

DOE OFFICE OF INDIAN ENERGY

# Renewable Energy Project Development and Financing: Facility Scale

Detailed Hypothetical Example of How to Use Renewable Power in Your Small to Medium-Sized Tribal Facilities



# Course Outline

## What we will cover...

- **About the DOE Office of Indian Energy Education Initiative**

- **Facility-Scale Process: Hypothetical Example**

- Project development and financing **concepts**

- Project development and financing **process and decision points**

- Facility-scale project as an **investment (or commitment to an alternative utility payment)**

- **How to pay** for facility-scale project (or the renewable energy from it)

- **Additional Information and Resources**

# Introduction

The U.S. Department of Energy (DOE) Office of Indian Energy Policy and Programs is responsible for assisting Tribes with energy planning and development, infrastructure, energy costs, and electrification of Indian lands and homes.

As part of this commitment and on behalf of DOE, the Office of Indian Energy is leading *education* and *capacity building* efforts in Indian Country.

# Training Program Objective and Approach

A specially designed curriculum was created to give tribal leaders and professionals background information in renewable energy development to:

- *Present foundational information on strategic energy planning, grid basics, and renewable energy technologies*
- *Break down the components of the project development process on the facility, commercial, and community scale*
- *Explain how the various financing structures can be practical for projects on tribal lands.*

# Course Audiences

## Tribal Leaders

- Primary decision makers
- Understand terminology
- Understand key decision points and factors influencing them

## Staff/Project Management

- May be self-managing project or managing consultants
- Communicate at key points with decision makers
- Require in-depth knowledge of process



# How This Advanced/In-Depth Course Fits

## Essentials

Basic process, decisions, and concepts for project development

**Audience:** All involved in project

## Advanced/In-Depth

Detailed, academic information for deep understanding of concepts

**Audience:** Project and contract managers

## Facility

Comprehensive, in-depth process pathways for project development and financing by project scale

**Audience:** Decision makers and project and contract managers

## Community

Comprehensive, in-depth process pathways for project development and financing by project scale

**Audience:** Decision makers and project and contract managers

## Commercial

Comprehensive, in-depth process pathways for project development and financing by project scale

**Audience:** Decision makers and project and contract managers



# Terminology in These Courses



## Why Is It Important?

- Provides common language for internal discussion
- Assists in interaction with external organizations
- Increases credibility in project development

## What Does It Include?

- Common terms and language for project development
- Acronyms for and roles of:
  - Federal agencies
  - Common federal and state policies



Your resource for reference: DOE-IE Course Terminology Guide



- Roles of the Tribe
- Risk and Uncertainty
- The Project Team
- Levelized Cost of Energy (LCOE)
- Tax-Equity Partnership

**In-depth information on each key concept available in Advanced Courses**

# About the Speaker

## Tom Harris

- Project Leader in the Project Development and Finance Group at the National Renewable Energy Laboratory
- Supporting municipal, state, federal, and international clients in all aspects of energy portfolio and project development
- Utility distribution engineering, enterprise consulting, and law background



# Agenda

- Project development and financing *concepts* for a **facility-scale** project
- Project development and financing *process and decision points* for a **facility-scale** project
- Facility-scale project as an *investment* (or alternative to utility payments)
- *How to pay* for a facility-scale project (or the renewable energy from it)



# PROJECT DEVELOPMENT AND FINANCING CONCEPTS: FACILITY SCALE





# Terminology: Project Scale

## Facility

**Definition:** single building system

**Primary purpose:** offset building energy use



## Community

**Definition:** multiple buildings, campuses

**Primary purpose:** offset community energy costs, energy self-sufficiency



## Commercial

**Definition:** stand-alone project

**Primary purpose:** revenue generation, financial self-sufficiency

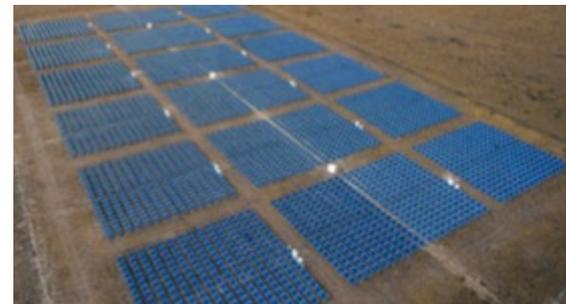


Photo credits: (top to bottom):  
NC Solar Center, NREL  
09373; Orange County  
Convention Center, NREL  
18077; Tucson Electric  
Power, NREL 13327

# Why Elect to Do a Facility-Scale Project?

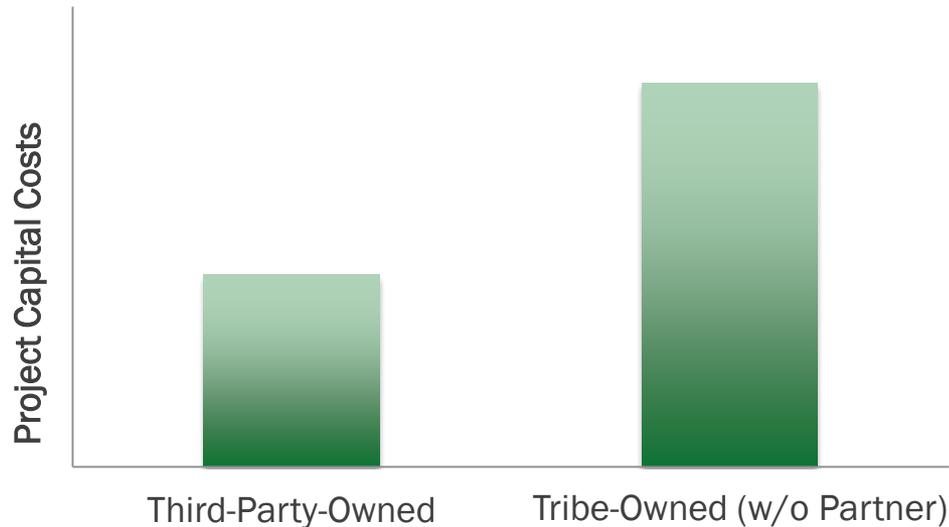
- Available, Tribe-controlled, *appropriate* location
  - May/may not be Tribe-owned
- Balance of factors not supportive of community or commercial scale
- Lower capital investment/lower overall risk (than a larger-scale facility)
- Gain experience with renewables before doing a larger-scale project
- Increase self-sufficiency, offset utility electricity costs/lower power bills
- Provide visual impact and green image
- Minimize environmental impact
- Diversify energy supply with local, renewable sources



Photo by Joe Ryan, NREL 19717

# So Why Seek a Tax-Equity Finance Partner?

- Tax incentives (MACRS and either PTC or ITC) can represent up to half the project value or reduce project's capital costs by ~50%



- Tax incentives can help to achieve a competitive price of power
- Many projects also require state-level incentives to be economic

# Project Scale Decision Factors

	Facility	Community	Commercial
<b>Definition</b>	Project serves one tribal facility/building	Project serves more than one tribal facility/building	Project power is sold to a third-party off-taker
<b>Value Proposition</b>	Save \$\$, reduce electricity cost, be more environmentally responsible	Save \$\$, reduce electricity cost, energy independence	Sale of power at competitive market terms whereby Tribe benefits
<b>Tribe's Success Measurement</b>	Cost avoidance	Cost avoidance	Revenue
<b>LCOE Comparison</b>	Retail electricity price	Retail electricity price	Wholesale electricity price
<b>Key Decision Point</b>	Savings/security of supply	Savings/security of supply	Revenue streams



- Risk and Uncertainty
- Roles of the Tribe
- The Project Team
- LCOE
- Tax-Equity Partnership

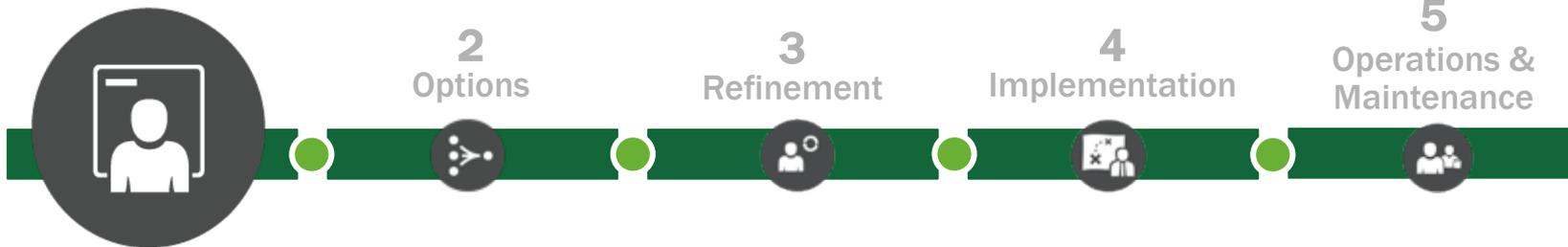
**In-depth information on each key concept available in Advanced Courses**



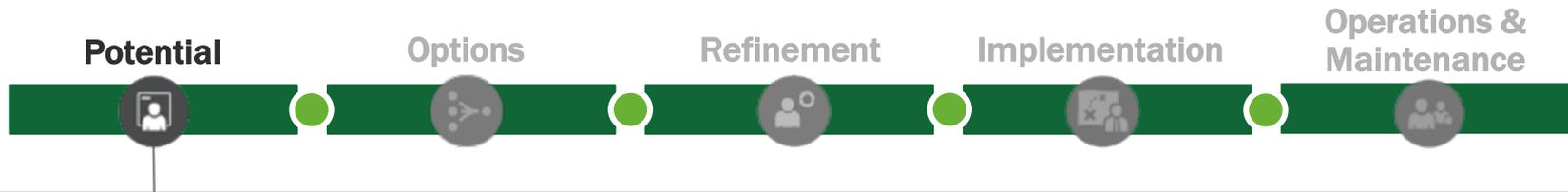
# PROJECT DEVELOPMENT AND FINANCING: PROCESS AND DECISION POINTS FOR FACILITY SCALE



# 1 Potential



# Step 1: Site, Scale, Resource and Market Potential



**Purpose:** Determine whether basic elements for a successful project are in place

## Tasks:

- Identify possible **site(s)** for project locations
- Confirm renewable energy **resource**
- Review tribal facility electric cost data, regulations for **permitting**, and interconnection requirements
- Assemble or communicate with the right **team**—those in positions or with knowledge to facilitate, approve, champion the project

➔ Analyze risks: financing, permitting, construction costs

➔ Analyze utility rules: interconnection, net metering, feed-in tariff (FIT)

# Step 1: Project Potential Example

	Potential	Options	Refinement	Implementation	Operations & Maintenance
		<b>Facility: California</b>		<b>Community: Minnesota</b>	<b>Commercial: Arizona</b>
<b>Baseline</b>		Solar for peak demand! Solid San Diego market		Large facility (e.g., casino) or many small buildings	Resource size vs. market size
<b>Economics</b>		High cost/kWh Time of use Com, Res: ~16¢		Mid cost/kWh Retail Ind., Com, Res: 6.5¢ – 11.0¢ (Wholesale: 3.75¢)	Low cost/kWh Wholesale: 3.54¢ (if BTM, Retail Ind, Com: 6.6¢ – 9.5¢)
<b>Policy</b>		RPS: 33% (2020 GAP) Net metering (1 MW) FIT 1.5 MW – >3 MW California Solar Initiative		RPS: 25% by 2025 No transmission needed (Net metering <40 kW)	Gap meeting 15% RPS Net metering (no limit; only if selling behind the meter [BTM])
<b>Technology</b>		Solar resource rich; solar dominates Southern CA		Wind resource rich; not nearly as much solar	Solar (photovoltaic [PV] or concentrating PV) strong, commercial
<b>Consensus</b>		Given facts, should Tribe pursue?		Given facts, should Tribe pursue?	Given facts, should Tribe pursue?

# Step 1: Site

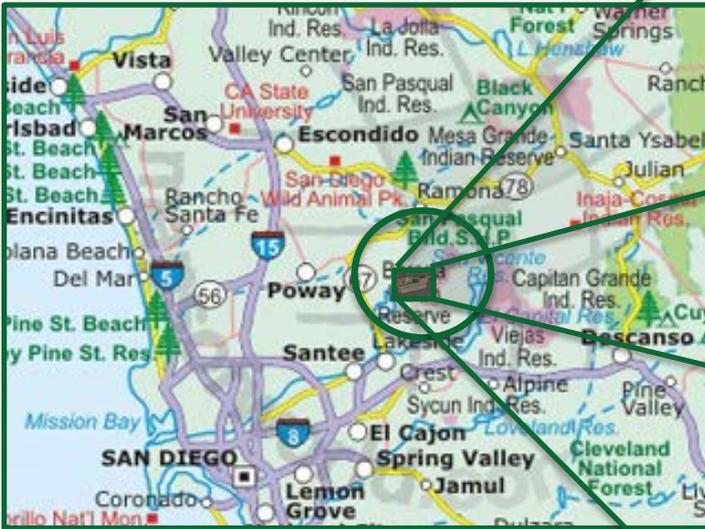
Potential

Options

Refinement

Implementation

Operations & Maintenance



<http://www.mapsofworld.com/usa/county-maps/california/san-diego-county-map.html#>

[https://maps.google.com/maps?f=q&source=s\\_q&hl=en&geocode=&authuser=0&q=Barona+Cultural+Center+%26+Museum,+Barona+Road,+Lakeside,+CA&aq=0&oq=barona+cultural&vps=4&sl=32.941896](https://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&authuser=0&q=Barona+Cultural+Center+%26+Museum,+Barona+Road,+Lakeside,+CA&aq=0&oq=barona+cultural&vps=4&sl=32.941896)

[https://maps.google.com/maps?f=q&source=s\\_q&hl=en&geocode=&authuser=0&q=Barona+Cultural+Center+%26+Museum,+Barona+Road,+Lakeside,+CA&hnear=&radius=15000](https://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&authuser=0&q=Barona+Cultural+Center+%26+Museum,+Barona+Road,+Lakeside,+CA&hnear=&radius=15000)

# Step 1: Resource, Off-take, Production, Savings

Potential

Options

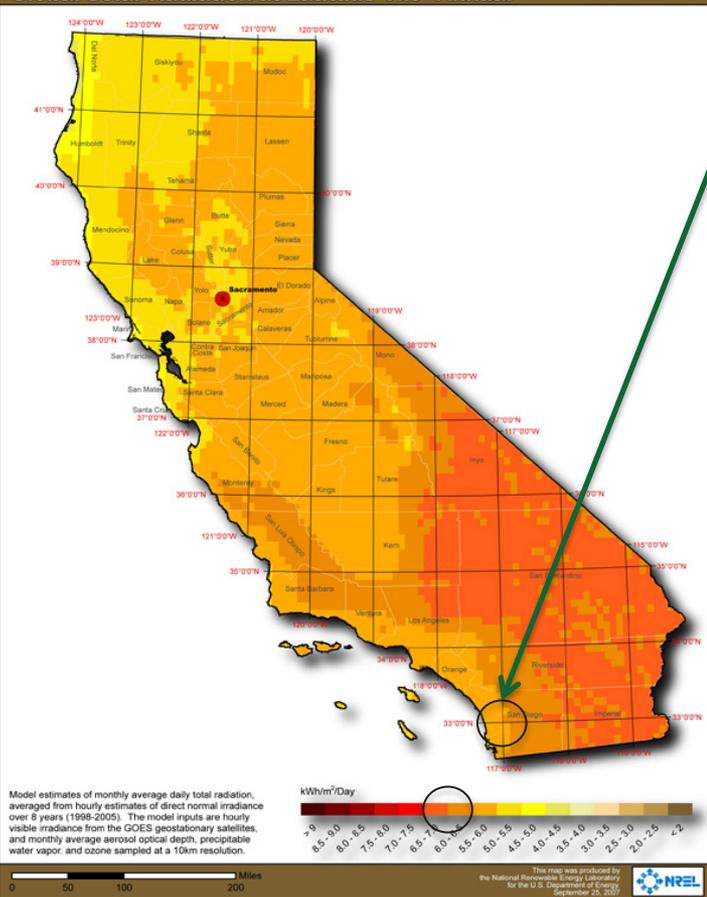
Refinement

Implementation

Operations & Maintenance



Global Solar Radiation at Latitude Tilt - Annual **California**



6-7 kWh/m<sup>2</sup>/day – good!

Off-taker:

Hybrid when instantaneous facility electric load

- > production: facility is off-taker
- < production: utility is off-taker by virtue of net metering or FIT

Production:

- Utilize NREL's online tool PVWATTS® for production estimate: 15,394 kWh/yr

Savings:

- Assume power purchase agreement (PPA) of \$0.12/kWh and retail average cost during production of \$0.16/kWh
- \$616/year

[http://apps1.eere.energy.gov/states/images/maps/map\\_large\\_pv\\_CA.jpg](http://apps1.eere.energy.gov/states/images/maps/map_large_pv_CA.jpg)



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Indian Energy

# Step 1: Hypothetical Facility-Scale Example – Outputs



- ✓ **Technology** – PV at this scale
- ✓ **Project scale** – 10 kW DC
- ✓ **Resource and market context** – excellent
- ✓ **Savings/production potential** – ~\$616/~15,394 kWh/yr
- ✓ **Preliminary sites options** – cultural museum, small facility
- ✓ **Team** – assume leaders and facility administrators are in favor, support, champion the project
- ✓ **Tribal role options** – own or host and purchase renewable energy (PPA)

# Facility-Scale Project Risk – Post Step 1

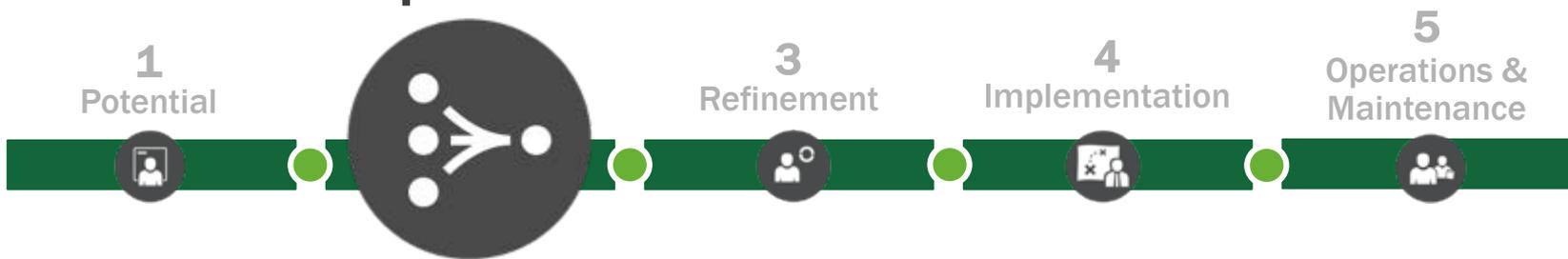
	Risks	Risk Assessment Post Step 1
<b>Development</b>	Loss/waste of development resources	<u>Low but rising; “calculated”</u>
<b>Site</b>	Improper orientation or project affected by shade	<u>Reduced</u>
	Inadequate foundation or structural integrity	Assumed low
	Site control challenges for safety/security purposes	Assumed low
<b>Permitting</b>	Tribe-adopted codes and permitting challenges	<u>Reduced</u>
	Utility interconnection challenges	<u>Reduced</u>
<b>Finance</b>	Capital constraints	Assumed low
	Incentive unavailability or insufficiency	<u>Reduced</u>
<b>Construction/ Completion</b>	Engineering, procurement, and construction difficulties	Assumed low, mitigable, or allocatable
	Cost overruns	Assumed low, mitigable, or allocatable
	Schedule overruns	Assumed low, mitigable, or allocatable
<b>Operating</b>	Output shortfall from expected	Assumed low, mitigable, or allocatable
	Operations & maintenance (O&M) issues	Assumed low, mitigable, or allocatable

NOTE: Underlining signifies that the risk assessment outcome changes during the step at hand.

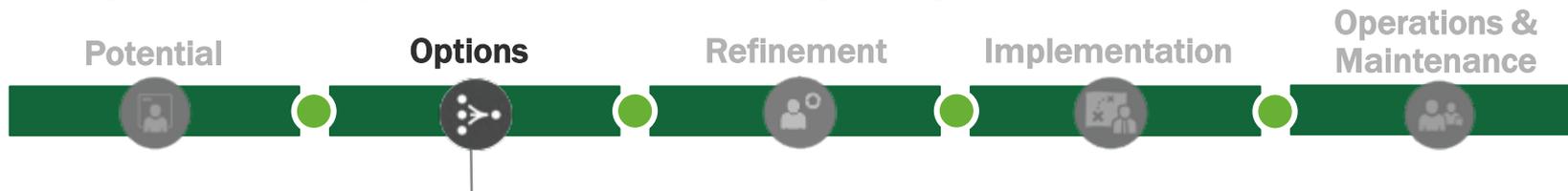
Sources: Adapted from Holland & Hart, RE Project Development & Finance & Infocast, Advanced RE Project Finance & Analysis



## 2 Options



# Step 2: Project Ownership Options and Permitting



**Purpose:** Decide ownership structure and determine permitting considerations

## Tasks:

- Understand ownership structures and usual risk allocations inherent
- Consider what ownership approach best corresponds to tribal entity goals and situation
- Understand and plan for permitting and site use considerations
- Begin investigation of interconnection agreements and utility requirements

**Key question: What viable ownership structure options are attractive to the facility?**

# Key Concept: Project Role Definitions



Title	Role
Resource/Land Owner	Owner or long-term lessor of project site
Generation Equipment Owner	Legal owner of generation equipment
Sponsor/Developer	Organizes all of the other parties and typically controls and makes an equity investment in the company or other entity that owns the project
Engineering Procurement and Construction Contractor (EPC)	Construction contractor provides design, engineering, and construction of the project
Financier	Entity that provides any loan to the EPC or owner to construct the project and may take a security interest in the project assets
Operator	Provider of the day-to-day O&M of the project
Product Off-taker	Entity that usually has a long-term contract to purchase the energy (and sometimes the renewable attributes) produced by the project

# Key Concept: Tribal Role Options



\* Also called Tribal Host

# Key Concept: Tribal Role Options



Role	Opportunity	Constraints	Comments
<b>Resource/ Land Owner*</b>	Utilization of otherwise unused area such as rooftop/small land parcel	Commits land or area to predetermined use for period of years. Must provide site access.	Limited risk associated with potential opportunity cost
<b>Off-taker/ Energy User</b>	Typically present energy cost savings and future price risk mitigation	Possible opportunity cost if utility prices fall in future	A role typically shared with utility somewhat. Historical price trends support the opportunity—low risk.
<b>Financier</b>	Potential for lower-cost financing	<ul style="list-style-type: none"> <li>• Requires ready capital</li> <li>• For more sophisticated financing arrangements likely require bundling of multiple facility-scale projects</li> </ul>	<ul style="list-style-type: none"> <li>• Med. risk, more complex</li> <li>• May require lending knowledge</li> <li>• Option for Tribes with limited lands, lots of \$</li> </ul>
<b>Sponsor/ Developer</b>	Self-determination of project; potential for profits (and losses) is moderate. Tribes with \$ don't need investors.	<ul style="list-style-type: none"> <li>• Investors require experience</li> <li>• Only consider as a new business (do multiple projects for diverse portfolio)</li> </ul>	<ul style="list-style-type: none"> <li>• High risk, complex</li> <li>• Tribes may be best served by outsourcing</li> </ul>
<b>Generation Equipment Owner</b>	Potential for profits (and losses) is moderate. Tribes with \$ don't need investors.	<ul style="list-style-type: none"> <li>• Only consider as a new business (do multiple projects for diverse portfolio)</li> <li>• Tribes investing money may not want this high risk/return investment</li> <li>• Tribe may not realize federal tax benefits as direct owner</li> </ul>	<ul style="list-style-type: none"> <li>• A project pipeline/portfolio mitigates some risks</li> </ul>
<b>Operator</b>	Control and self-determination of project's potential for profits (and losses) is minimal	<ul style="list-style-type: none"> <li>• Investors require experience</li> <li>• Only consider as a new business (multiple projects in a portfolio)</li> </ul>	<ul style="list-style-type: none"> <li>• Tribes may be best served by outsourcing</li> </ul>

# Step 2: Permitting and Interconnection



## Permitting

- Ensure tribal experts familiar with permitting are on the team
- Discuss/document and factor permitting actions and timeline into the evolving project plan
- Plan/schedule such that permitting is complete or eminent before contracting

## Interconnection

- Inspect utility interconnection agreement and process early involving key tribal stakeholders
- Consider need for system impact or interconnection study
- Third party owner often handles interconnection process and agreement

**Key questions: What will be involved in permitting and getting the project interconnected and operational?**

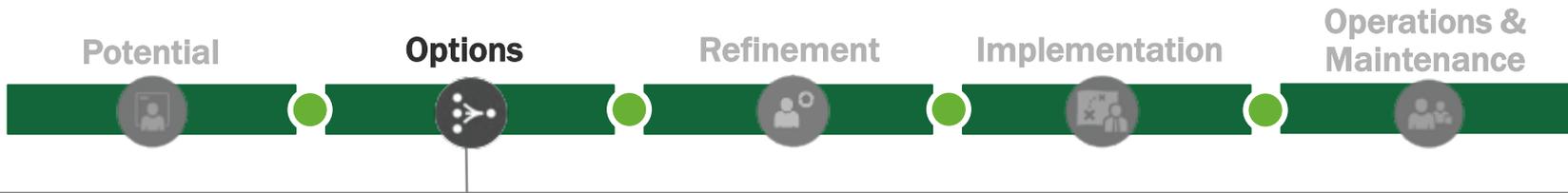
## Step 2: Ownership Structure Options



- Direct ownership
- Third-party owned; PPA

Key question: What viable ownership structure options are attractive to the facility?

## Step 2: Hypothetical Facility-Scale Example – Outputs



- ✓ **Permit needs and process** – local and tribal experts manage permitting requirements
- ✓ **Interconnection** – tribal decision-makers investigate utility processes and agreements and begin consideration
- ✓ **Finance options and costs** – private third-party financing secured through developer/owner
- ✓ **Tribal role options** – host and purchase renewable energy (PPA)

# Facility-Scale Project Risk – Post Step 2

	Risks	Risk Assessment Post Step 2
<b>Development</b>	Loss/waste of development resources	Still low but rising; “calculated;” <u>more assurance of success</u>
<b>Site</b>	Improper orientation or project affected by shade	Reduced
	Inadequate foundation or structural integrity	Assumed low; <u>developer to assess</u>
	Site control challenges for safety/security purposes	Assumed low
<b>Permitting</b>	Tribe-adopted codes and permitting challenges	<u>Further reduced</u> ; now <u>well informed</u> <u>(team-critical)</u>
	Utility interconnection challenges	Reduced
<b>Finance</b>	Capital constraints	Assumed low; <u>PPA elected</u>
	Incentives unavailability or insufficiency	<u>Low; allocate to developer to facilitate</u>
<b>Construction/ Completion</b>	Engineering, procurement, and construction difficulties	<u>Low; allocate to EPC/developer</u>
	Cost overruns	<u>Low; allocate to EPC/developer</u>
	Schedule overruns	<u>Low; allocate to EPC/developer</u>
<b>Operating</b>	Output shortfall from expected	<u>Low; allocate to owner</u>
	Technology O&M failure	<u>Low; allocate to owner or O&amp;M contractor</u>

NOTE: Underlining signifies that the risk assessment outcome changes during the step at hand.

Sources: Adapted from Holland & Hart, RE Project Development & Finance & Infocast, Advanced RE Project Finance & Analysis



# 3 Refinement



# Step 3: Project Refinement



**Purpose:** Validate decisions, complete permitting

**Tasks:**

- Confirm that ownership structure decision was valid
- Finalize permitting (including environmental reviews)

**Outputs:**

- Confirm cost savings or goals to be met
- Vendors selected
- Completed environmental reviews and finalized permits

# Step 3: Project Refinement – Outstanding Risks



Site	Resource	Off-take	Permits	Technology	Team	Capital
Securing site: No site, no project	Engineering assessment (input)	Power purchases: off- take contract – (revenue)	Anything that can stop a project if not in place...	Engineered system (output)	Professional, experienced, diverse	Financing structure
<ul style="list-style-type: none"> <li>• Site control</li> <li>• Size and shape</li> <li>• Location to load and T&amp;D</li> <li>• Long-term control</li> <li>• Financial control</li> <li>• Clear title</li> <li>• Lease terms</li> <li>• Collateral concerns</li> <li>• Environmental</li> <li>• Access</li> <li>• O&amp;M access</li> <li>• Upgradable</li> </ul>	<ul style="list-style-type: none"> <li>• Volume/ Frequency</li> <li>• Variability</li> <li>• Characteristics (power/speed)</li> <li>• 24-hour profile</li> <li>• Monthly, seasonal, and annual variability</li> <li>• Weather dependence</li> <li>• Data history</li> <li>• Std. Deviation</li> <li>• Technology suitability</li> </ul>	<ul style="list-style-type: none"> <li>• Credit of counterparty</li> <li>• Length of contract</li> <li>• Terms and conditions</li> <li>• Reps and warranties</li> <li>• Assignment</li> <li>• Curtailment</li> <li>• Interconnection</li> <li>• Performance</li> <li>• Enforcement</li> <li>• Take or pay</li> <li>• Pricing and terms</li> </ul>	<ul style="list-style-type: none"> <li>• Permitting/ entitlements</li> <li>• Land disturbance</li> <li>• Environmental and cultural impacts</li> <li>• Resource assessments</li> <li>• Wildlife impacts</li> <li>• Habitat</li> <li>• NEPA, EIS</li> <li>• Utility inter- connection</li> <li>• Other utility or PUC approvals</li> <li>• Lease and/or ROW approvals</li> </ul>	<ul style="list-style-type: none"> <li>• Engineering design plans</li> <li>• Construction plans</li> <li>• Not generic solar panel and inverter</li> <li>• Engineered resource/ conversion technology/ balance of system designs</li> <li>• Specifications</li> <li>• Bid set</li> </ul>	<ul style="list-style-type: none"> <li>• Business management</li> <li>• Technical expertise</li> <li>• Legal expertise</li> <li>• Financial expertise (including tax)</li> <li>• Transmission interconnection expertise</li> <li>• Construction/ contract management</li> <li>• Operations</li> <li>• Power marketing/sales</li> </ul>	<ul style="list-style-type: none"> <li>• Development equity</li> <li>• Project equity</li> <li>• Nonrecourse project debt</li> <li>• Mezzanine or bridge facility</li> <li>• Tax equity</li> <li>• Grants, rebates, other incentives</li> <li>• Environ- mental attribute sales contracts (RECs)</li> <li>• Bond finance</li> </ul>

# Simple LCOE Tools: Geo, Wind, PV, Digester

Available at: <http://financere.nrel.gov/finance/content/CREST-model>

## Cost of Renewable Energy Spreadsheet Tool (CREST) Model:

- Designed to give public utility commissions (PUCs) and others a tool and methodology to quickly evaluate LCOE
- Can handle simple or complex level of inputs (user's choice)
- Simple to operate—no macros
- Outreach and interaction tool:
  - PUCs
  - Utilities
  - Other stakeholders
- Solar, geothermal, wind, and anaerobic digester

## White Paper:

Describes each term in LCOE and weighs choices for analysis methodology

*Renewable Energy Cost Modeling: A Toolkit for Establishing Cost-Based Incentives in the United States*

<http://www.nrel.gov/docs/fy11osti/51093.pdf>

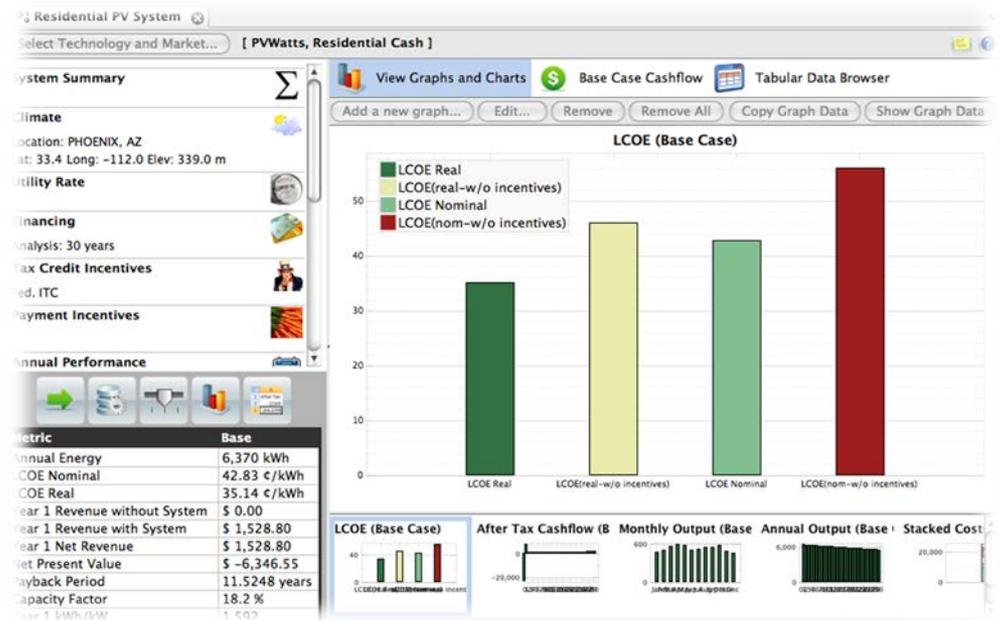
Check			Notes
	<b>Selected Technology</b>	Photovoltaic	?
	<b>Project Size and Performance</b>		
	Generator Nameplate Capacity	kW <sub>dc</sub>	2,200 ?
	DC-to-AC Conversion Efficiency	%	77.0% ?
			?
	Net Capacity Factor, Yr 1	%, ac	18.5% ?
	Production, Yr 1	AC kWh	2,745,296 ?
	Annual Production Degradation	%	0.5% ?
	Project Useful Life	years	25 ?
	Feed-in Tariff Payment Duration	years	25 ?
	Feed-In Tariff Escalation Rate	%	2.0% ?
	% of Year-One Tariff Rate Escalated	%	30.0% ?
	<b>Capital Costs</b>		
	Select Cost Level of Detail	Intermediate	?
			?
	Generation Equipment	\$	\$10,500,000 ?
	Balance of Plant	\$	\$0 ?
	Interconnection	\$	\$0 ?
	Development Costs & Fee	\$	\$0 ?
	Reserves & Financing Costs	\$	\$488,815 ?
			?
	Total Installed Cost	\$	\$10,988,815 ?
	Total Installed Cost		\$4.99 ?

# Advanced Tool: NREL's System Advisor Model

Available at: <https://www.nrel.gov/analysis/sam/>

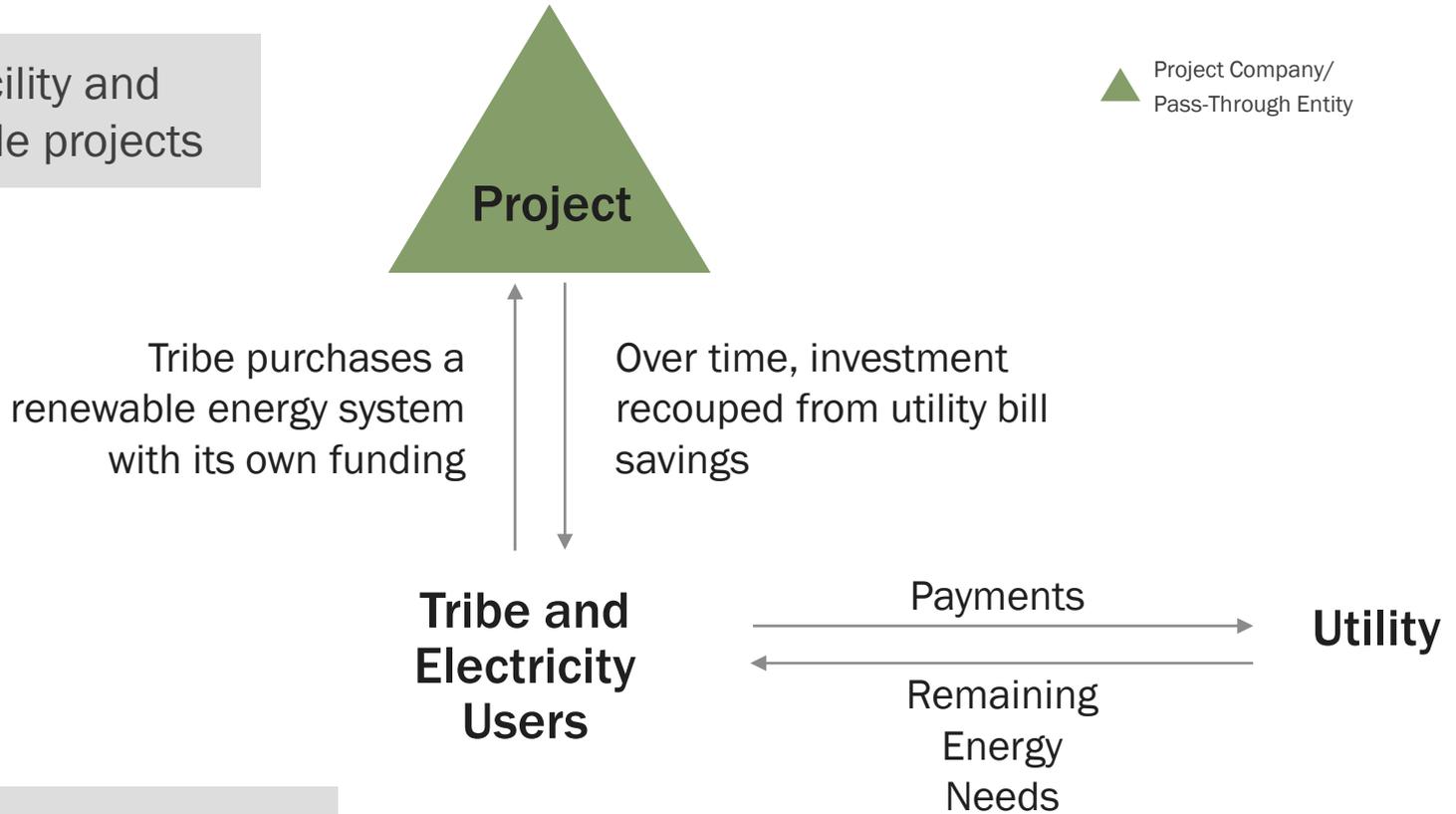
NREL's System Advisor Model (SAM) is a free computer program that **calculates a renewable energy system's hourly energy output** over a single year and **calculates the cost of energy** for a renewable energy project over the life of the project.

- Solar, wind, geothermal, and other renewable and fossil technologies available
- These calculations are done using detailed performance models, a detailed cash flow finance model, and a library of reasonable default values for each technology and target market



# Direct Ownership Structure

Primarily for facility and community-scale projects



The Tribe is the owner in this structure and self-generates its electricity

# Ownership Options – Direct Ownership

## Advantages

- Maximum reduction in electricity bills
- Lower finance costs (or none depending on source)
- Full control over a project: design, operations, and risks
- Own renewable energy credits (RECs) and can choose to retain or monetize
- Might be only option for small projects

## Challenges

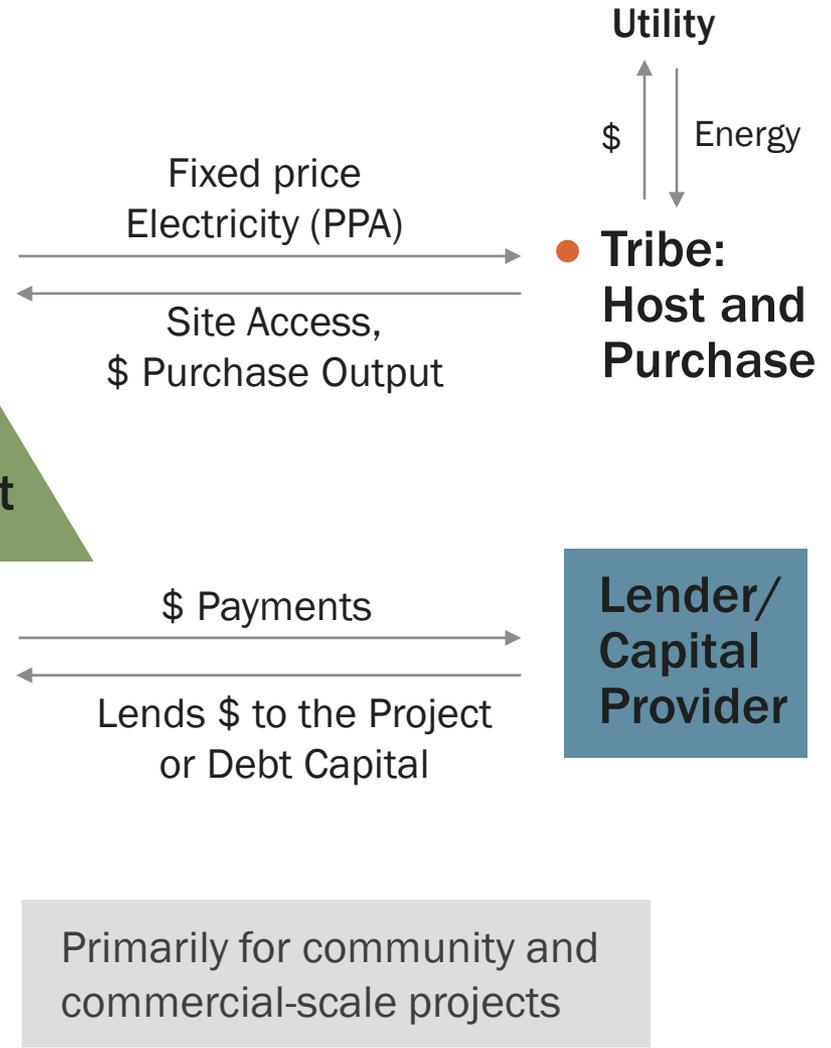
- Need the resources to pay for the project
- Don't fully benefit from available tax incentives given tax-exempt status
- Responsibilities of ownership (operations & maintenance)

# Tax-Equity Partnerships and Third-Party PPAs

- Corporations
- ▲ Project Company/  
Pass-Through Entity
- ◆ Tax Equity
- Potential Tribal Role

The Tribe is the host in this structure and agrees to buy electricity generated by the renewable energy system.

**Project**



**Tax-Equity Investor**

# Tax-Equity Partnerships and Third-Party PPAs

## Advantages

- No/low up-front outlay of capital
- Ability for tax-exempt entity to benefit from savings derived from tax-based incentives
- Fixed electricity price for 15–25 years
- No operating and maintenance responsibilities
- Path to ownership if desired

## Challenges

- The process of negotiating a PPA *can be* (but isn't necessarily) lengthy and costly
- Need to be able to enter into longer-term contracts (10–25 yrs)
- Still pay for 100% of electricity
- Don't own the green attributes (RECs) unless they are purchased
- Need to allow and manage site access

# Step 3: Project Refinement – Ownership Approach and Vendor Selection

Market research and tools permit comparison of alternatives:

- Evaluate baseline, ongoing utility costs with escalation and variation
- Evaluate PPA price and expected production and subtract expected production as utility savings going forward
- Consider direct ownership
  - Only if:
    - Cash or financing available
    - Project is desired use of funds
    - Risks and responsibilities are appropriate—even if best economic case, do you want the risks and responsibilities?
  - Factors
    - Outlay
    - O&M, repair and replacement (R&R), insurance
    - Cost of money
    - System degradation
    - Utility savings from expected production
- Metrics for comparison
  - LCOE
  - Net present value
  - Savings-to-investment ratio

The market research performed at this stage (could be informal, depending on tribal rules) will usually provide sufficient information for selection of a developer/vendor.

# Step 3: Project Refinement – Permitting

- Bureau of Indian Affairs (BIA) approval required for leases and rights-of-way on tribal lands
- Federal environmental (National Environmental Policy Act [NEPA]) and other statutory review (environmental assessment [EA], environmental impact assessment [EIA], categorical exclusions [CatX]) may be required, so assess implicated sacred sites such as:
  - Burial grounds
  - Native plant harvesting areas
  - Ceremonial locations.
- Consult with Tribe on unique or archaeological resources or culturally relevant features on a proposed site
- Utilize attorneys, local staff, and tribal contacts knowledgeable in complexities of leasing, permitting, and project siting on tribal lands
- Understand scheduling implications of all of the above

# Step 3: Hypothetical Facility-Scale Example – Outputs



- ✓ Decision confirmation on ownership structure – third-party owned PPA
- ✓ Economic models/market research – PPA is economical
- ✓ Vendor(s) selected – SD Solar\*
- ✓ Finalized permits – selected rooftop was not sensitive and required no special permitting<sup>+</sup>
- ✓ Interconnection – negotiating with utility or contractor will manage

\*Hypothetical contractor

<sup>+</sup> No implication intended as to actual permitting that would be required for project on rooftop of tribal facility

# Facility-Scale Project Risk – Post Step 3

	Risks	Risk Assessment Post Step 3
<b>Development</b>	Loss/waste of development resources	<u>Medium; now with more assurance of success</u>
<b>Site</b>	Improper orientation or project affected by shade	<u>Low; some may be assumed by host</u>
	Inadequate foundation or structural integrity	Assumed low; developer to assess
	Site control for challenges for safety/security purposes	Assumed low
<b>Permitting</b>	Tribal-adopted codes and permitting challenges	<u>Low; permitting completed</u>
	Utility interconnection challenges	Reduced
<b>Finance</b>	Capital constraints	<u>Low; PPA elected and confirmed</u>
	Incentive unavailability or insufficiency	Low; allocate to developer to facilitate
<b>Construction/Completion</b>	Engineering, procurement, and construction difficulties	Low; allocate to EPC or developer
	Cost overruns	Low; allocate to EPC or developer
	Schedule overruns	Low; allocate to EPC or developer
<b>Operating</b>	Output shortfall from expected	Low; allocate to owner
	Technology O&M failure	Low; allocate to owner or O&M contractor

NOTE: Underlining signifies that the risk assessment outcome changes during the step at hand.

Sources: Adapted from Holland & Hart, RE Project Development & Finance & Infocast, Advanced RE Project Finance & Analysis



# 4 Implementation



# Step 4: Implementation



**Purpose:** Contract for, realize physical construction of project

## Tasks:

- Finalize project agreements
- Finalize vendor contracting process
- Finalize preconstruction tasks
- Realize construction and equipment installation
- Realize interconnection
- Realize project commissioning leading to commercial operation

**Output:** Completed project (commercial operation)

# Step 4: Project Implementation Example



## Check:

- Ensure permitting is complete
- Ensure on-site activities will not interfere with construction and vice versa
- Communicate and plan with the vendor/contractor

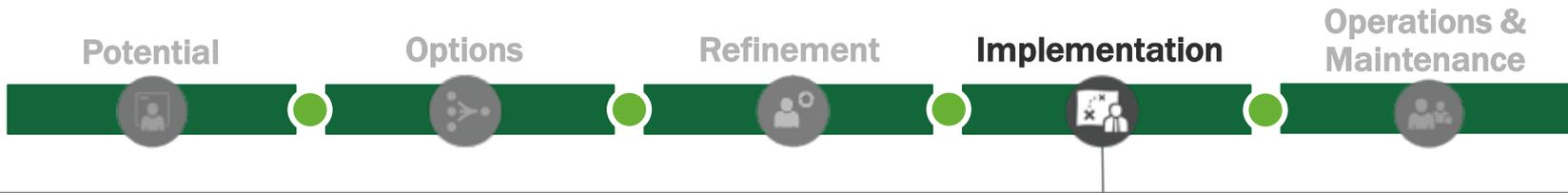
## Interconnection:

- Sometimes contracted and completed by system owner in cooperation with utility
- Sometimes involves host
- Often coordinated by contractor/system owner

## Construction/commissioning: diligence of each party as appropriate to its assumption of risk as:

- PPA energy seller (or purchaser) – least diligence for tribal entity – economic due diligence needed
- Energy system seller (or purchaser/owner) – technical diligence and capability for tribal entity

# Step 4: Hypothetical Facility Scale Example – Outputs



✓ Completed and operating project

## Project Implementation Success

- Project generating electricity
- Facility utilizing generated electricity



Photo by Dennis Schroeder, NREL 21512

# Facility-Scale Project Risk – Post Step 4

	Risks	Risk Assessment Post Step 4
<b>Development</b>	Loss/waste of development resources	<u>Medium; now with more assurance of success</u>
<b>Site</b>	Improper orientation or project affected by shade	Low; some may be assumed by host
	Inadequate foundation or structural integrity	<u>Low; developer assessed</u>
	Site control for challenges for safety/security purposes	<u>Low; some assumed by host</u>
<b>Permitting</b>	Tribe-adopted codes and permitting challenges	Low; permitting completed
	Utility interconnection challenges	<u>None</u>
<b>Finance</b>	Capital constraints	<u>None; project constructed/commissioned</u>
	Incentive unavailability or insufficiency	<u>Low to none; allocated to developer</u>
<b>Construction/Completion</b>	Engineering, procurement, and construction difficulties	<u>None; EPC complete</u>
	Cost overruns	<u>None; construction complete</u>
	Schedule overruns	<u>None; construction complete</u>
<b>Operating</b>	Output shortfall from expected	<u>Low; allocated to owner</u>
	Technology O&M failure	<u>Low; allocated to owner or O&amp;M contractor</u>

NOTE: Underlining signifies that the risk assessment outcome changes during the step at hand.

Sources: Adapted from Holland & Hart, RE Project Development & Finance & Infocast, Advanced RE Project Finance & Analysis



# 5 Operations & Maintenance



# Step 5: Operations & Maintenance



**Purpose:** Conduct or ensure ongoing O&M/R&R\*

## O&M Costs:

- Equipment maintenance and upkeep
- Inverter replacement
- Insurance
- Labor and staffing
- Extended warranty agreements

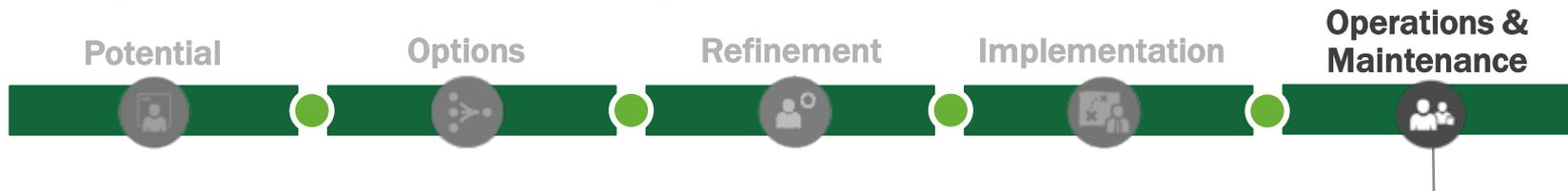
**If PPA,** vendor typically manages maintenance

\* Esp. if owner – role of highest O&M risk



Photo from Henry Price, NREL 14952

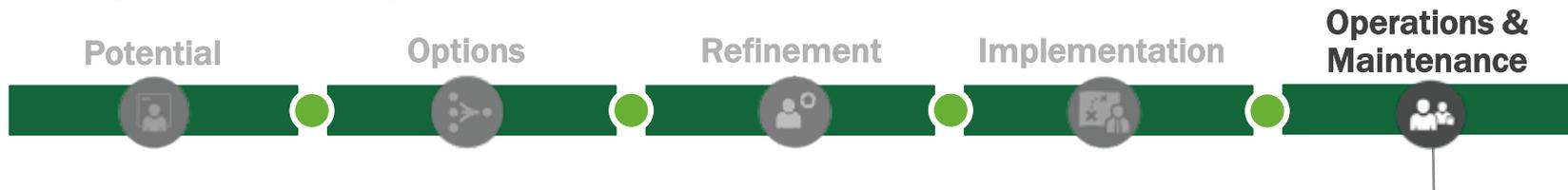
## Step 5: O&M Example



In our hypothetical case, the museum and cultural center elected the PPA third-party ownership model.

- Museum has no responsibility for O&M
- If O&M is not conducted and the system doesn't produce, the museum still only pays for delivered energy
- The vendor is incented to keep the system in good working order so that it continues to receive revenues

# Step 5: Outputs



- Ensure that responsible party carries out O&M/R&R\*
- Measuring and tracking success
- Correlation with business plan and comprehensive energy plan
- Reporting

\* Esp. if owner



Photo from Henry Price, NREL 14952

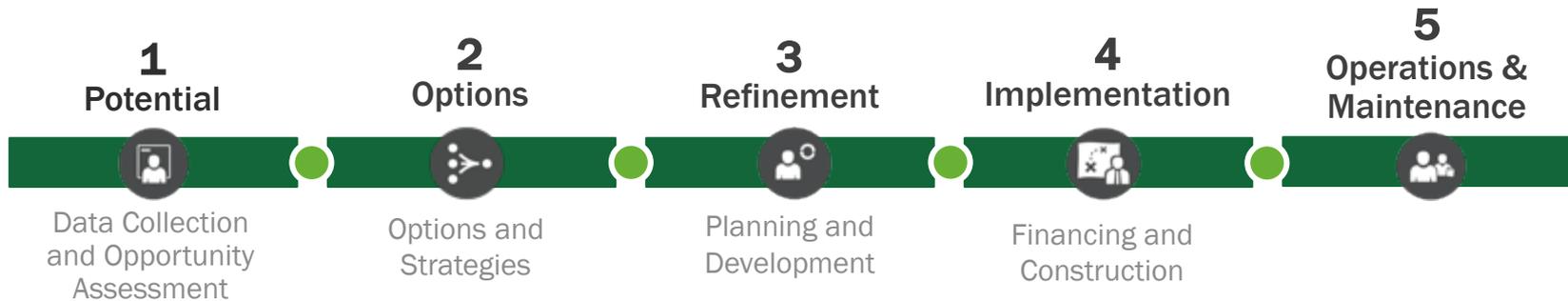
# Facility-Scale Project Risk – Post Step 5

	Risks	Risk Assessment Post Step 5
<b>Development</b>	Loss/waste of development resources	Medium; now with more assurance of success
<b>Site</b>	Improper orientation or project affected by shade	Low; some assumed by host
	Inadequate foundation or structural integrity	Low; developer assessed
	Site control for challenges for safety/security purposes	Low; some assumed by host
<b>Permitting</b>	Tribe-adopted codes and permitting challenges	Low; permitting completed
	Utility interconnection challenges	None
<b>Finance</b>	Capital constraints	None; project constructed/commissioned
	Incentive unavailability or insufficiency	Low to none/allocated to developer
<b>Construction/ Completion</b>	Engineering, procurement, and construction difficulties	None; EPC complete
	Cost overruns	None; construction complete
	Schedule overruns	None; construction complete
<b>Operating</b>	Output shortfall from expected	<u>Being managed by appropriate party</u>
	Technology O&M failure	<u>Being managed by appropriate party</u>

Sources: Adapted from Holland & Hart, RE Project Development & Finance & Infocast, Advanced RE Project Finance & Analysis

NOTE: Underlining signifies that the risk assessment outcome changes during the step at hand.

# Summary of Actions by Step



**Step 1:** Gather all relevant data in order to make first pass at potential project, understand tribal role options

**Step 2:** Consider ownership approach, begin to identify vendors, begin planning interconnection and permitting in consideration of site use

**Step 3:** Finalize permitting, choose vendor(s), and confirm economic and ownership structure decision, negotiate interconnection if needed

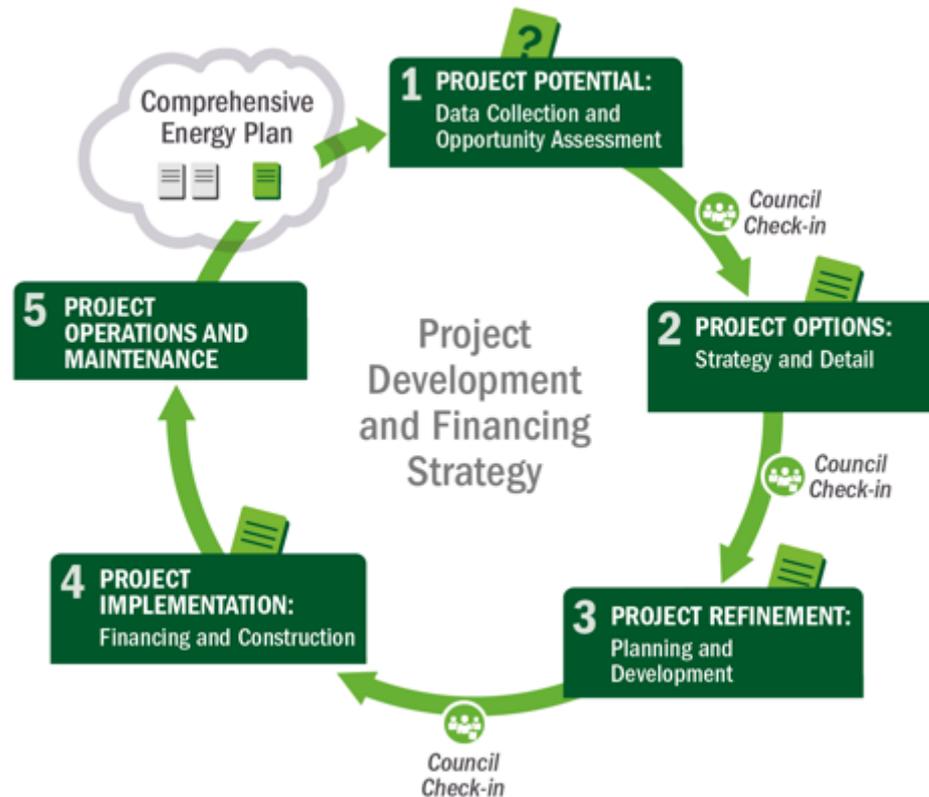
**Step 4:** Finalize agreements (incl. vendor contracting), installation, interconnection, commissioning, begin operation

**Celebrate!**

**Step 5:** Conduct or ensure ongoing O&M/R&R

# Not Quite Done!

- Check back in with planning document – update as necessary
- Identify next potential project from plan



# Wrap-Up: Project Development Process



# Key Concepts Review



- Roles of the Tribe
- Risk and Uncertainty
- The Project Team
- LCOE
- Tax-Equity Partnership

**In-depth information on each key concept available in Advanced Courses**

These courses were designed in coordination with Tracey LeBeau and Pilar Thomas of the DOE Office of Indian Energy by a team including Dan Beckley, Stacy Buchanan, Karlynn Cory, Jason Coughlin, Elizabeth Doris, Mike Elchinger, Sara Farrar-Nagy, Bill Gillies, Tom Harris, Travis Lowder, Anirudh Paduru, Paul Schwabe, Bob Springer, Blaise Stoltenberg, and Rachel Sullivan of the National Renewable Energy Laboratory; Joe Cruz and Matt Ferguson of Cohn Reznick; Paul Dearhouse of Dearhouse Consulting Group; and Carolyn Stewart of Red Mountain Energy Partners.

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For more information: [www.energy.gov/indianenergy](http://www.energy.gov/indianenergy)

Additional courses: [www.nerlearning.org](http://www.nerlearning.org)

# THANK YOU



# INFORMATION ON THE CURRICULUM PROGRAM AND OFFERINGS

# Curriculum Structure and Offerings

## Foundational Courses

Provide an overview of foundational information on renewable energy technologies, strategic energy planning, and grid basics

## Leadership and Professional Courses

Cover the components of the project development process and existing project financing structures

# Foundational Courses

## Energy Basics

- Assessing Energy Needs and Resources
- Electricity Grid Basics
- Strategic Energy Planning

## Renewable Energy Technology Options

- Biomass
- Building Heat & Hot Water
- Geothermal
- Hydroelectric
- Solar
- Wind

All courses are presented as 40-minute webinars online at: [www.nerlearning.org](http://www.nerlearning.org)

# Leadership and Professional Courses

## Essentials

### Project Development and Financing Essentials

- Key concepts
- Process overview
- Decision points

## Advanced/In-Depth

### Project Development

- Concepts
  - Risk and uncertainty
  - Tribal project roles
  - Policies and renewable energy (federal & state)
- Process
  - Project scale decision factors
  - Understanding the energy market
  - Project team
  - Procurement

### Project Finance

- Concepts
  - LCOE
  - Business structures
  - Tax-equity partnerships
- Process and Structures
  - Direct ownership
  - Flip
  - Leaseback
  - Inverted lease

### Project Scale

- Facility
- Community
- Commercial