Introduction to Renewable Energy Project Development

Mark Jacobson
Sr. Project Lead - Deployment

Five Points Solar Park: Slide courtesy of the University of California
OUTLINE

• RE Development Process
  – Understand Primary Activity Buckets
  – Understand How They Interrelate
  – Understand Best Practices
  – Mitigate Risk
RENEWABLE (RE) Development Process
RE Development Process

Similar to Most Energy Development Steps
Solar Development:

- Market
- Solar Resource
- Land
Market:

- **Identify Customers**
  - Who has purchased RE in the past?
    - Utilities buyers
    - Corporate buyers

- **Understand Drivers:**
  - Wholesale market price comparisons
  - Regulatory/Policies: Example “National Targets = an appetite to buy RE

- **Research Transmission Availability:**
  - Interconnection Studies/process
  - Transmission Studies/process
  - Long Term transmission plans (IRP—integrated resource plan)
    - Where will transmission be built in the future?
Objective: Capacity Factor estimate for pricing

- Find publicly available data, or
- Purchase a regional Solar map, or
- Develop/purchase a model of the Solar Resource, or
- Installs Solar Measurement stations to validate the resource
- Use the RE Data Explorer if it exists in your region

Solar Resource:
Solar Resource Assessment

Take the next step:

Solar Farm siting:
• Find good Meteorological tower sites
• Equipment selection and specification
• Met instrument installation and maintenance

Data Assessment:
• Data monitoring and storage
• Met data processing and inspection
• Long term correlations and adjustment

Regional solar Maps:
• Mesoscale modeling
• Measurement campaign (Long term reference data)
• Graphical representation/dissemination (RED-E tool)
  Surface grade
Land:

Land Ownership Profile
- Private
- Public
- Usage Profile

Wildlife/Avian Habitat
- Threatened and Endangered Species habitat in or near project?

Permitting Requirements
- Federal, State and Local
- Zoning Ordinances
- Application requirements and schedule
- Public hearings
- Study requirements (Environmental, noise, etc.)

Legal Contracts
Stakeholder Engagement

Educational Outreach & Social Acceptance

- Unbiased information for local, State and Federal decision-makers
- State and Regional Solar Working Group network
- Educational programs, monthly recorded webinars, e-newsletter on deployment issues and workshops
- Information portals
- IEA Task – international research on solar impacts
Solar Development Process:

1. Desktop analysis: Market, Solar Resource, Land Uses (environmental)/Ownership

2. Find Overlap – Strongest solar Resource, Potential Customers, Proximity to Transmission Lines
   - Evaluate Land Uses:
     - Ownership (Private, State or Federal lands...large or small parcels)
     - Proximity to Homes, Schools, churches and businesses Parks, Wildlife refuges, forests

3. Visit the Area: Landowners Meetings, and Permitting Representative Meetings

4. Site Selection:
   - Evaluate Available Transmission and submit Interconnection Application
   - Initiate Land Leasing and
   - Install MET Towers

5. Permitting (Federal):
   - Aviation
   - Wildlife
Solar Development (continued):

6. Permitting (State and Local)
   - Sound study
   - Flicker study
   - Wildlife impact studies (birds and Threatened & Endangered species)
   - SHPO (State Historical Preservation Office)
   - Jobs and Tax benefits to community identification
   - Environmental benefits to community (water conservation and reduced emissions)
   - Commssearch (microwave tower study—communities emergency communication)
   - ....if yes, then:

7. Develop pricing tools to see if proposed Solar farm competes well with existing costs of “new” energy needs

8. Market the Power of “proposed” Wind Farm or Solar Array
   - Respond to RFP’s
   - Negotiate Bi-lateral Contracts

9. Complete Power Contract negotiations with Buyer
   - Utilities
     - PPAs
     - BTAs
   - Corporations (PPAs)

10. Build the Wind Farm or Solar Array
Summary

... in Pictures
Renewable Energy Data Explorer

“RED-E” tool…

…Understand the Market and the Resource
Meet and Sign agreements with your host Landowners…

Landowner Meetings
Complete Wildlife and Archeological Studies...
Public Engagement and Permitting…
Pour your Foundations…
Transport in your Turbine Components…
Flying up your Rotor Assemblies…
Operate your Wind Farm…
Questions?

Mark.Jacobson@nrel.gov