



Energy Storage for Microgrids

Maximizing Clean Energy Value

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About NRStor

NRStor works closely with communities, utilities and energy consumers to identify opportunities and deliver world class projects

- NRStor was founded in 2012 to develop low cost, reliable energy storage projects that provide value-add services to customers
- Our success stems from our:
 - **Woman-Led Management Team.**
 - **Proven Track Record Deploying First of Kind Projects.**
 - **Partnership-First Business Model.**
 - **Diversified Value Streams and Monetization Strategy.**
 - **Trusted Relationships.**
 - **Impact Investments.**



Utilities

Enabling clean, flexible and reliable electricity systems through large-scale energy storage projects



Microgrids

Partnering with remote communities and mines to reduce dependence on diesel fuel using clean energy microgrids



Distributed & Residential

Empowering residential customers to take control of their energy supply

NRStor Remote Communities and Mines

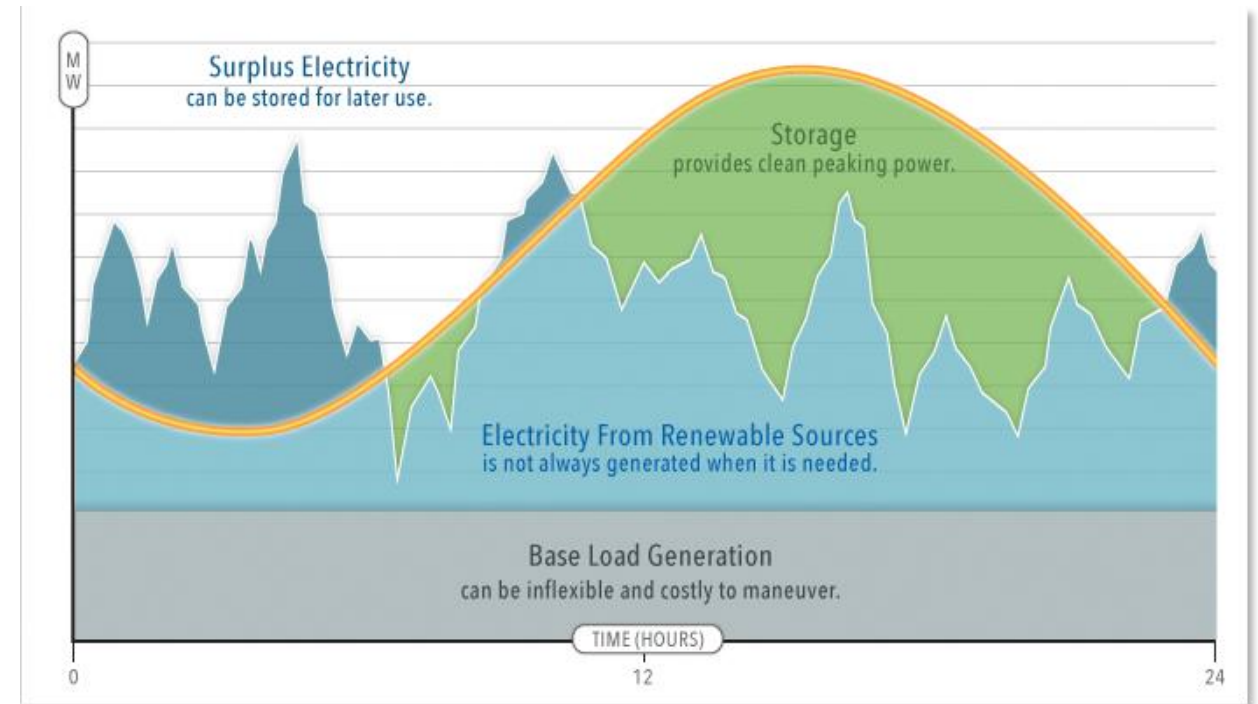
NRStor Remotes actively engages and partners with Indigenous communities to deliver clean energy microgrids reducing dependence on diesel fuel

- **Partnerships First:** We actively seek opportunities for more meaningful engagement, involvement and partnership on community projects
- **Local Economic Benefits:** Our projects can enable significant infrastructure ownership and local revenues for indigenous communities
- **Locally Tailored Solutions:** Our technology agnostic approach identifies community's needs, technology preferences, and economics for owning and operating renewable microgrids



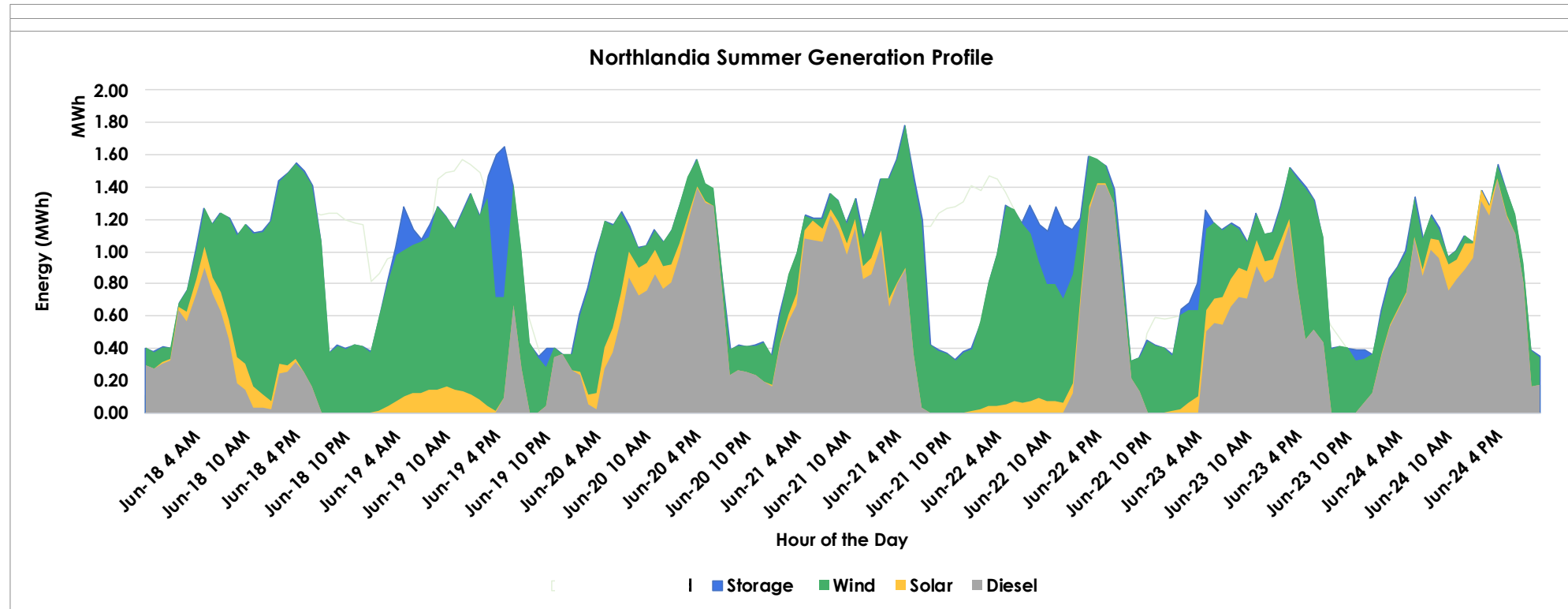
Unlocking Value with Energy Storage

- Energy storage can balance energy supply and demand to maximize the use of renewable energy, and also make the energy system more reliable.
- Energy storage allows wind or solar energy to be stored and used when the wind is not blowing, or the sun is not shining.
- Energy storage improves the efficiency of the whole system



Unlocking Value with Energy Storage

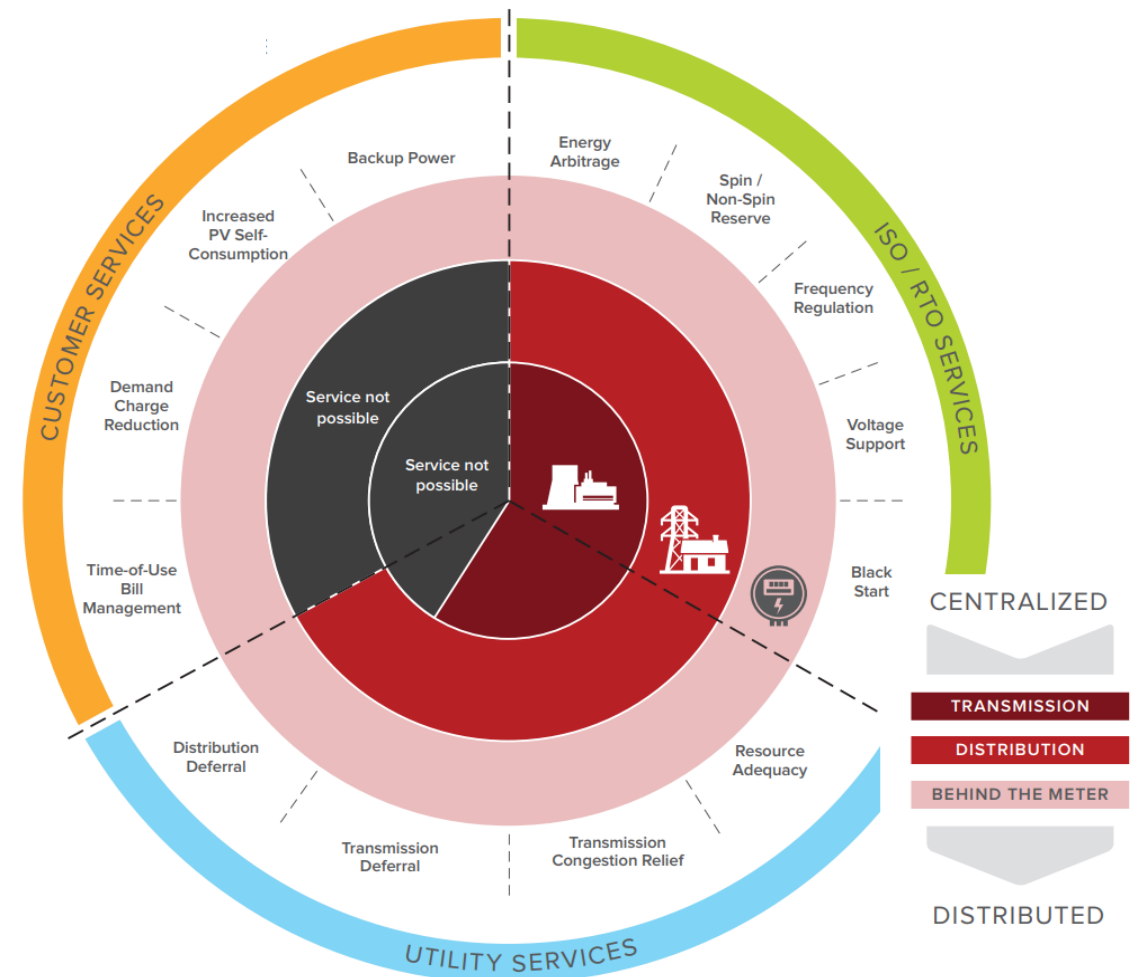
Renewable Integration – Case study: 1.6 MW wind + 0.2 MW solar + diesel + storage



Better renewable integration means less CO2!

Energy Storage Can Provide Many Different Services

- Energy storage can be used to “stack” multiple services
- Consider whether storage should be **behind-the meter vs. in front of the meter**
- Storage has been added to many microgrids already, with utilities understanding that it is needed to act as a ‘buffer’ between the clean sources and the diesel.
 - Some utilities have ownership of the storage assets to help manage the overall microgrid.



Valuing Energy Storage for Microgrids

- Currently, many jurisdictions provide PPAs based on a flat price per kWh electricity to generators
 - RE + Storage installations show marginal to negative impacts on project economics with increasing storage capacity, duration
 - On a pure energy basis, technologies like BESS can only offer 2-10% 'additional' energy at similar capacities as installed generation and duration up to 4 hours.
- Energy storage in other jurisdictions are being valued for their additional services.
 - Capacity-based RFPs in Ontario landed at ~\$18,500/MW/mo for storage.
 - Economics will need be weighed against the main alternative, diesel. Capacity payments can be calculated based on the cost of having diesel units on standby.
- Some value streams are more relevant to microgrids
 - Frequency regulation: providing fast response to system disturbances is crucial in overall stability
 - Black start and back up: having enough reserve energy available in case of system outage, assisting with diesel start up.
 - Tx/Dx deferral, energy arbitrage, are not necessarily relevant to microgrids.

		Duration of Storage (hrs)																			
		0.5	1	1.5	2	2.5	3	3.5	4	4.5											
Capacity in kW	% OFF DIESEL	0	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%
	50	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%
	100	67%	67%	67%	67%	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%
	150	67%	67%	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	200	67%	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	250	67%	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	300	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	350	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	400	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	450	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	500	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	550	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	600	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	650	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	700	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	750	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	800	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
	850	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%
900	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	69%	

%Off diesel for a 2MW wind + 200 kW solar project, with varying energy storage

Arviat Clean Microgrid Project

We looked at the energy needs in Arviat and local wind and solar resource to design the project

After many studies, we determined that the best solution for Arviat will include:

200 kW Solar System

Target 2024



2.0 MW Wind Turbines

Target 2025+



2 MW / 2 MWh Battery Energy Storage

Target 2024+



Preliminary analysis shows that over 20 years, this project could:

- Prevent over 160 thousand tonnes of CO₂ from entering the atmosphere
- Avoid burning ~ 30 million litres of diesel fuel

The Hamlet of Arviat will own the project with NRStor and make revenues from it by selling the clean energy to the utility (QEC).



Thank you

L'au

Matna

*“Yesterday is ashes. Tomorrow is green wood. Only today does the fire burn brightly”
-Inuit proverb*