



Wind Energy's Future Demand Driver

## Wind for Remote Communities and Remote Industries

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## **I. Challenges & Opportunities for Wind**

- In Remote Communities
- In Remote Industrial Applications / Projects

## **II. Remote Project Experience and Case Study**

- Remote Project Experience
- Diavik, Canada
- Husahagi, Faroe Islands

## **III. What is Needed to Replace Diesel by Wind?**

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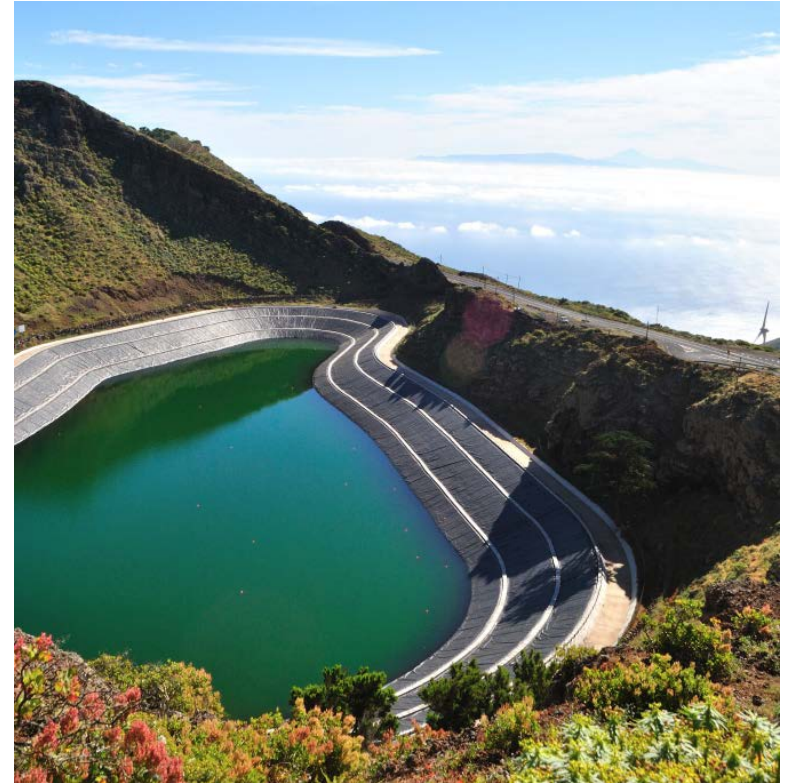
## **III. What is Needed to Replace Diesel by Wind?**

## Challenges

- ❑ Complex projects requiring unique solutions for each community, attempt to incorporate old technology
- ❑ Limited financing capacities, dependence on government subsidies and programs
- ❑ Lack of O&M capacity
- ❑ Difficult demand forecast
- ❑ Existing vs. new employment

## Opportunities

- ❑ Reduction of electricity costs and independence from changing fuel market price
- ❑ Avoidance of social costs inherent to use of diesel and focus on environmental benefits in general
- ❑ Potential to increase electrification across community



*El Hierro, Spain*

## Challenges

- ❑ Complex market requiring unique solutions for each project
- ❑ Risk-adverse clientele: electricity supply security, non-standard business decisions
- ❑ Existing electricity production is part of the original project design, adding new sources of production at a later stage is complicated
- ❑ Project life of industrial projects, such as mines, often shorter than typical PPA length

## Opportunities

- ❑ Hedge and lower energy procurement risks and costs, control operating costs and increase resilience by diversifying fuel sources
- ❑ Social license requirements with First Nations and surrounding communities and as well with clients and general public in regards to GHG reduction efforts



*Raglan, Photo: Justin Bulota, Copyright: Tugliq Energy*

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## Over 85 islanded grid projects in 11 countries

1994-2013	4 islands, <b>Spain</b>
1995-2011	Gotland Island, <b>Sweden</b>
1999-2011	12 islands, <b>Greece</b>
2002-2013	6 islands, <b>Portugal</b>
2003	Corsica, <b>France</b>
2003	Utsira Island, <b>Norway</b>
2004	Rottneest Island, <b>Australia</b>
2007-2014	4 islands, <b>United-Kingdom</b>
2007-2010	<b>Bonaire</b> Island
2012	Diavik Mine, <b>Canada</b>
2012-2014	<b>Faroe</b> Islands, <b>Danemark</b>
2014	Raglan Mine, <b>Canada</b>



*Faroe Islands, Copyright: SEV*

### Hybrid System Experience

-  Diesel
-  Solar Photovoltaic
-  Flywheel – RD in-house
-  Battery – RD in-house
-  Hydrogen

# Case Study – Diavik Diamond Mine, NWT

- ❑ 4 x E-70 E4 2.3MW, COD: 2012
- ❑ Owner-Operator: Rio Tinto
- ❑ Energy costs: > 25% OPEX, CAPEX: \$33M, payback period: < 8 years
- ❑ Replacing 4.5 million liters of diesel / annually, 11% of the mine's diesel consumption, up to 56% penetration
- ❑ Average wind speed: 6.3 m/s



*Copyright: Diavik Diamond Mines Inc.*

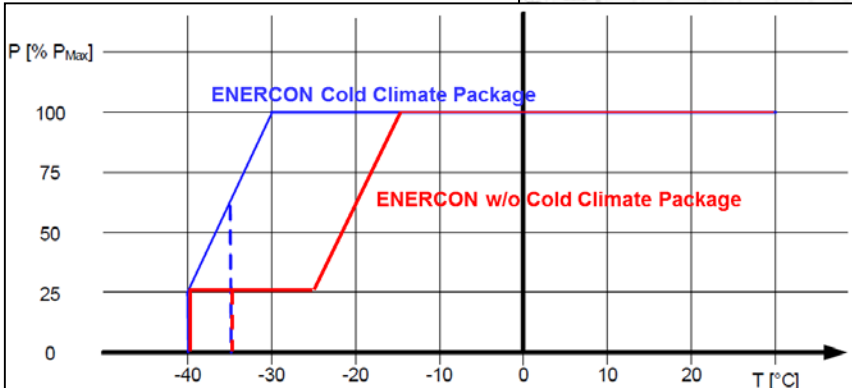
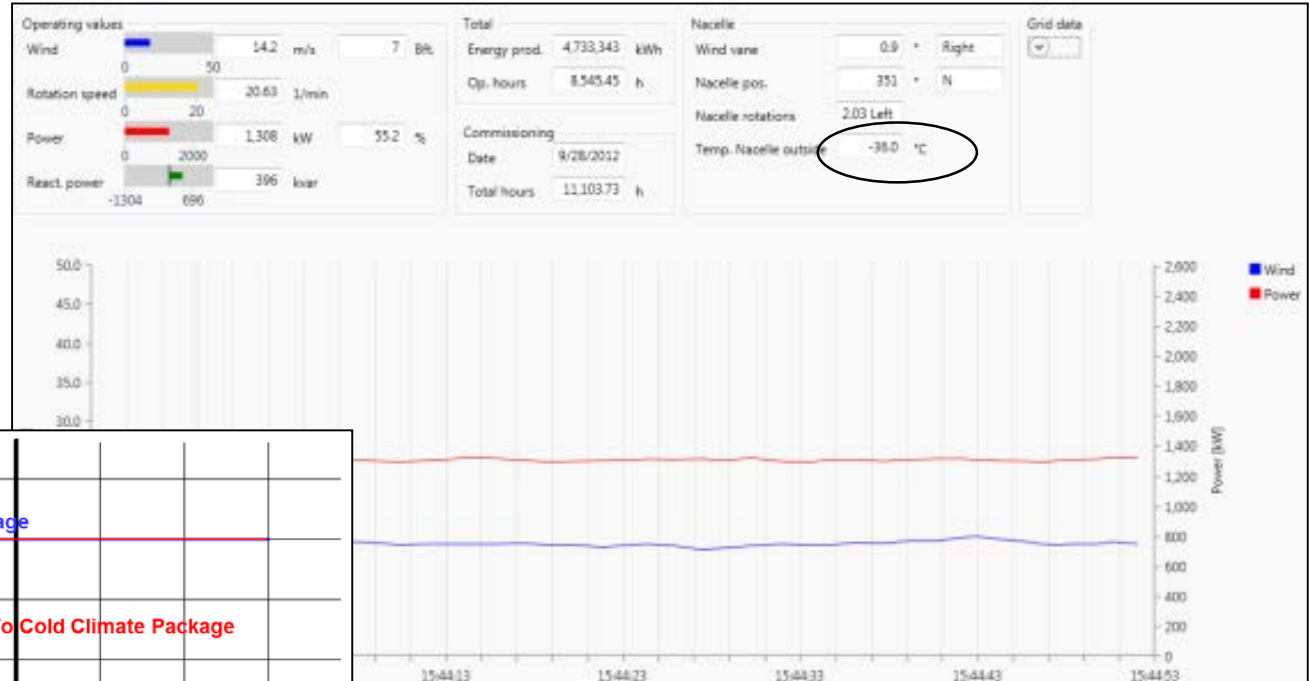


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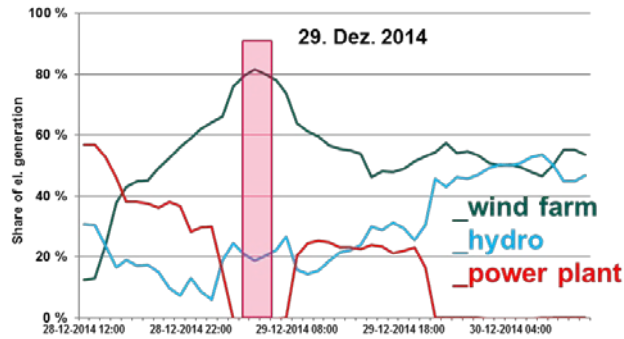
- Oil-free direct drive
- Rotor blade heating
- Cold climate package



Other manufacturers with CC options shutdown at -30°C

# Case Study – Husahagi, Faroer Islands

- 18 x E-44 900kW, COD 2012 and 2014
- 15% share of total installed generating capacity
- Peak instantaneous penetration of 84%, annual fuel savings of 8000 t
- ENERCON SMART Container 2.3MW with Li-Ion battery from supplier Saft, enhancing grid stability by smoothing ramp rates and providing ancillary grid services such as frequency control



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# What is needed to replace diesel by wind energy?

- ❑ Proven technology
- ❑ Creation of market and planning through long-term government programs
- ❑ Potentially carbon taxes
- ❑ Viable market mechanisms (PPA) which allow easier access to financing
- ❑ O&M solutions



*Antarctica, Copyright: NREL*

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