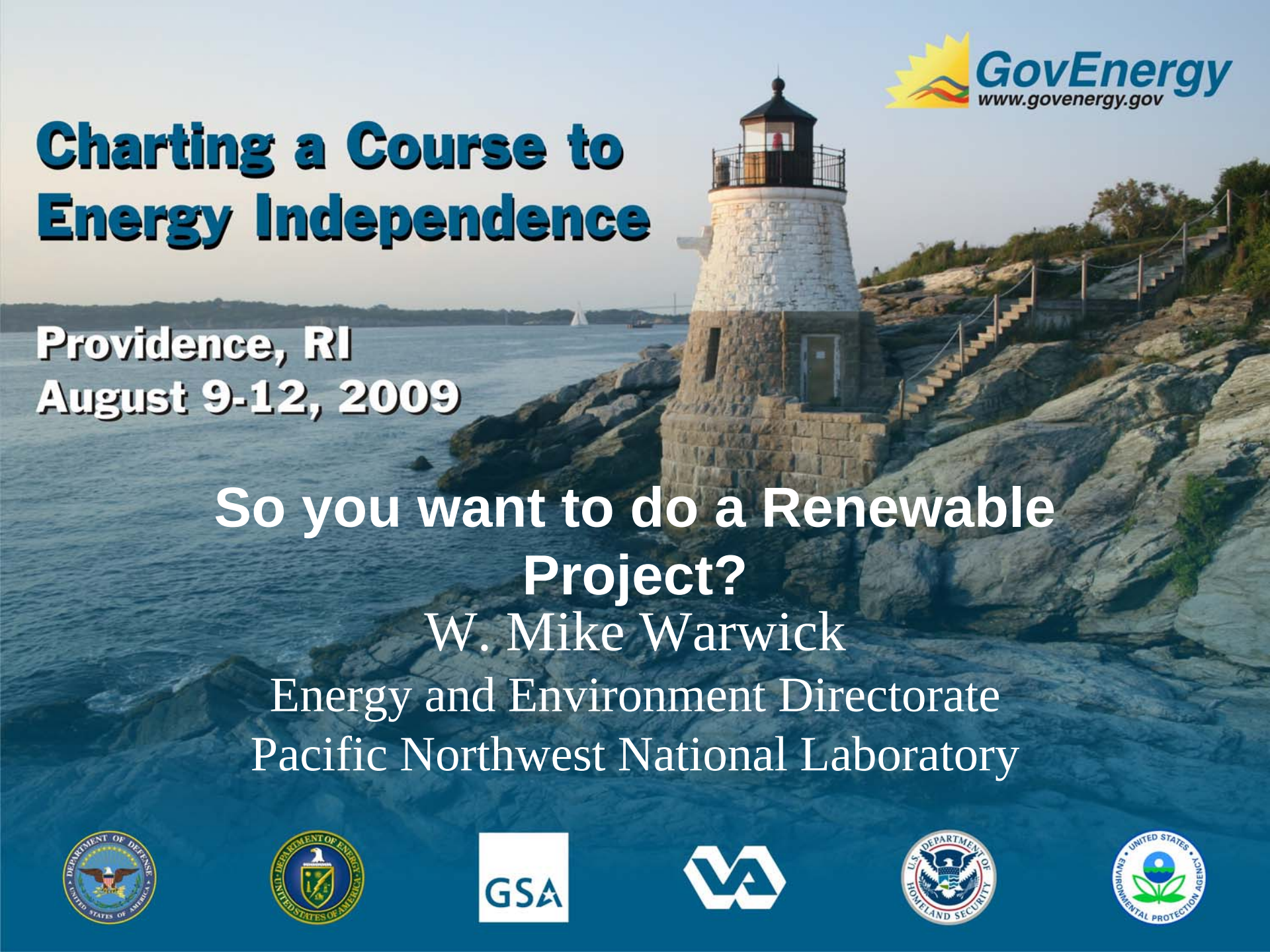

So you want to do a Renewable Project?

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Overview

- Focus on on-site projects
- Keys to success
- Site requirements
- Typical costs
- Financing options
- Examples
- Lessons learned
- Q&A

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On-site versus Off

- On-site projects
  - Enhance energy security and reliability
  - Count “double”
  - Can hold down future power costs
  - Don’t include land costs
  - Don’t require transmission, but may have interconnection issues
  - May have performance and other risks

- Off-site projects
  - All risks on vendor
  - May be cheaper due to better resource and available incentives
  - Include transmission and other costs that can’t be controlled or forecast easily

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Keys to Success

- Renewable resource
- Control of the site with the resource
- Access to transmission/site power grid
- Break even or better financials
- “Cooperative” utility
- Contracting mechanism
- Project champion
- Implementation team in place

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Renewable Resources

- Solar
  - PV and CPV
  - CSP
- Wind
- Geothermal
  - High temp
  - Low temp
- Biomass
- Waste-to-energy (WTE)
- Hydro
  - “New” hydro
  - Hydrokinetic
  - Turbine-in-a-pipe
  - Ocean (too far out technically and economically)

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Site Requirements - Solar

- 2-10 acres of bare land for 1 MW of ground mounted solar PV.
  - 2-4 acres for 1 long string, more for multiple strings to prevent shading and provide road access.
  - 48-64 acres minimum for CSP (thermal), plus lots of water.
- 150,000 – 400,000 square feet of south (or flat) facing roof for 1 MW of PV.
- 200,000 – 600,000 square feet of flat, “basic” parking lot area for 1 MW of shade structure PV.

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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

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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

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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)

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Requirements - Biomass

- Access to bio-fuel to fire/co-fire central plant for thermal energy or co-generation.
- If new plant, 20 plus MW of power requirement (minimum) – 40-60 MW ideal
- 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

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Requirements - WTE

- 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

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Requirements - Hydro

- Existing dam (new hydro)
  - Add turbines/capacity
  - Increase station efficiency
- Hydrokinetic
  - Tidal turbines
  - In-stream turbines
- Turbine-in-a-pipe
  - Flowing water from site with significant head (30 ft or more)
  - Large diameter pipe

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Typical Costs

- 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 40 MW or larger project

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Financing Options 101

- **ECIP (for DOD) –** Project developed with appropriated funds. Limited funds means few or small projects.
- **ESPC –** 3rd party investment with payback up to 25 years.
- **UESC** - Like ESPC but 3rd party is local utility. Payback period currently limited to "10" years.
- **Power Purchase Agreement (PPA) –** On-site project developed by 3rd party with long term contract to sell output to government at specified price.

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Financing Options 101

- **Enhanced Use Lease (EUL) –** Land leased for "commercial" power project in exchange for "in-kind" lease payment.

- **Energy Joint Venture (EJV) –** What the Navy uses to develop geothermal projects. Land is leased for energy projects subject to payment of royalties on commercial sales. Deposited a Navy fund reserved for energy projects.

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ECIP Challenges For Renewables

- Can be used for any renewable projects
- Lack of funding for resource assessment
- 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 (but these are somewhat offset by avoidance of taxes)
- Lag between project design and funding resulting in budget or savings shortfalls
- 10 year payback requirement too short for renewables given long life or assets
- On-going O&M costs often overlooked

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ESPC and Renewables

- Specifically established to "share" energy bill "savings." Repayment from actual bill savings, not power "price/value"
- Project costs and risks are borne by 3rd party, who may also assume O&M responsibility.
- Projects are "owned" by the government, which may increase project costs (limits incentive $)
- Can be used for building integrated projects, including central plants and co-generation

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ESPC and Renewables

- Can be use for stand-alone project if bundled with efficiency projects
- Use for projects in remote areas challenging (what is utility bill and repayment mechanism?)
- Use of PPA-like payment mechanism is not considered legal by some. Probably can't use to sell power back to the facility.

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UESC and Renewables

- Limited utility interest in UESC in general and renewables in particular
- Limits on utility use of incentives
- 10 year payback criteria

But:

- Clear authority for energy production projects
- No conflicts with utility regulations, interconnection, etc.
- Utilities increasingly motivated to do renewables
- Utilities better understand generation projects
- Can be implemented like PPA or through tariff service instead of UESC

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PPA Challenges

- Lack of precedents challenges procurement staff
- Tension between resource characterization and performance risk/price. What is the right cost/benefit?
  - Does DOD invest $ to characterize resource to get better prices, or
  - Does DOD just offer to purchase power from projects on specific real estate?
- Lack of comparison price (price to beat) given market uncertainties.
- Utility/regulatory uncertainties
  - Retail wheeling issue
  - Prospects of future changes to rules/regulations that impact long term price. How to share the risk?
  - Prospects for stand-by, back-up, and stranded cost fees?

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Other Mechanisms (EUL, PPV)

- Few agencies able to use these authorities
  - Considerable uncertainty surrounding EUL, establishing “value” for leases, etc.
  - Conflict between “making money” for a lease and “saving money” on energy costs.
  - Use of FAR authority for long term purchases and “scoring.”

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Well Trod Paths

- Use of ECIP for solar walls, PV roofs, single wind turbines, etc.
- Use of ESPC for ground source heat pumps, biomass and waste fired central plants.
- Adding generation on base to use landfill gas piped to the site via ESPC
- Purchase of renewable power from off-site sources as part of utility supply or from competitive source in deregulated states
- Purchase and sale of renewable energy credits (RECs)

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Examples
(not all complete or successful)

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Solar PPA Project in Hawaii

- Aggregate suitable rooftops across all services
- Issue RFP for purchase of “up to” amount of solar power
- Provide industry with our characterization of roof orientation, condition, size, etc.
- Allow limited site inspection prior to receipt of proposal

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Wind Farm EUL in Hawaii

- Wind resource characterized by local utility that wanted to purchase output.
- Local conditions required two-part process,
  - EUL RFP – Winner selected on ability to compete in utility power supply RFP and on “in kind” offer for land use.
  - Local utility RFP selected future renewable projects. If project on Army site selected, EUL implemented.
- Initial estimate was for over $600,000 in benefits for 40-60 MW project.
- Change in management at facility killed the deal.

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Texas Off-Site Wind Power Purchase

- Proposal to provide wind power to “anchor” customer to finance new wind farm using long term contract
- Wind power would be at fixed price
- Firming and shaping services to be purchased at market price
- Expected savings (over market price of power) in $100s of millions over 20 year contract term
- Predicting future market prices and ongoing changes in how transmission priced killed the deal

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Lessons to Date

- **ECIP**
  - Projects being downsized due to lag between proposal/funding/award and rapid changes in renewable project costs.
  - Large amounts of ECIP funds required
- **ESPC**
  - Overheads push projects out of cost-effectiveness range

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Lessons to Date

- **UESC**
  - 10 year payback limit is a killer
- **PPA**
  - Timid procurement staff halting projects
- **EUL**
  - Confusion over objectives (revenue versus energy projects) halting projects

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Recap – Keys to Success

- Must have a good resource that is economic to develop
- Must have a procurement plan/contract path that works (typically long term contract or open-ended term)
- Must have a good team (contracts, legal, utilities, champion, management support, etc.)
- Best to avoid utility entanglements (wheeling, formal interconnections, etc.)

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Q & A

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