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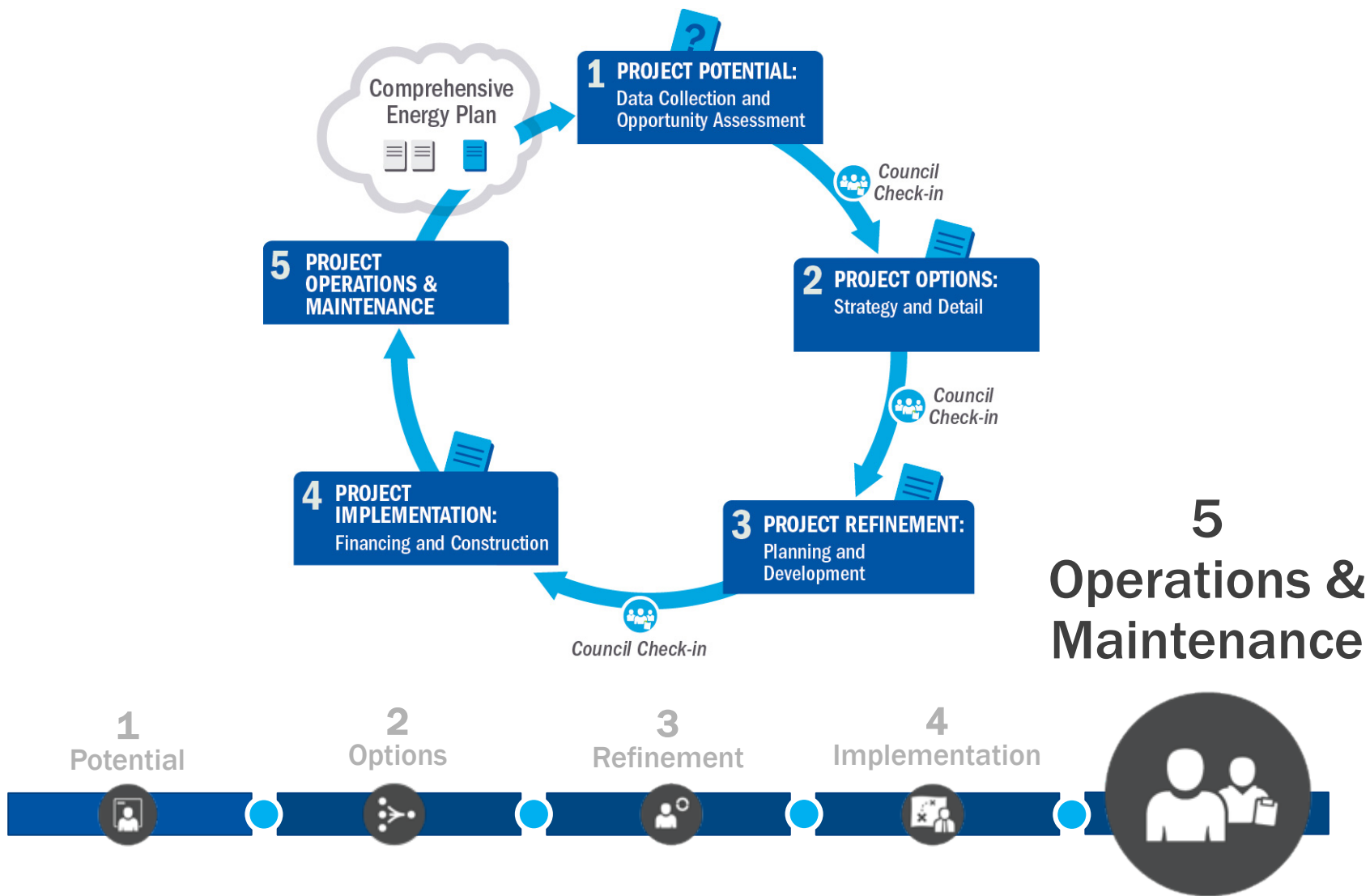
Step 5: Project Operations & Maintenance



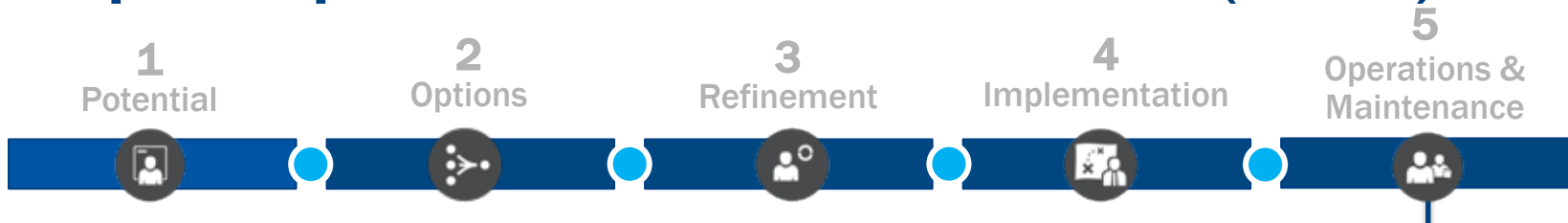
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Project Development Process



Step 5: Operations & Maintenance (O&M)



Purpose: To ensure ongoing, effective project operation, i.e., energy production

Operational Costs:

- Equipment maintenance and replacement
- Monitoring
- Insurance
- Labor
- Extended warranty agreements

If leasing, lessor often manages maintenance

If PPA, vendor typically manages maintenance

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



Photo from Florida Solar Energy Center, NREL 14728

Post-Procurement: Project O&M

1. O&M agreements
2. Warranties
3. Monitoring and reporting system/services
4. Performance guarantees
5. Production guarantees
6. Buyout options

A photograph of three wind turbines standing on a mountain peak. The turbines are partially obscured by a thick layer of white mist or fog that fills the valley and surrounds the base of the mountain. The sky is a clear, bright blue. The overall scene is serene and emphasizes clean energy.

BIOMASS O&M



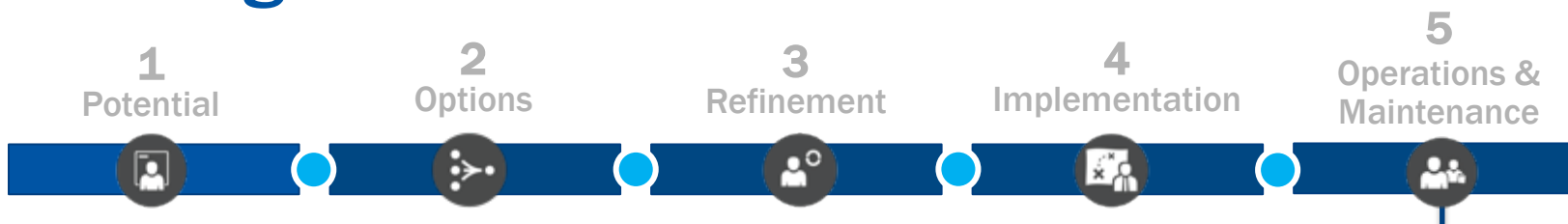
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Biomass Post-Procurement: Project O&M

1. O&M agreements
2. Fuel supply
3. Warranties
4. Biomass plant operations (monitoring the system and fuel supply)
5. System performance

O&M Agreement



Purpose: Conduct or ensure ongoing O&M, including repair and replacement (R&R)*

O&M Costs:

- Biomass fuel
- Labor
- Equipment maintenance and upkeep
- Insurance
- Extended warranty agreements

If leasing, lessor often manages maintenance

If Power Purchase Agreement (PPA), vendor typically manages maintenance

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



Fuel Supply Key to Project Success

1
Potential



2
Options



3
Refinement



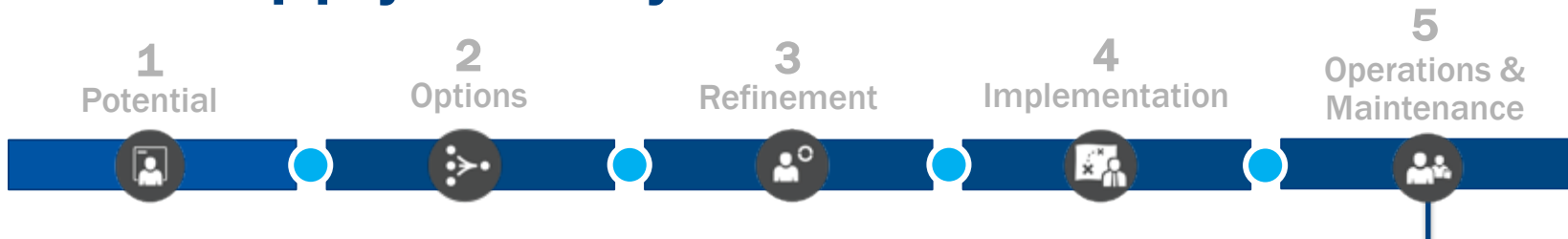
4
Implementation



5
Operations &
Maintenance



Fuel Supply Greatly Affects O&M



- Biomass equipment needs clean fuel
 - Not landscape mulch
 - Not animal bedding
 - Not playground chips
- Biomass fuel suppliers may change
 - Know what your plant needs
 - Inspect new suppliers for quality



Contaminated Fuel Supply

1
Potential



2
Options



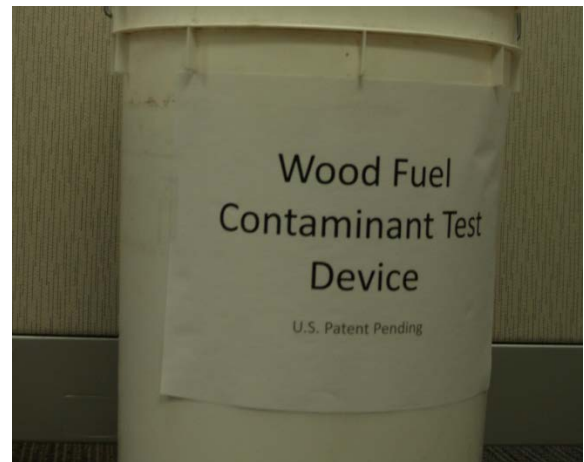
3
Refinement



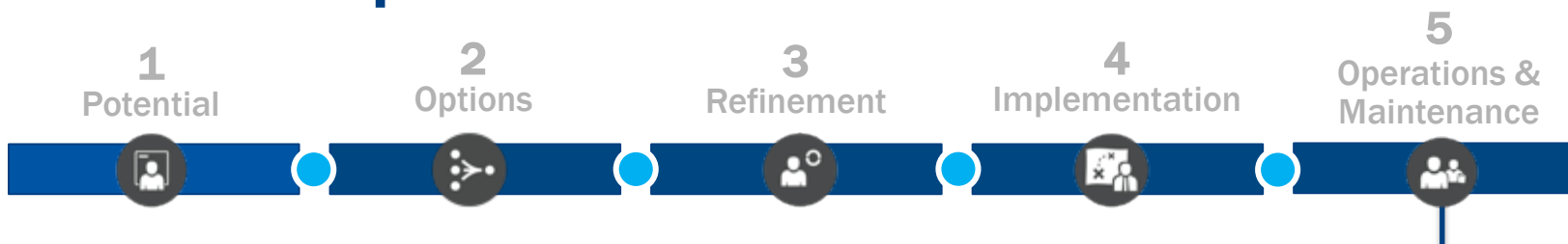
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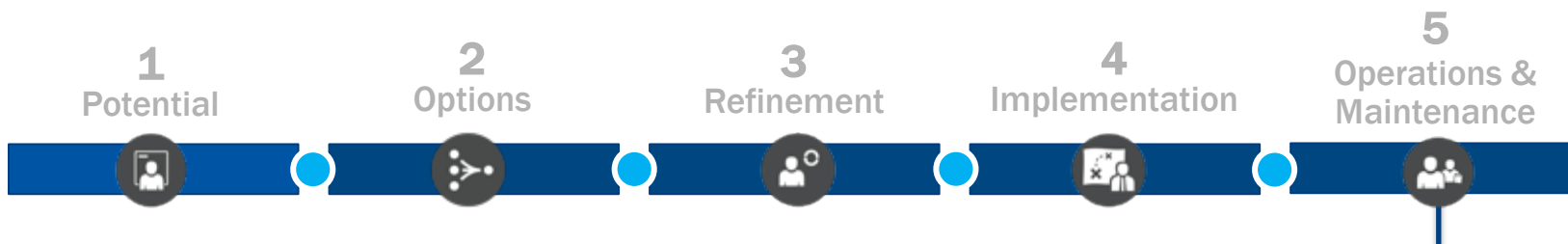


Biomass Operators



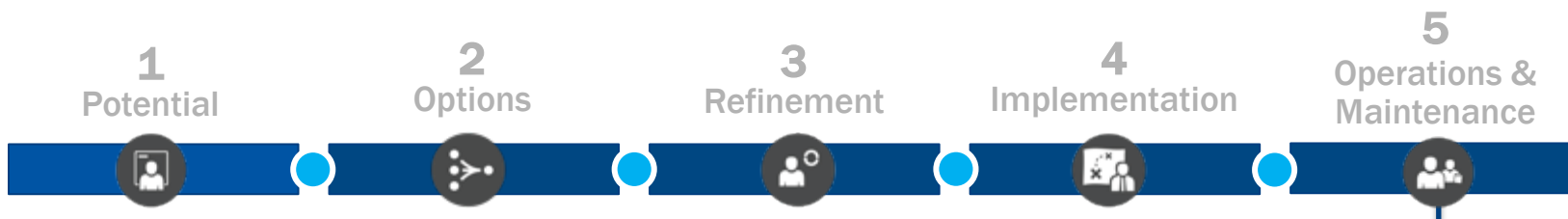
- Train plant operating staff
 - AEA Tanana biomass training
 - Check with AEA for future trainings
- Operators monitor a clean fuel supply chain
 - Harvesting biomass
 - Processing into fuel
 - Storage
 - Consistent delivery
 - Plan for a backup fuel source
- Maintain machinery

Biomass Warranties



- Best warranty is guaranteed performance (also most expensive since vendor bears all risk)
- Warranties should cover premature failure of machinery
- Most industrial equipment carries a one-year warranty
- Make sure warranty period begins at startup, not receipt of equipment

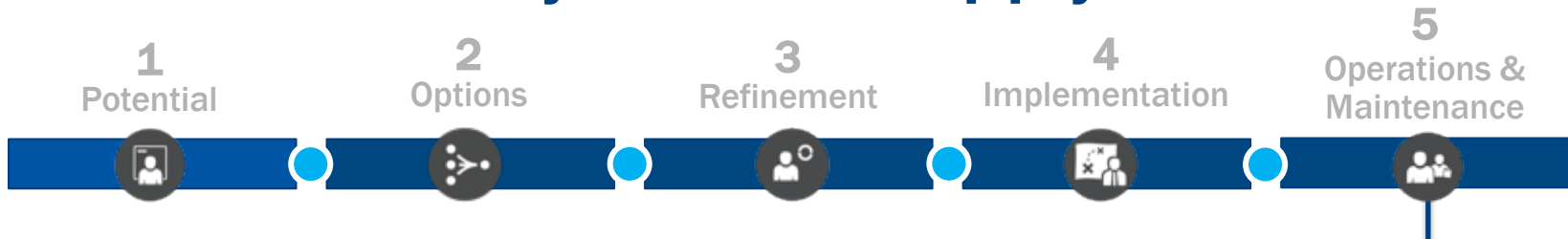
Biomass Maintenance



Machinery maintenance:

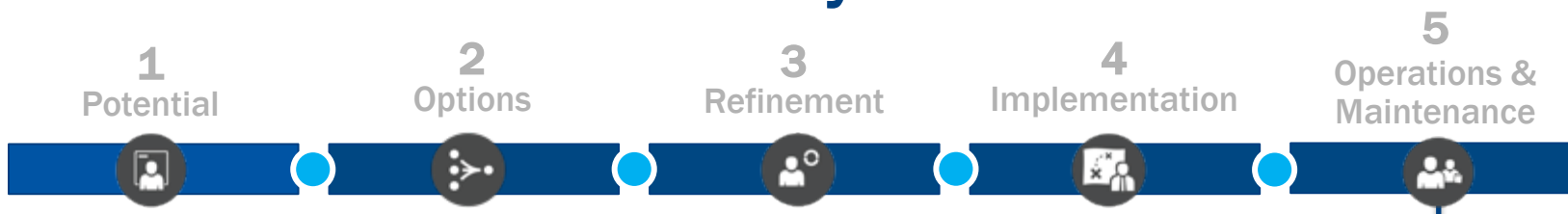
- Build a maintenance plan with equipment sales team
- Verify maintenance and operations plan fulfills all warranty obligations
- Schedule regular maintenance according to your biomass equipment needs
- Contract a maintenance plan for multiple years if possible
- Budget annually for scheduled maintenance

O&M Case Study on Fuel Supply Failure



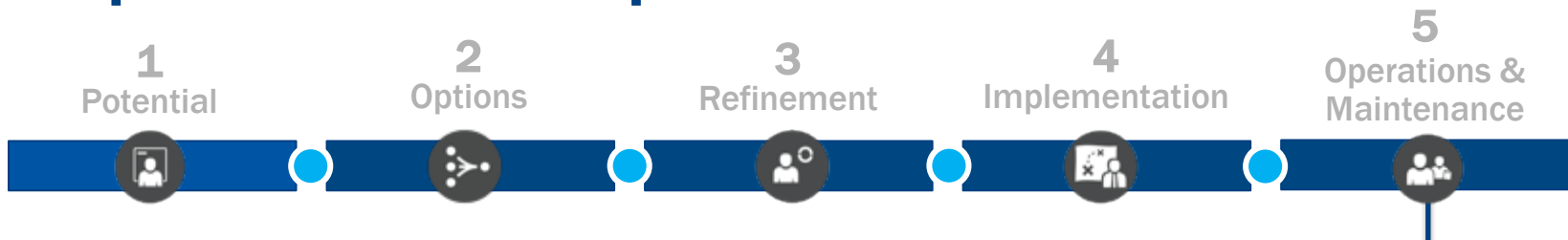
- Business plan assumed \$38/ton biomass fuel
- Boiler could not tolerate low-grade fuel
- Cost to upgrade fuel exceeded budget at \$75 to \$100 per ton
- Locate biomass fuel you can afford *first!*
 - Key question: Is it available for life of project?
- *Then* choose combustion equipment

Biomass O&M Takeaways



- Include O&M budgets and schedules early in the planning process
- Be realistic about fuel costs
- Fuel supply quality should be closely monitored by plant operators with authority to reject loads
- Warranties should cover motors, drivers, controllers, and as many moving parts as possible, regardless of multiple vendors
- Clean fuel and machinery maintenance will determine system performance

Step 5: O&M– Outputs



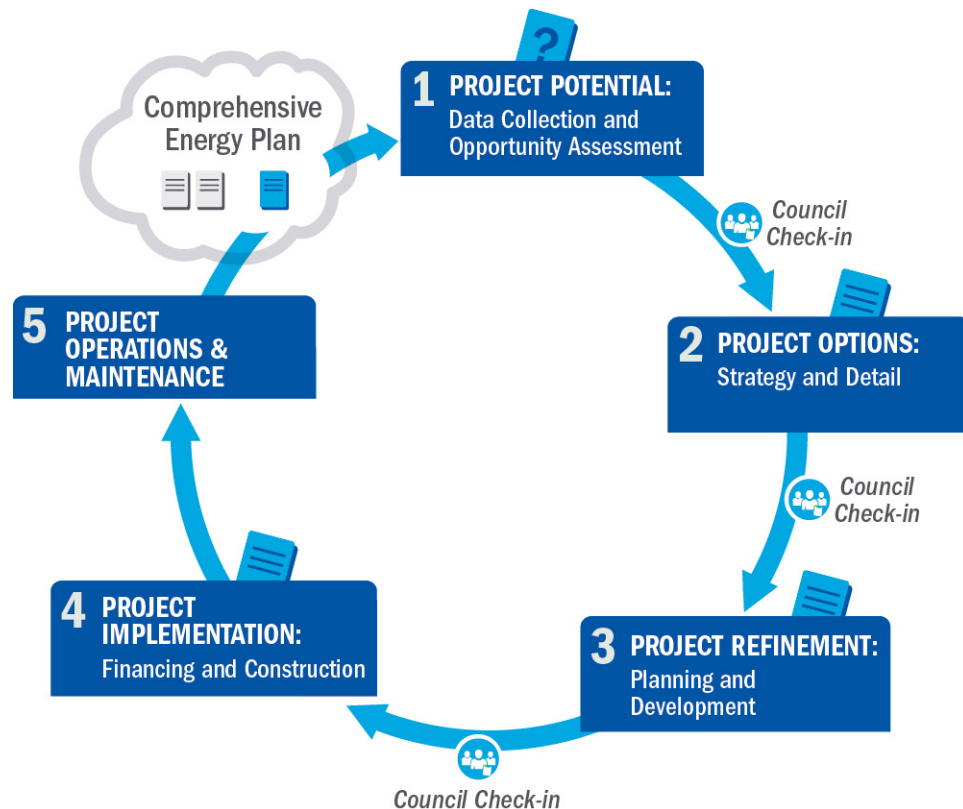
- Ensure responsible party carries out O&M/R&R*
- Measuring and tracking success
- Correlation with business plan and strategic energy plan
- Contract compliance
- Reporting of generation
- Met or exceeded energy and financial performance

*Esp. if owner



Not Quite Done!

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



Summary of Actions by Step



Step 1: Gather all relevant data to make first pass at potential project, understand Tribal role options

Step 2: Estimate value to Tribe, consider ownership approach, begin to identify off-takers, partners, vendors, begin planning permitting and site use

Step 3: Finalize economic assumptions and tribal roles, finalize permitting, interconnection, transmission and off-take agreements, and determine financial partnerships, ownership structure

Step 4: Finalize agreements (including vendor contracting); financial close and construction; project commissioning, begin operation

Celebrate!

Step 5: Maintenance plan implementation (conduct or ensure ongoing O&M, R&R)