A Resilient and Autonomous Microgrid Powered by Marine Renewable Energy

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Igiugig, Alaska
Igiugig, Alaska

Regional Detail (Alaska)

Local Detail (Igiugig, Alaska)
Project Summary

Project Objective
• To acquire and install smart microgrid electronics and energy storage, to provide autonomous operation of the microgrid to power all Village of Igiugig homes and facilities for sustainable energy supply and resilient operations

Project Need
• Igiugig has very high energy costs. Like most remote northern communities, we are not connected to a centralized electrical power grid or fuel supply pipelines
• The power plant is comprised of three diesel generators, each with 65 kW prime power capacity, which produce 325 MWh/year using a total of 24,789 gallons of diesel
Igiugig
Self-Governance

The People & Values

Gov’t Services

Igiugig Village Council

Electric Utility

Companies

Bulk Fuel

Housing

Igiugig Native Corp.

Local Businesses

Igiugig Native Corp.
9,000+ yrs ago
Yup’ik people living sustainably in Central Western Alaska

1867-1930s
Commercial Fishing Economy

1930s-1970s Era of Land Claims Settlement Act (ANCSA)

1971-2000
Growing Diesel Dependence, Alaska Oil Pipeline

2000-Today
Journey Towards Sustainability

• Fuel prices continue to go up
• Dependence on gov’t assistance and electric company subsidy growing
• Rural outmigration continuing
• No end in sight!
### Annual Cost to Operate Igiugig Electric Co. 2018

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>57.21%</td>
<td>$255,707.79</td>
</tr>
<tr>
<td>Depreciation Expense</td>
<td>18.60%</td>
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<tr>
<td>Payroll Expenses</td>
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<tr>
<td>General Administrative</td>
<td>3.32%</td>
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<td>Power Plant</td>
<td>3.25%</td>
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<tr>
<td>Freight</td>
<td>2.80%</td>
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<tr>
<td>Miscellaneous</td>
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<tr>
<td>Casual Labor</td>
<td>1.40%</td>
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<tr>
<td>Utilities</td>
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<tr>
<td>Internet</td>
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<tr>
<td>Other</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$255,707.79</strong></td>
</tr>
</tbody>
</table>

### Fuel Prices in Igiugig

- Heating oil: $6.00 per gal
- Gas: $7.80 per gal

### Electricity

- $0.91/kWh
- $0.62/kWh power cost
- Equalization subsidy
Igiugig Hydrokinetic Project: Phase I
Phase I Project Funding and Technology Partner

- Funded by the Department of Energy Water Power Technology Office
- Igiugig Village Council selected ORPC for its patented marine renewable energy technology proven in both tidal and river environments
Technology Selection
Ensuring long-term viability through local ownership

- Simple design & maintenance
- Attainable Operations
- Local Involvement

Local Ownership

- Reduced OPEX
- Long-term viability
- Scalability
Igiugig Hydrokinetic Project

Longest-operating river hydrokinetic project in the Americas
Phase I Highlights

• First tribal entity to hold a FERC hydrokinetic pilot license
• Recorded tens of millions of sockeye salmon transiting past the device, with no observed injuries or mortalities
• Survived Alaskan winter (-40°C) and two frazil ice events
• During spring ice break-up, over 2 ft of lake ice flowed safely over device
Igiugig Hydrokinetic Project: Phase II
Phase II Project Funding and Technology Partners

- Funded by the Department of Energy Office of Indian Energy
- ORPC and Schneider Electric
A microgrid delivers baseload renewable energy from free-flowing rivers and tides

• A RivGen-powered smart microgrid can relegate diesel generators to backup only.
• RivGen provides constant, predictable power (baseload).
• Energy storage and smart controls, coupled with RivGen baseload power, improve the value proposition of intermittent sources like wind and solar.
Work Completed to Date and Lessons Learned
• During Phase I, we installed one RivGen Power System including device, cabling, anchor, shore station with electronics, and interconnect to Igiugig Electric Corporation
Work Completed to Date: Battery Energy Storage System

- Installed fall 2021, commissioning in November/December
- Ability to be grid following or forming
- Rated for 253 kWh, 125kW inverter
Lessons Learned

• Phase II of the project is still happening...lessons learned to come...
• Phase I provided lessons we applied to work in Phase II
  • Weather and seasonality can impact project timelines
    • Prepare for ice, and then prepare more
  • Communication between project teams is key
  • Interconnection will never go as you plan
Thank You