

Demystifying Diesel Reduction

A set of introductory guides in support of remote community clean energy

Do you want to bring renewable energy — such as wind, solar, or hydro — to your remote community? This series, *Demystifying Diesel Reduction*, is a set of introductory guides that will give you the info you need to help get clean energy working for you.

The other guides in this series are available at pembina.org/demystifying-diesel

Understanding high-penetration renewable energy microgrids

Maximizing community diesel reduction

Diesel reduction and energy sovereignty are ambitious community energy goals, but they're also becoming more achievable with large renewable energy projects (e.g. wind turbines, solar array).

But, the bigger the renewable energy project, the more complicated the work will be, both for the community and the utility. This document provides some insight into what it means to have a “high-penetration renewable energy microgrid” and what complexities come with that.

What does high-penetration mean?



DEFINITION

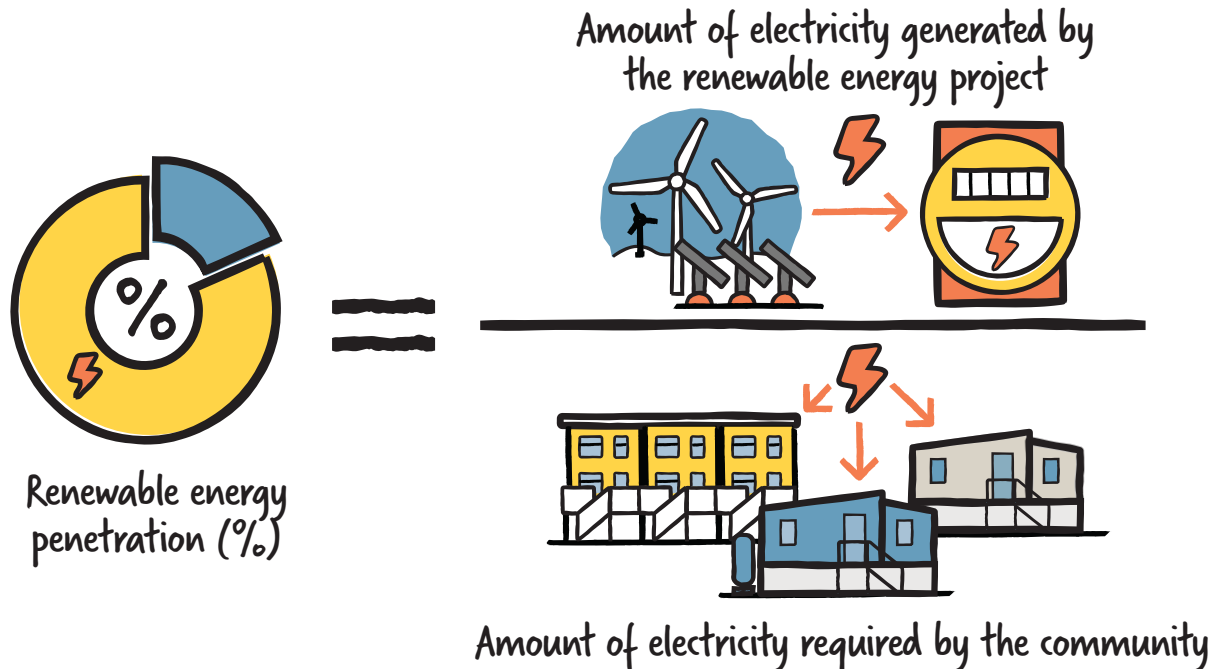
Renewable energy penetration

The **amount** of renewable energy brought onto the microgrid: the renewable energy penetration is the **percentage** of total energy used by the community that is supplied by renewables.

"My community is almost off diesel; we run an 80% renewable energy penetration microgrid!"

How is it calculated?

There are different ways to calculate penetration level, but the simplest way to describe this is:



Keep in mind! It is common to assume renewable energy penetration equals diesel reduction—but they are not always the same. You will need to work with your engineering team to do these calculations.

How are high-penetration projects more complicated?

As renewable energy penetration goes up, so does the complexity of a project. A high-penetration system usually means:

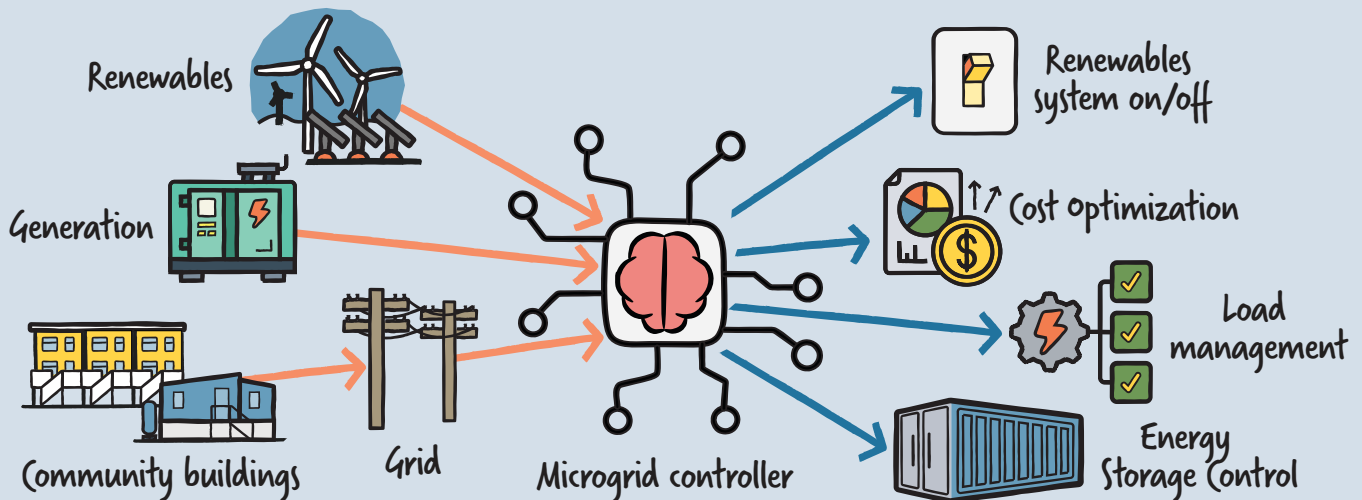
- More diesel reduction, and more complicated engineering required
- More likely to need a **battery** to keep the electricity grid stable
- More likely to need a **microgrid controller** to manage the renewable energy getting generated



DEFINITION

Microgrid controller

The “brain” of the electricity system. It is responsible for making sure the battery, diesel, and renewable energy all work together.



Keep in mind! If the microgrid controller does not work correctly, your community could end up using more diesel than intended. This issue can be avoided through good project design and detailed collaboration with your utility.

In many cases, the utility prefers to own and operate the microgrid controllers and batteries so they can maximize the amount of renewable energy on the grid while maintaining reliability.

What are the levels of renewable energy penetration?

Renewable energy penetration levels are usually described as low, medium, or high.

Low penetration

(less than 20% renewable energy)

Low-penetration grids are usually those that only have net metering projects, like a rooftop solar installation. These don't require a battery or microgrid controller.



Medium penetration

(around 20% to 70% renewable energy)

Medium-penetration grids usually require a battery and microgrid controller. Your community may be able to turn off the diesel generators at times. This can be achieved with a standalone solar or wind project.



High penetration

(over 70% renewable energy)

High-penetration grids always require a battery and microgrid controller. Your community will be able to turn off the diesel generators for days or even weeks at a time. Often this requires either a hydroelectric project or both a large wind *and* solar project.

Kluane First Nation now harnessing wind energy to help power community, reduce reliance on diesel

In spring 2025, Destruction Bay and Burwash Landing, two diesel-reliant communities in the Yukon, celebrated over eight uninterrupted days off diesel. This milestone was reached after Kluane First Nation constructed the Lhù'áán Mân N'tsi Project, a 900 kW wind turbine that is now set to cut diesel use by 325,000 litres per year. The community now has a 52% renewable energy penetration microgrid. *Source: APTN News*



Learn more about the project →





The Pembina Institute is a Canadian think tank that researches the clean energy transition across Canada, including how to advance Indigenous energy sovereignty and diesel reduction for remote communities.

We work with Indigenous clean energy leaders, policy makers, and utilities to collaboratively address barriers to diesel reduction and advocate for funding and policy reforms that support community-led clean energy projects.

Questions? Reach out to an expert – email us at info@pembina.org to get the conversation started.

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