

Presentation to CACOR

Date: 17 Sep 2024

The Greening Of Ottawa:

Major focus on energy

Primarily Pictures and Graphics of Global Equipment

Major Policies are set by Federal and Provincial governments with other contributions from:
Municipal government, organizations, companies, communities, individuals

Citizens use policy outputs, often with financial assistance.

By: Dr. J. A. Hunter

The Canadian Association for the Club of Rome (CACOR)



OLD WAY

NEW WAY

"The cheapest electricity is the kind you don't use,"

Section 1 – Grids and Microgrids

Transactive Energy Systems

Microgrids extend the utility grid into our homes

They permit the utility extending the life of aging grid infrastructure.

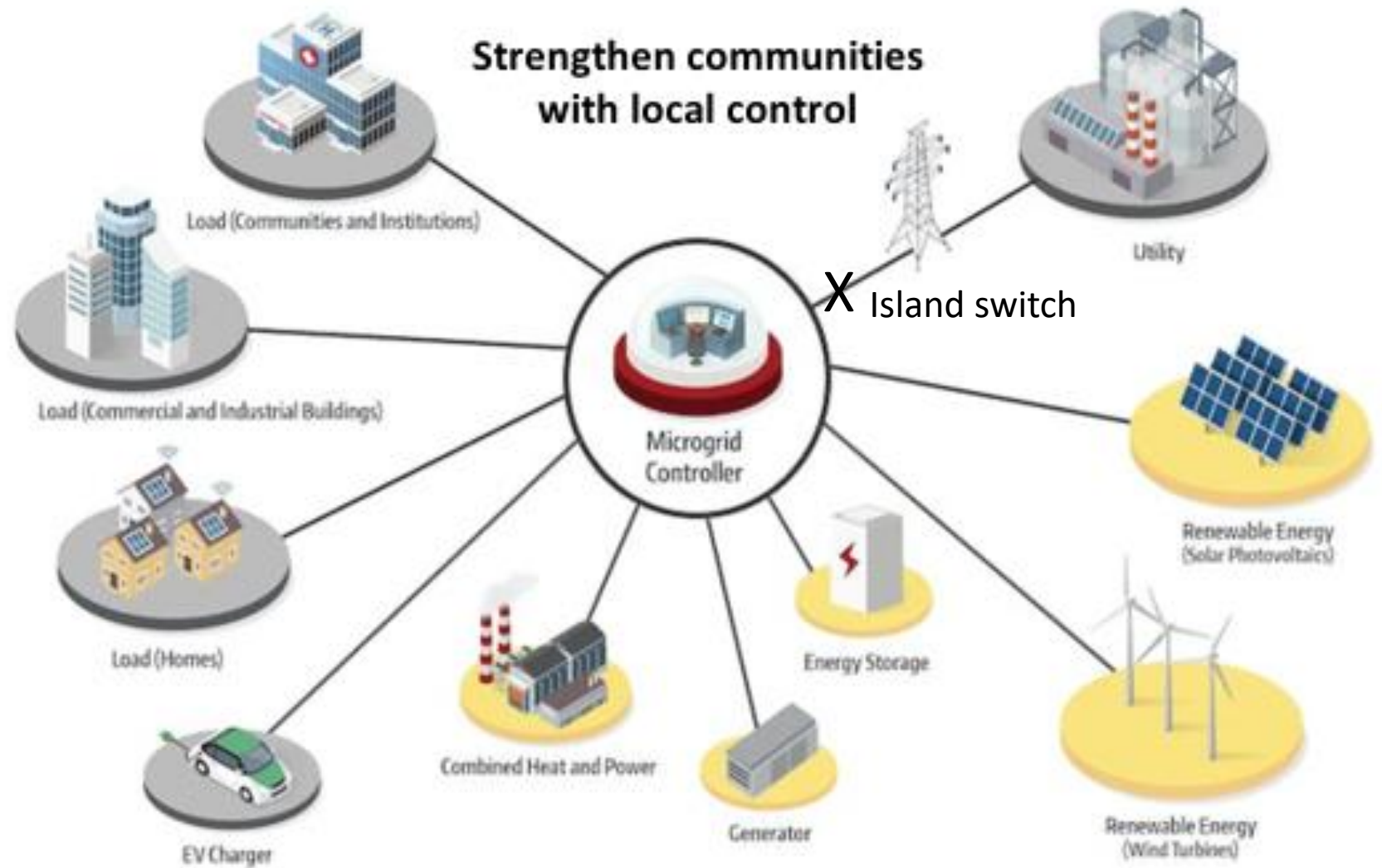
Cost savings to all utility customers

A Typical Microgrid

A microgrid is a decentralized small version of the main utility grid but may also include thermal energy.

One part or some or all of these parts make up a microgrid.

Typically, all these parts are in one geographic location.



A home microgrid in its simplest form.

The energy demand response profile is dynamic and site specific

The energy generation profile is dynamic and weather and site specific



Hot water heaters consume

17% to 32%

Of demand for home energy

Heat/cool structure

82% low grade heat
18% electricity

Digitize, Electrify, Decarbonize, Economize.

The utility grid is a backup supply to the microgrid

An aerial architectural rendering of a sustainable community microgrid in the Netherlands. The scene features a central area with rows of greenhouses, surrounded by modern houses with solar panels on their roofs. A winding river or canal flows through the landscape, which is also populated with trees and paths. The text "Community Microgrid in the Netherlands" is overlaid in the center.

Community Microgrid in the Netherlands

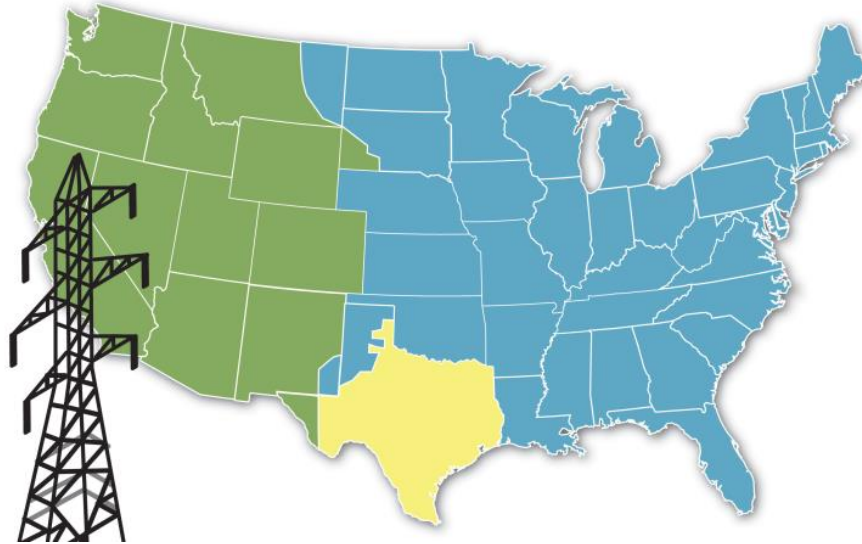
A Mobile Microgrid with solar PV, batteries and propane generator backup.
Take it to the desired location.



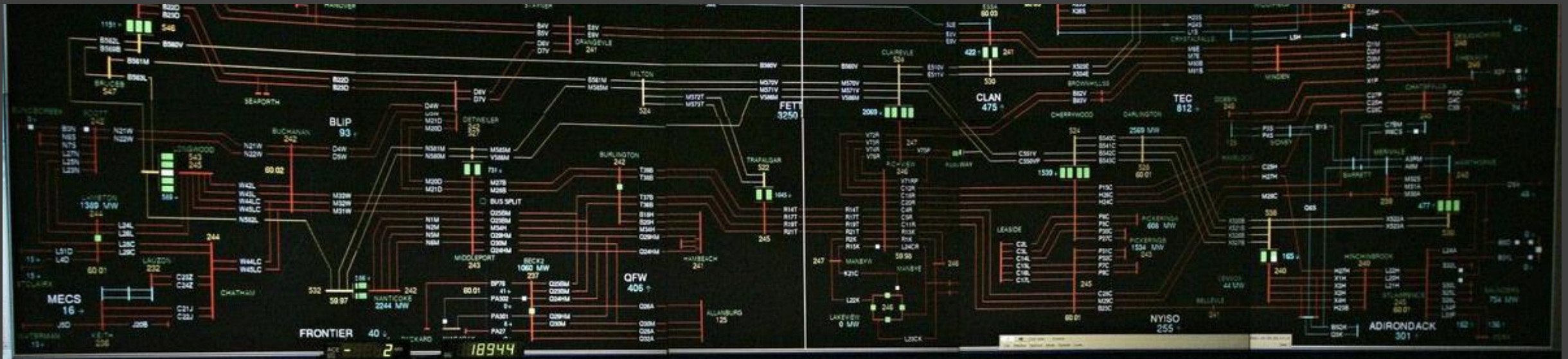
North American Grids: energy sources

Three North American independent grids in Canada, USA and Mexico

- East
- West
- Texas



- Each State or Province has its own grid ISO (Independent System Operator)



Ontario's Independent Electricity System Operator (IESO) Command and Control Center





Distributed Energy Resource Management (DERM) System

Visualize and control DERs

Ontario IESO Grid Component Parts

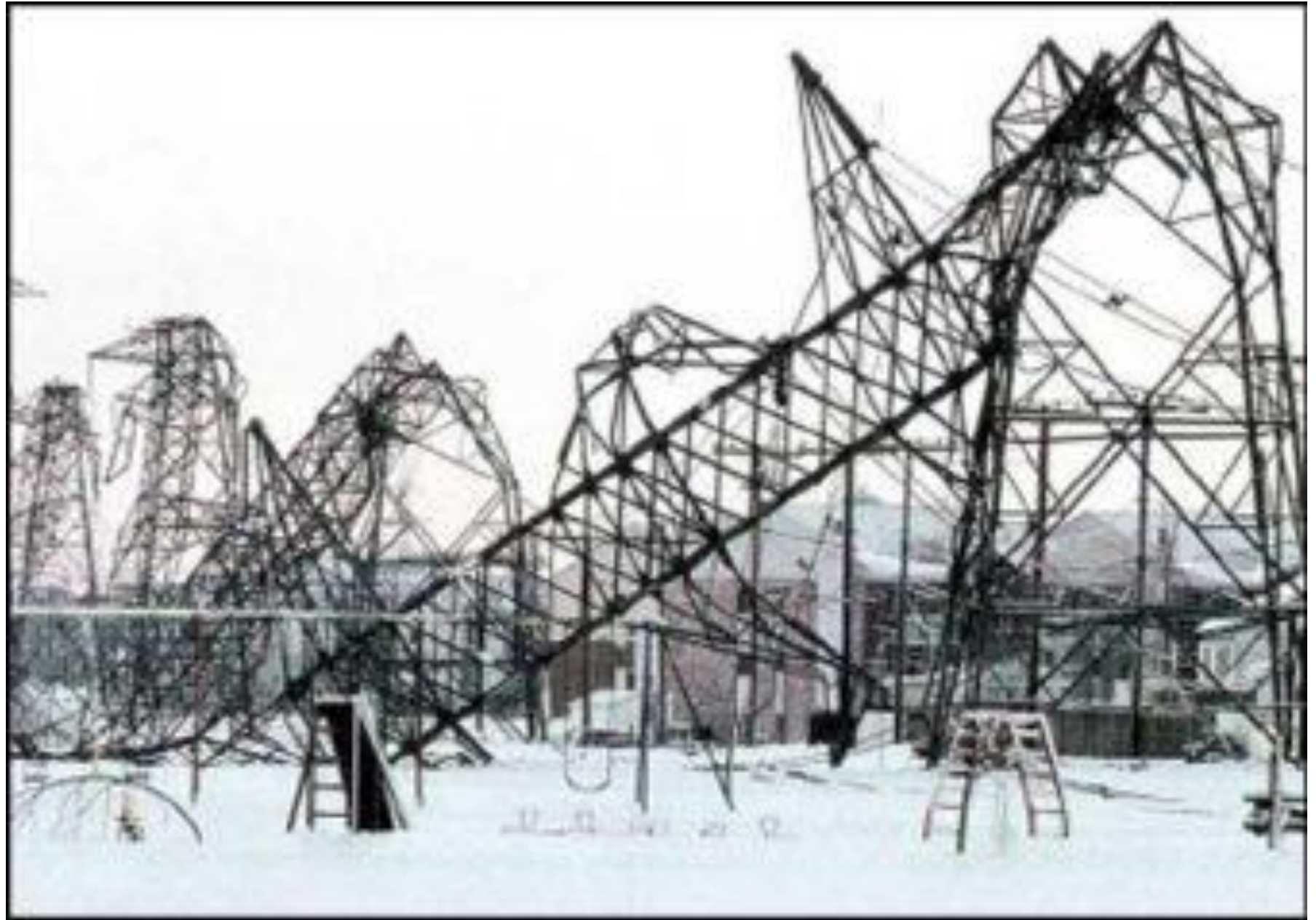
• Substation transformers	3,238
• Transmission Line (using metal towers)	23,000 km
• Distribution transformers	1,102,000
• Distribution Lines	124,000 km
• Power poles (often wood)	10,850,000
• Area covered	961,000 sq km

- What could possibly go wrong with this widely disbursed aging infrastructure?



The Ice Storm of 1998 (Ottawa area)

Electricity is a vital
commodity next to
water



Hydro One transmission towers near the Merivale transformer station photo: Hydro One



Tornado
2018 September 21

- 137,000 of 332,000 customers without power for more than 48 hours,
- Full repair:
 - 12 weeks and
 - \$10 million

**Ottawa street the morning after
190 km/h winds (derecho)
21 May 2022**



Ice load stretching cables to the ground: Freezing Rain

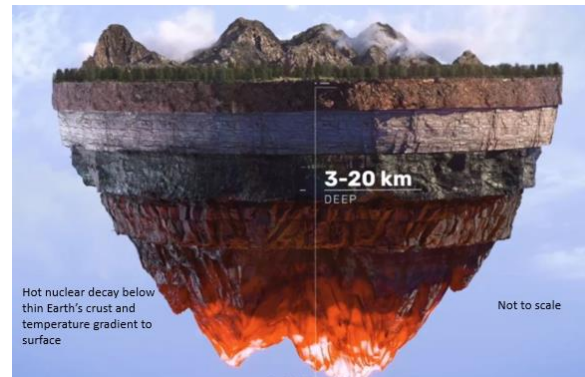
**Decentralize to
avoid these
problems**

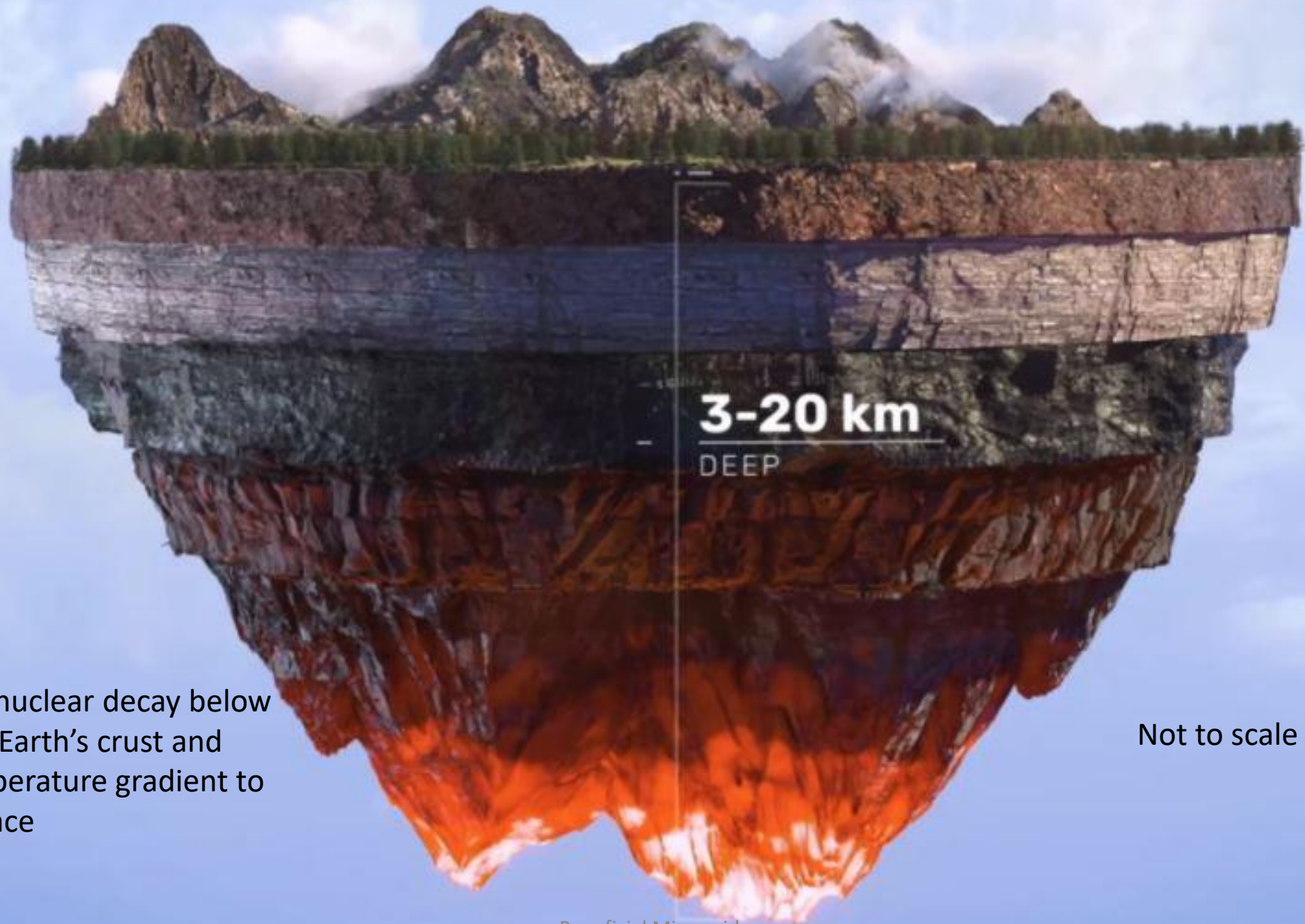


Section 2 : Geothermal

You are standing on infinite amounts of high temperature energy

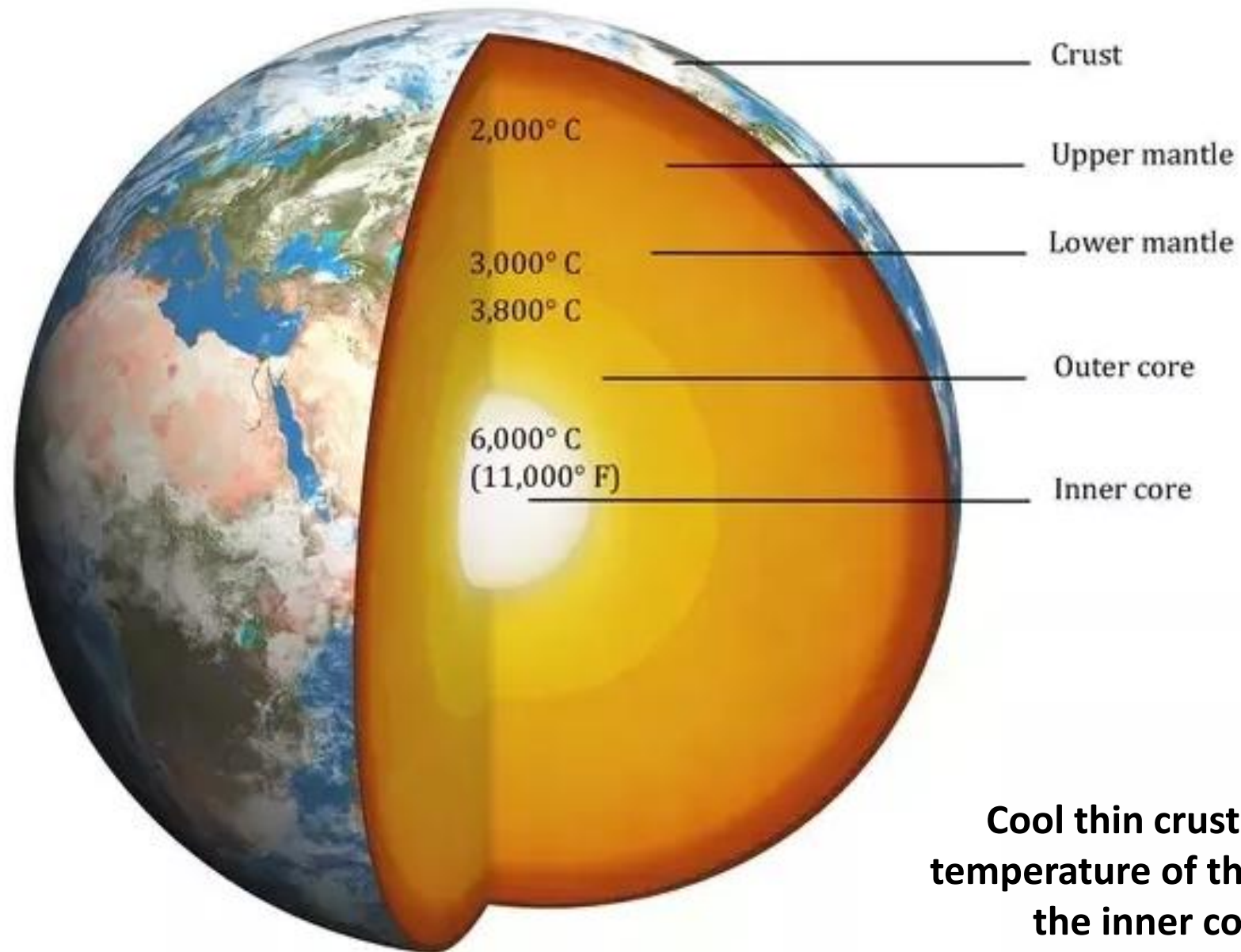
Thermosiphons, Heat Pumps and Heat exchangers provide access





Hot nuclear decay below
thin Earth's crust and
temperature gradient to
surface

Not to scale

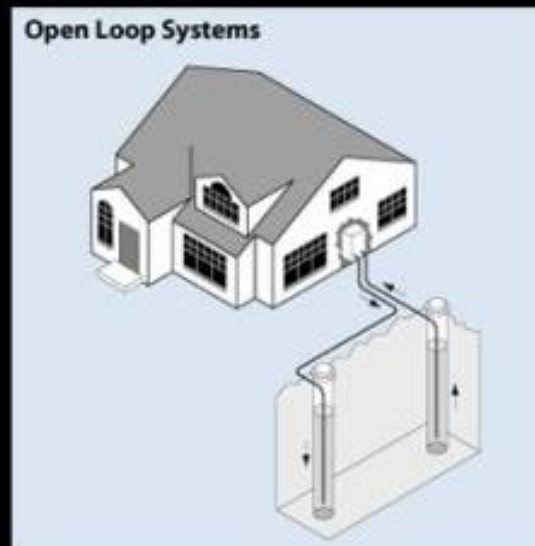
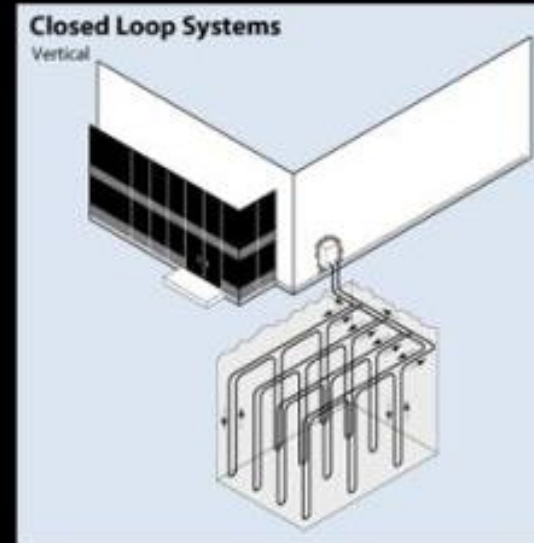
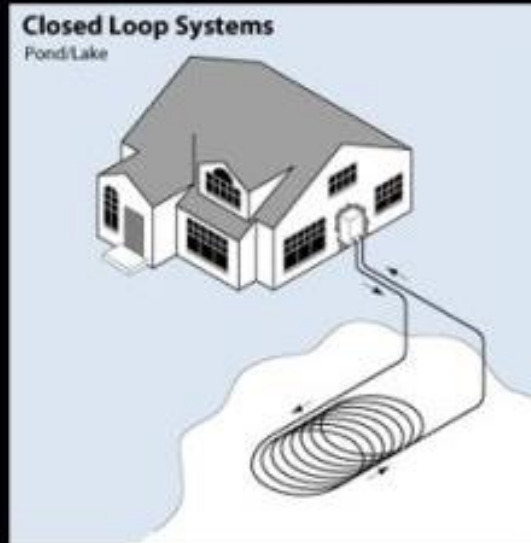
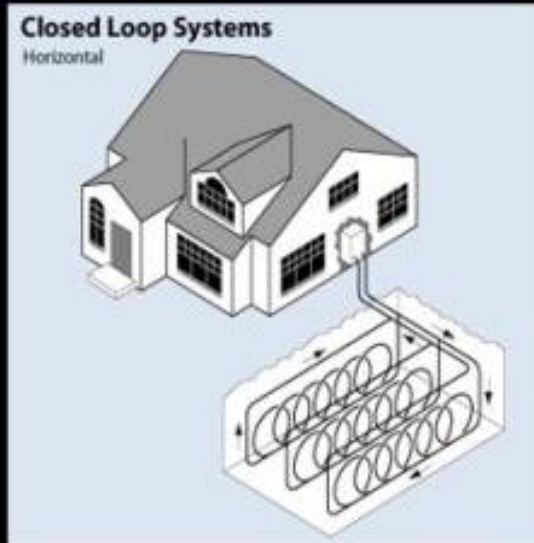


**Cool thin crust and
temperature of the sun at
the inner core**



Steam rises from the chimneys of a wellhead plant at the Olkaria Geothermal Complex, operated by Kenya Electricity Generating Company Plc (Kengen), in Hells Gate National Park in Naivasha, Kenya. *Photographer: Patrick Meinhardt/Bloomberg*

Geothermal Heat Pumps



There are four types of geothermal heat pump systems. Three of these—horizontal, pond/lake, and vertical, above—are closed-loop systems. These systems are entirely self-contained.

The fourth type is open-loop. This type of system pumps water directly to and from a well or pond.

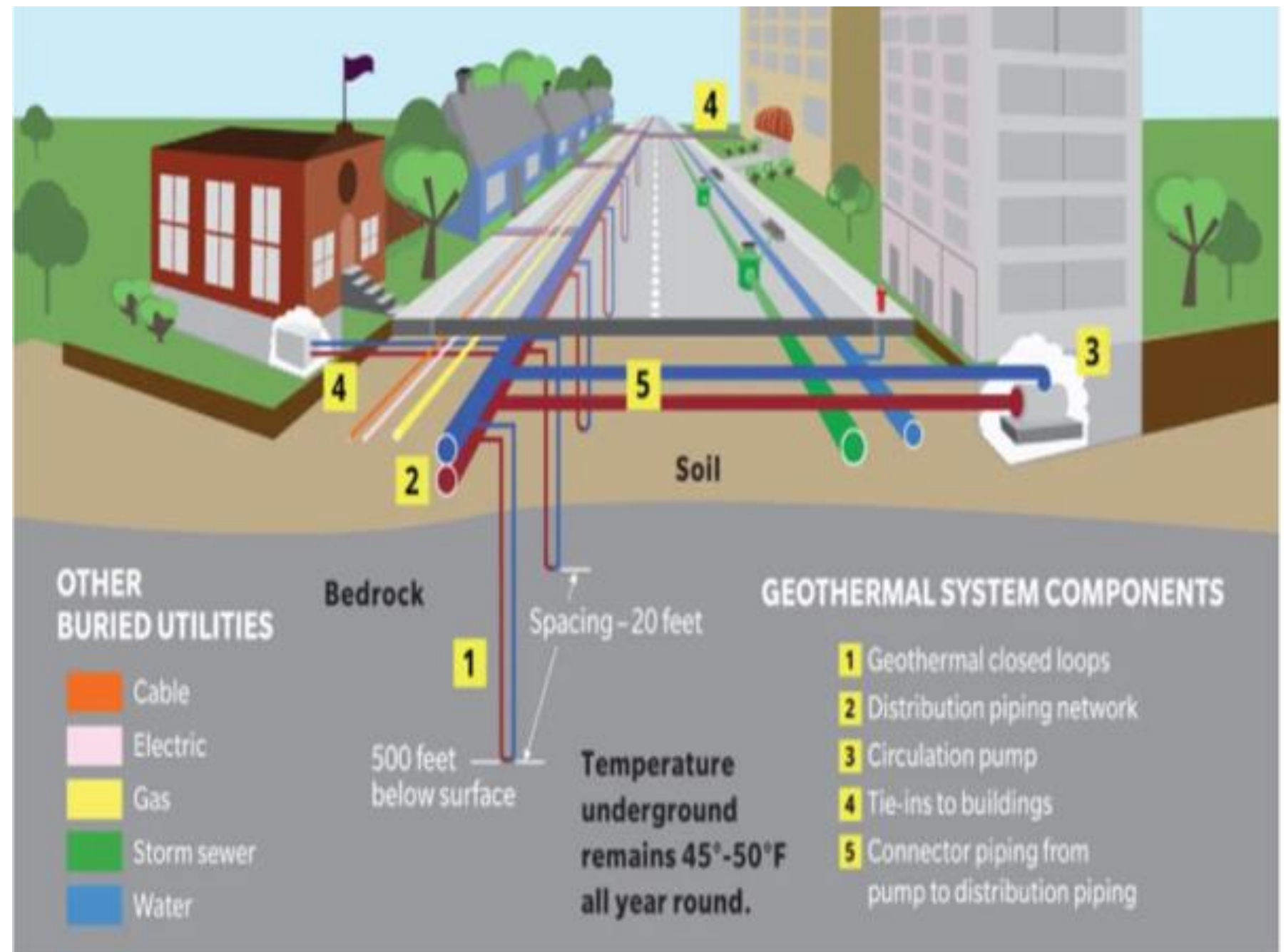
The Manotick Microgrid
Thermal Battery installation
– Svec Coil, May 2018.
Leda clay is an aquitard
– note vertical trench walls



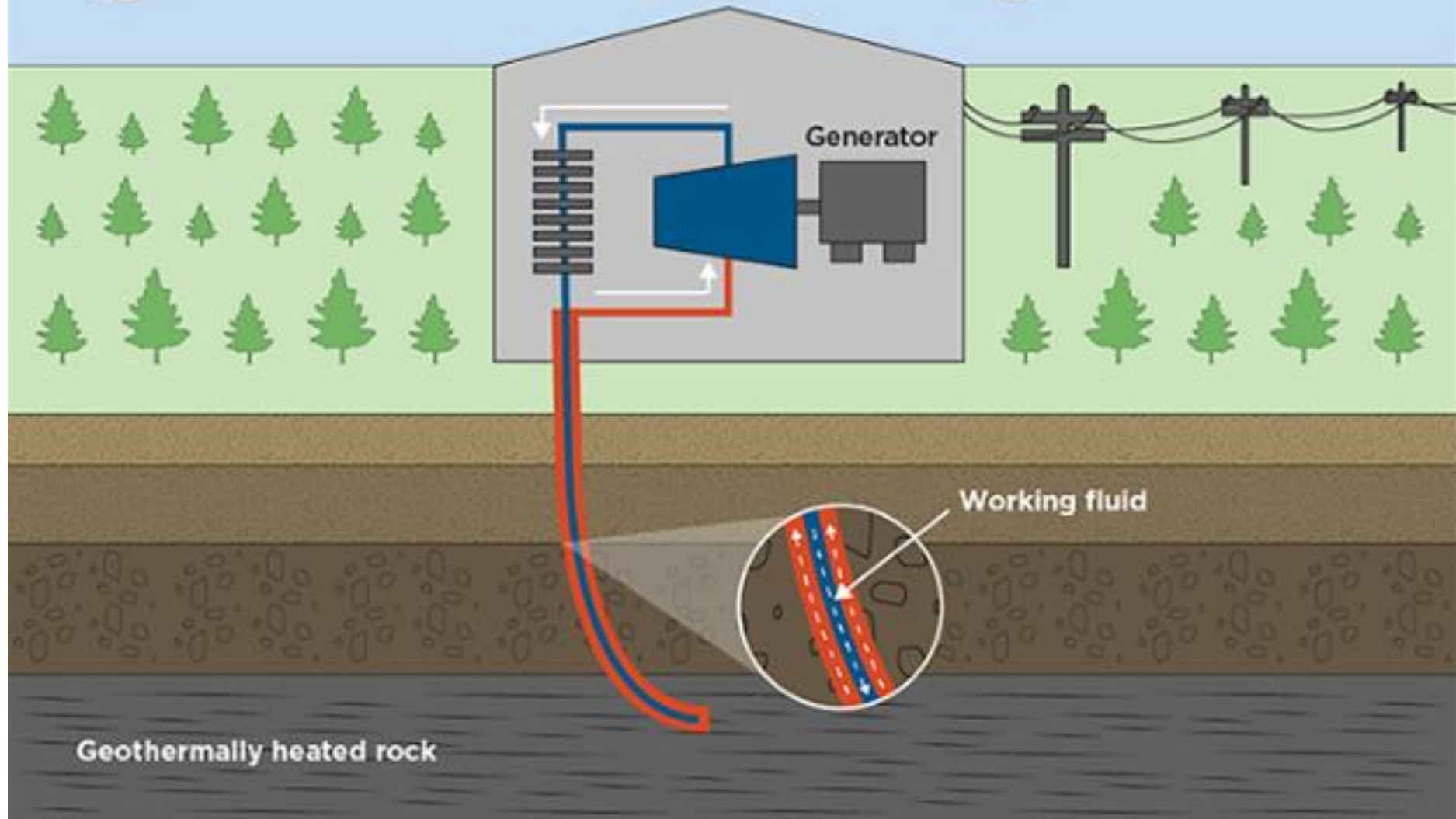
Geothermal Wall with Actuators and Sensors.



Community microgrid using geothermal heating beside other buried utilities



Geothermal – water, steam, electricity



Section 3 : Solar, Wind and Storage

Many natural and creative ways to generate and store energy



The Old Way – Alberta Tar sands mining



Solar and Wind Farm in China



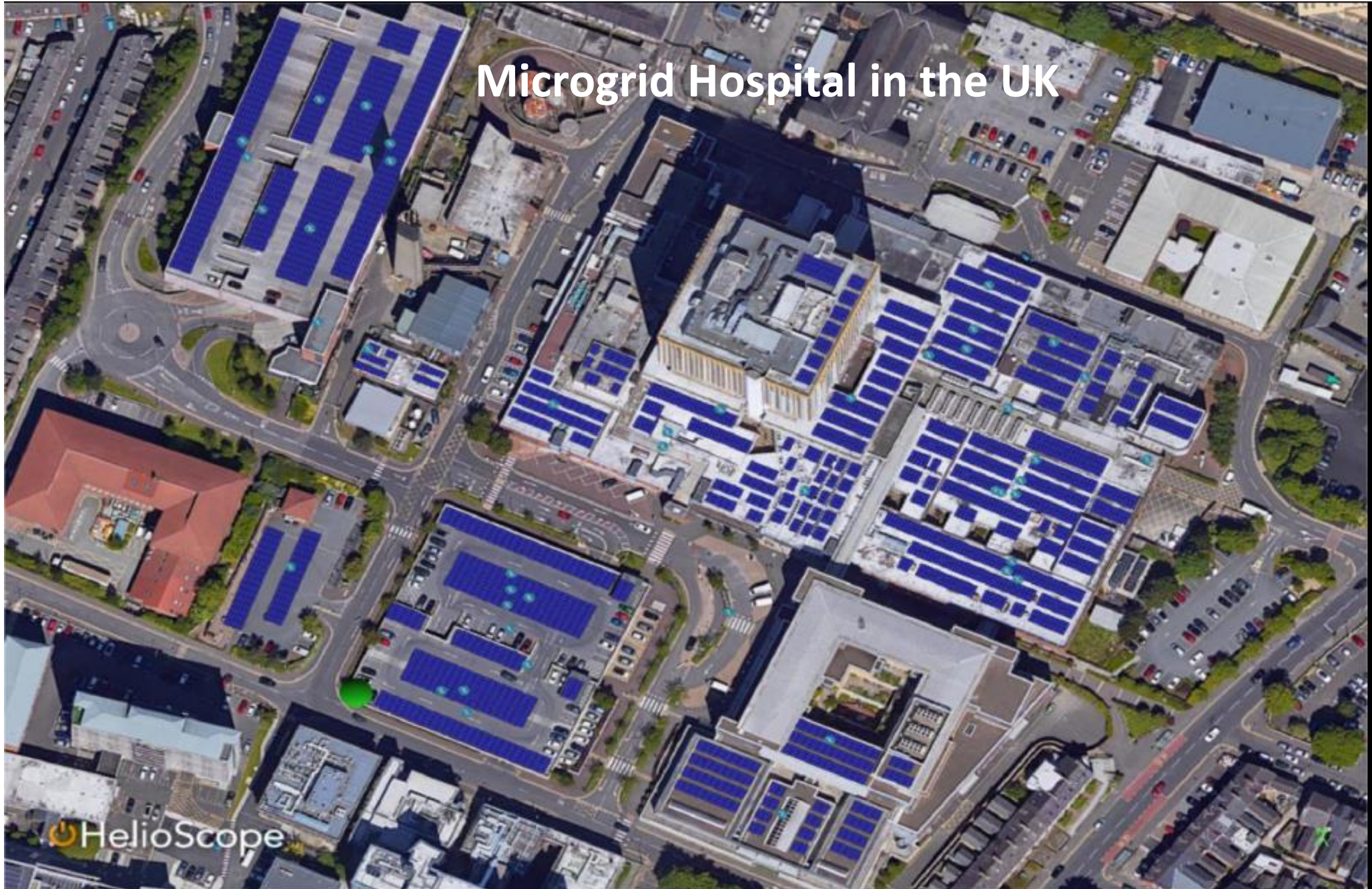
Texas Solar and Battery Energy Storage System (BESS)



Lift off the ground to rooftops



Microgrid Hospital in the UK



 HelioScope

Tesla Solar Roof in Hawaii



Germany: Combined Solar and Wind



Solar Photovoltaic and hot water panels in European Microgrid





Backpack Solar Panels

to charge cellular telephones

**Pole Mounted
Community Battery in a
Solar rich but cash shy
Neighbourhood
– A Network of 40
Community Batteries
within a VPP**

Tesla Megapacks – Utility scale “4 Hour Battery”

- 
1. Interconnection: 480V AC 3 phase
 2. Dimensions: W 359 in, D 65 in, H 110 in (shipping container)
 3. Weight: 83,996 lbs
 4. Energy & Power: 3,878 kWh/970 kW = 4 hours

107 MWh storage system at a Chinese cement plant microgrid



Agrivoltaics



**Solar Panels are up to 20 C cooler (20 % more efficient) when over crops
The crops are also cooler for less stress and less water required (berries thrive).**

Wind and Solar Agrivoltacis farm under construction in the Netherlands



Sheep graze amongst solar panels



Vertical Solar Panels



Floating Solar Farm in China

Keeping the water cool for the fish



Unique Design in Morocco



Mixed Solar and Wind Farm east of LA





A rendering of a solar-array prototype spanning a canal in Central California (Solar AquaGrid)

Stationary Solar Tracking Canopy Over a Car Park



Play (k)



Aggressive rooftop Solar arrays, some car park canopy, room for more.



**much of our energy supply could
come just from rooftops alone?**

Balcony Solar PV with Balcony Battery and Garden



Solar and wind alongside roadways in Germany



A photograph showing a person riding a bicycle on a path made of solar panels. The path is bordered by a grassy area and a canal on the left, and a grassy area with trees on the right. The text "Dual use of land in the Netherlands" is overlaid in the center.

Dual use of land in the Netherlands



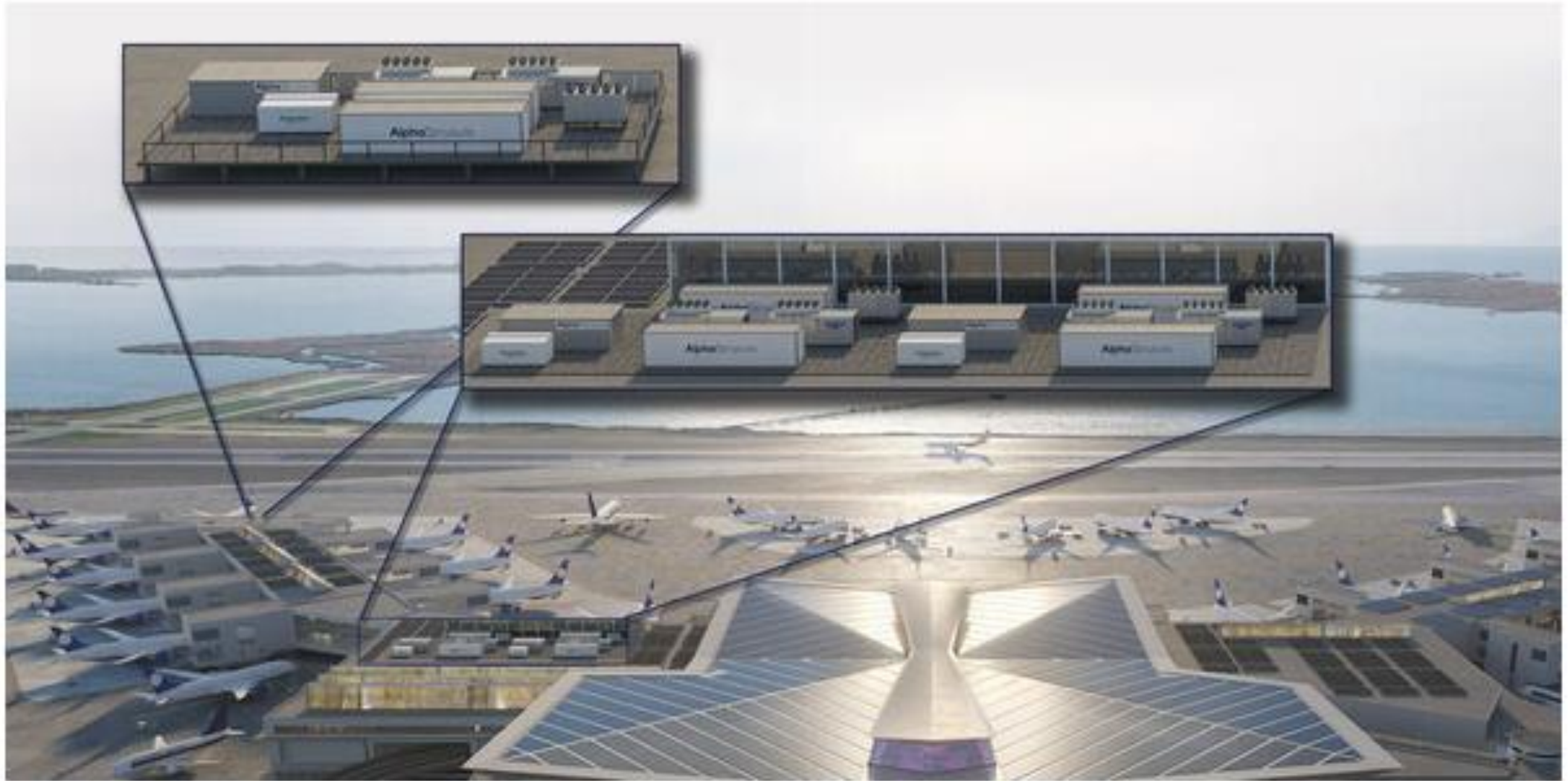
Solar Lights in the Galapagos

Service Station (energy station) Microgrid in Massachusetts

solar panels on the canopy, a battery storage unit, and a portable generator connection



Swedish wooden solar paneled car park



The 11.34-MW microgrid at JFK Airport will be delivered through an EaaS solution. (Source: Schneider Electric)

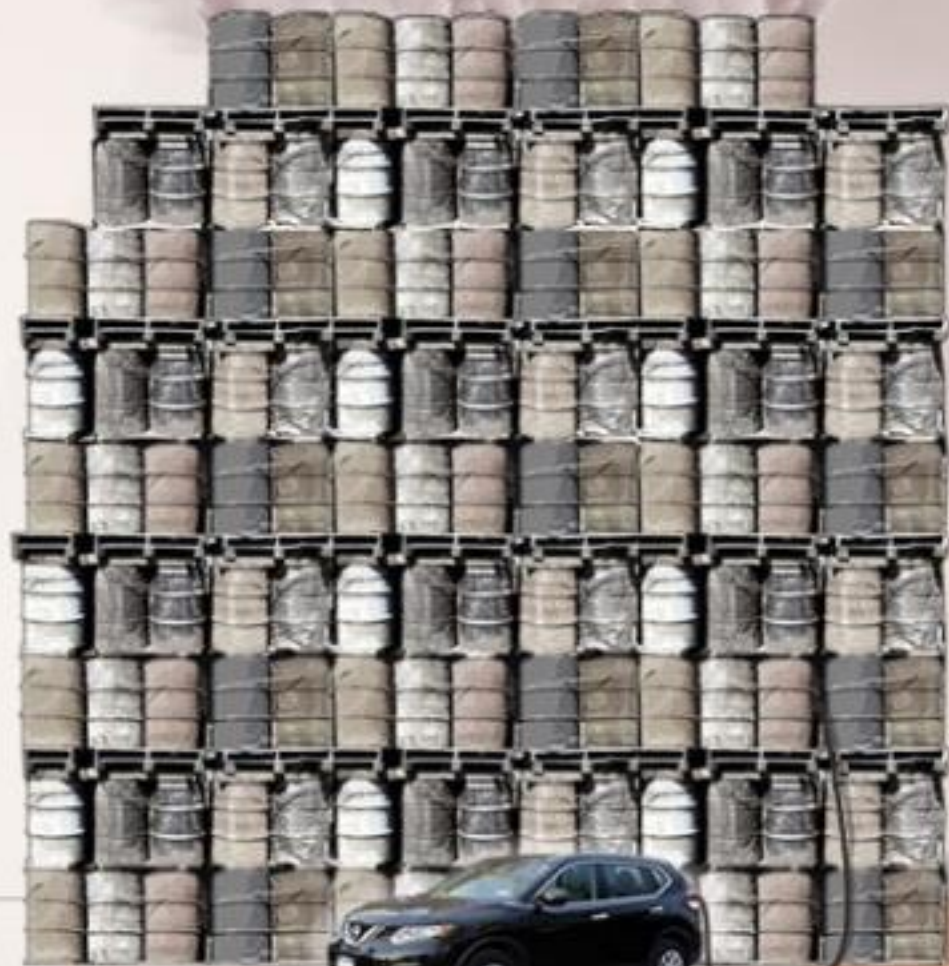
Offshore Wind Farm



Section 4: Electric Vehicle (EVs)

An amazing addition to a microgrid:
electrify the way we move





**Typical All Electrical home
Microgrid with a Tesla EV in
the garage**

**Powerwall
Batteries**

**Level 2
Charger
Up to
150 kW
AC**

Tesla, in 2022, confirmed [having ramped production to about 6,500 Powerwalls per week.](#)

Solar canopy over Tesla Supercharging station

Where is the 40,000+ Tesla power station energy coming from?

Also, second life (100 years) used Lithium-Ion batteries

Level 3 up to 250 kW DC

A photograph of a Tesla Supercharger station at the Giga Berlin facility. The station features a large, modern canopy supported by dark metal pillars, with solar panels mounted on the underside. Several blue Tesla Supercharger charging stalls are visible, with cars parked at them. In the background, there's a building with the Tesla logo and some greenery under a clear blue sky.

NEWS

Tesla Giga Berlin's first V4 600 kW Superchargers are live

Ford Charging Station in 1900





Electric School Bus Fleet with two-way Virtual Power Plant Energy Flows.

Port of Long Beach, California - Class 8 Tractor



Australian 100% battery-powered, heavy-haul freight locomotive for mainline service in 2024.



By using regenerative braking, it will charge its battery on the 344 kilometer (214 mile) downhill run from our mine to port facility and use that stored energy to return to the mine

World's largest fuel cell electric vehicle weight 290 tons carries 45-ton payload



Autonomous Liebherr T264 ton Battery Electric Vehicle



A large yellow excavator is shown in the process of loading a yellow Fortescue dump truck. The excavator's arm is extended, and its bucket is dumping a load of brown dirt into the truck's bed. The truck is marked with the number 'DI5397' and the Fortescue logo. A large cloud of dust is rising from the point of impact between the bucket and the truck bed. The background is a clear blue sky.

Both Machines are
Battery Electric
Vehicles

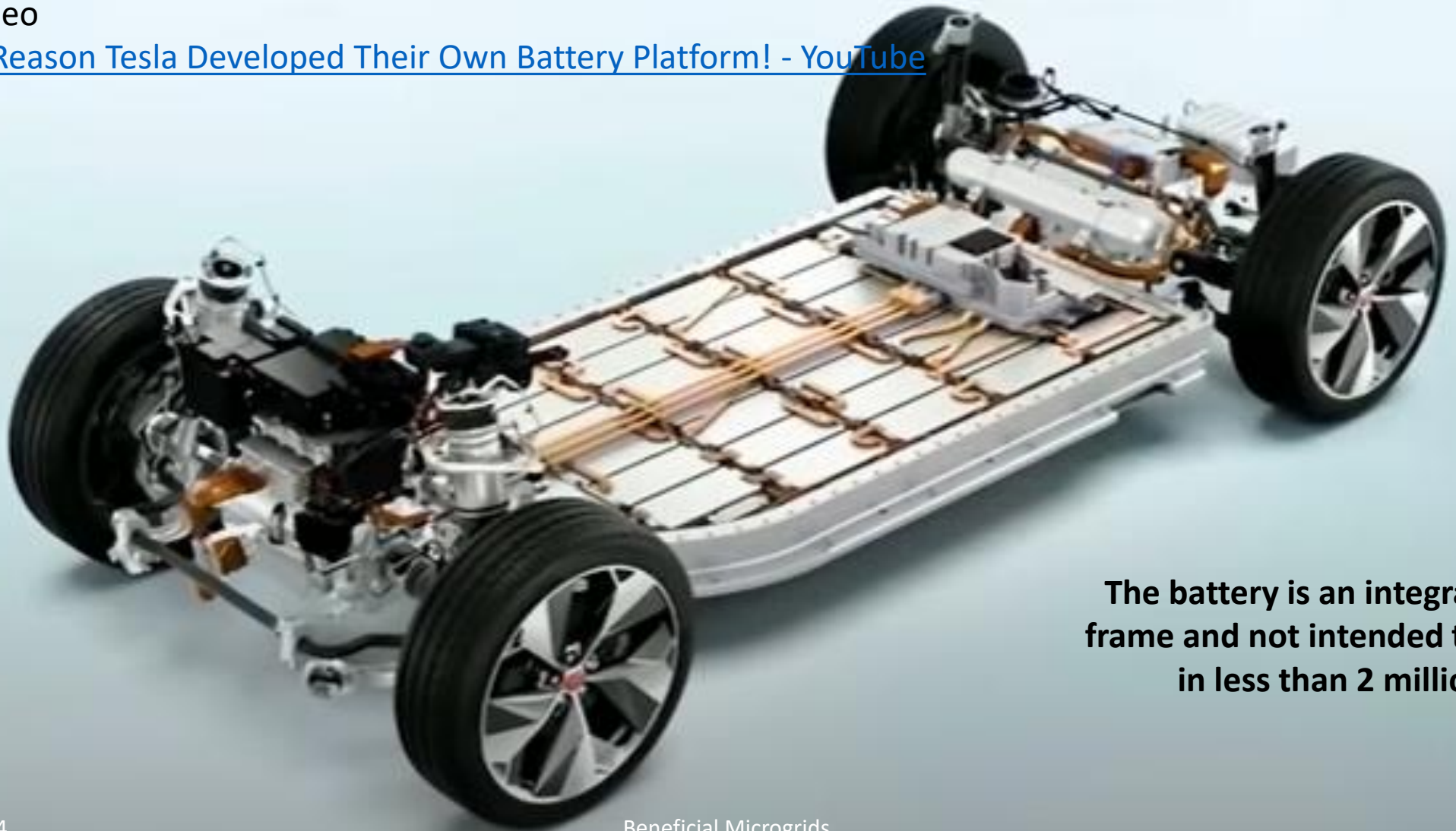
Underground parking lot managed charging stations



Tesla skateboard, battery, frame, motors, computer

An excellent video

[\(108\) The Real Reason Tesla Developed Their Own Battery Platform! - YouTube](#)



The battery is an integral part of the frame and not intended to be replaced in less than 2 million miles

Basic Microgrid EV Charging Station





Transportable Four Vehicle Mobile Charger



**Take chargers to where there aren't any – high rise condo buildings,
remote parking lots, temporary events or emergency use**

Tesla Gigafactory in Texas

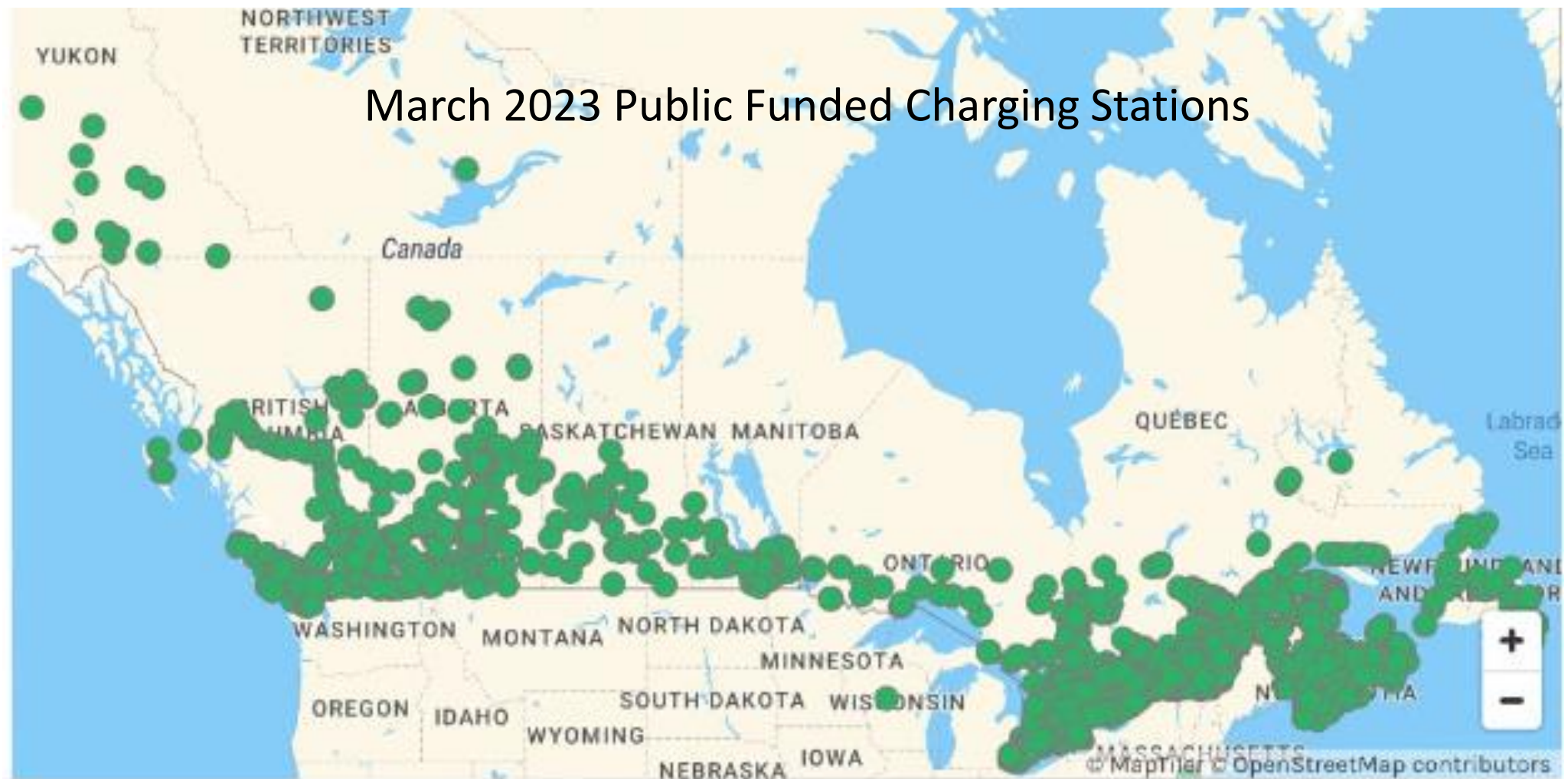


**Second use EV batteries form part
of an energy storage system in
California. Just hook em up!**



Vehicle to Everything Charge Points – V2X

- V2X means a vehicle connected via a bidirectional charge point to everything including V2 Home, V2 Grid, V2 Building, V2 Load, and V2 Microgrid.
- The 2024 buildout will be over 30,000 more points as other EV suppliers convert to the North American standard connector (Tesla's).
 - [Tesla Charging Network: All the Upcoming Compatible EVs - Canadian Association for the Club of Rome \(canadiancor.com\)](https://canadiancor.com/tesla-charging-network-all-the-upcoming-compatible-evs/)
- Wireless charging, under parking spots, has great potential.

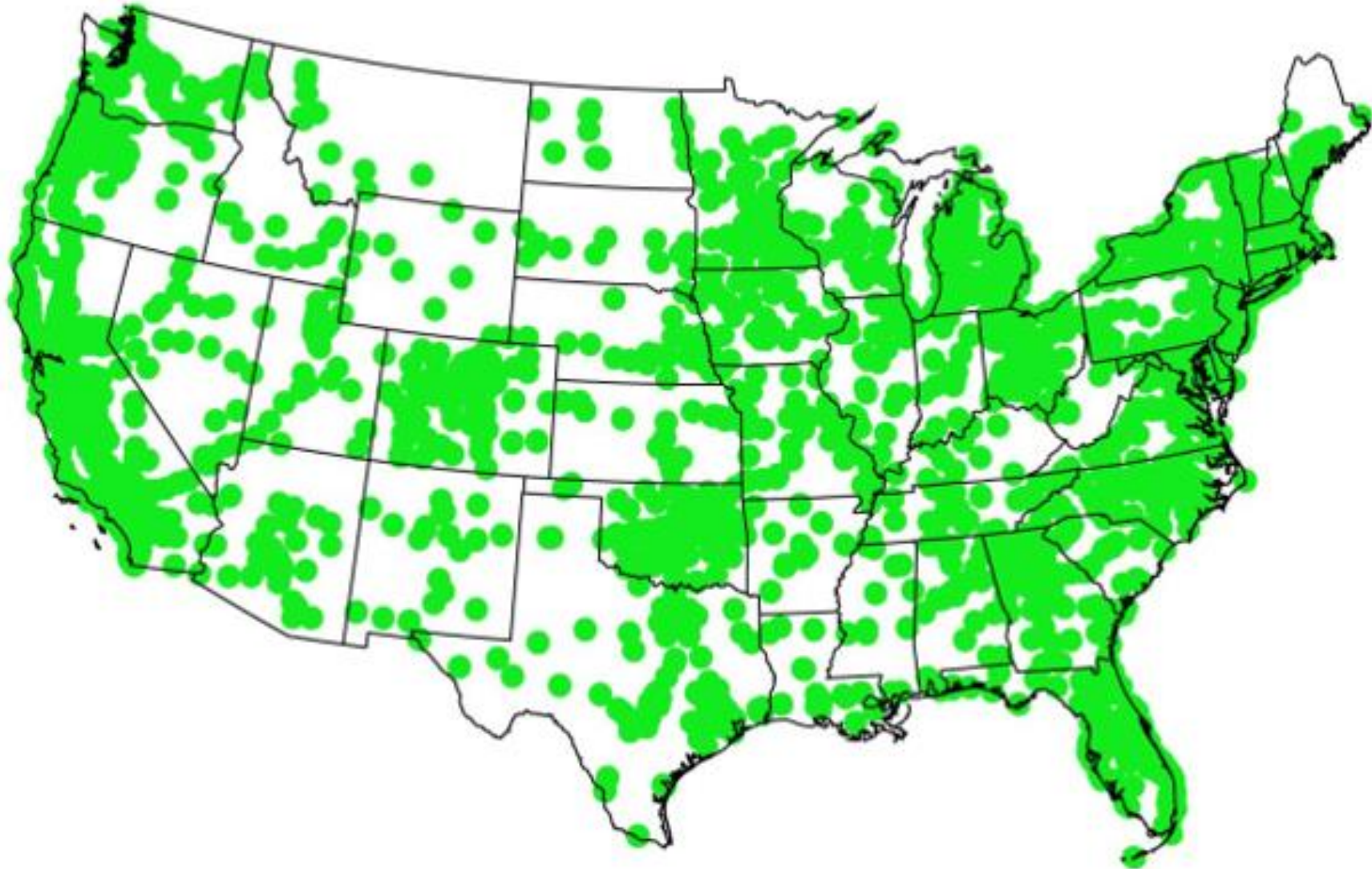


Canada's publicly funded charging stations as of March 2023. Photo: NRCan

[2023 EV charging networks report: Canada's public charger installations grew 30 per cent since start of 2022 - Canadian Association for the Club of Rome \(canadiancor.com\)](https://canadiancor.com/2023-ev-charging-networks-report-canadas-public-charger-installations-grew-30-per-cent-since-start-of-2022/)

Area of the US Within 25 Miles of a Charging Station

As of July 2023

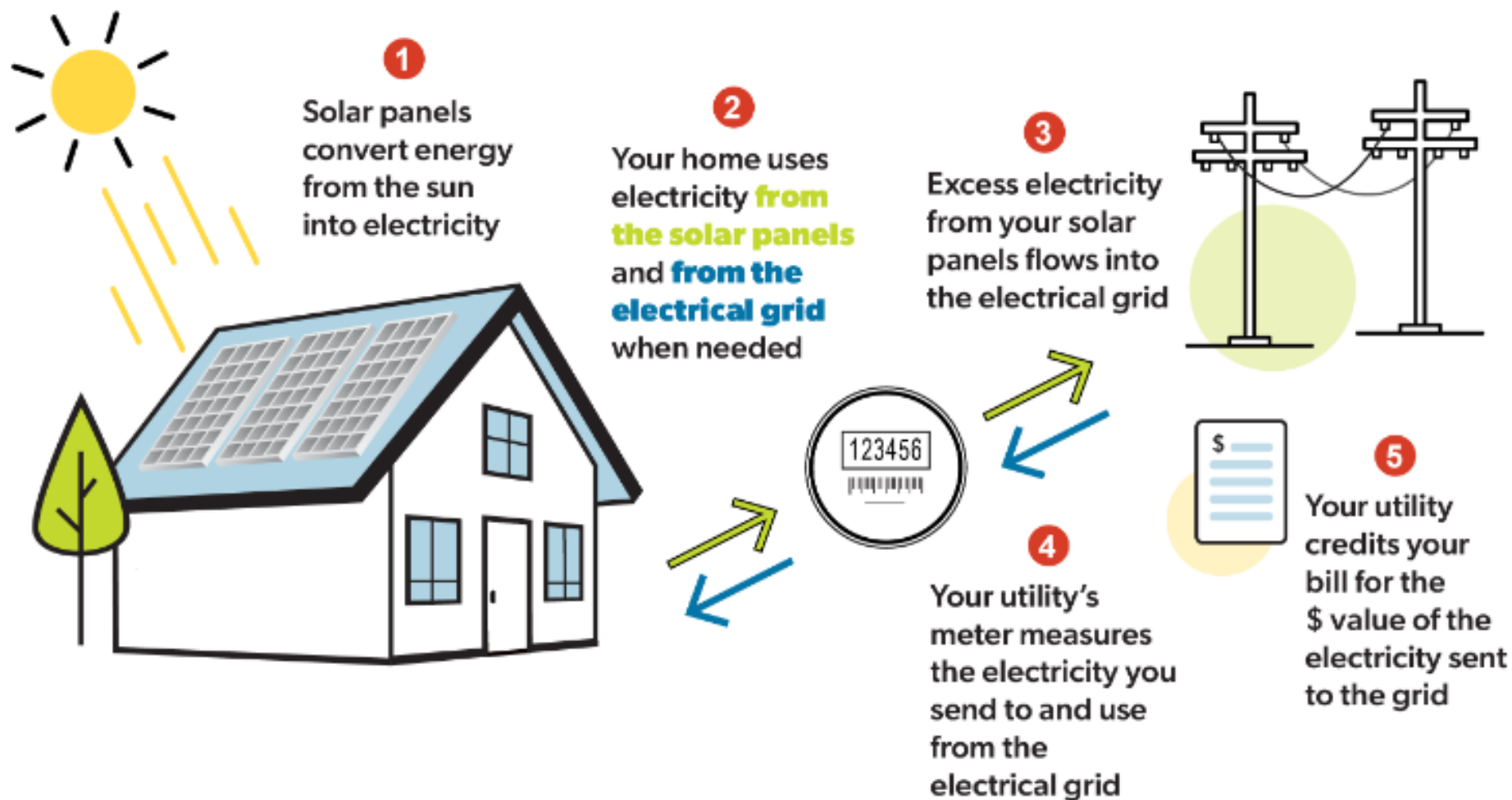


Section 5 : Control system

Hardware and software

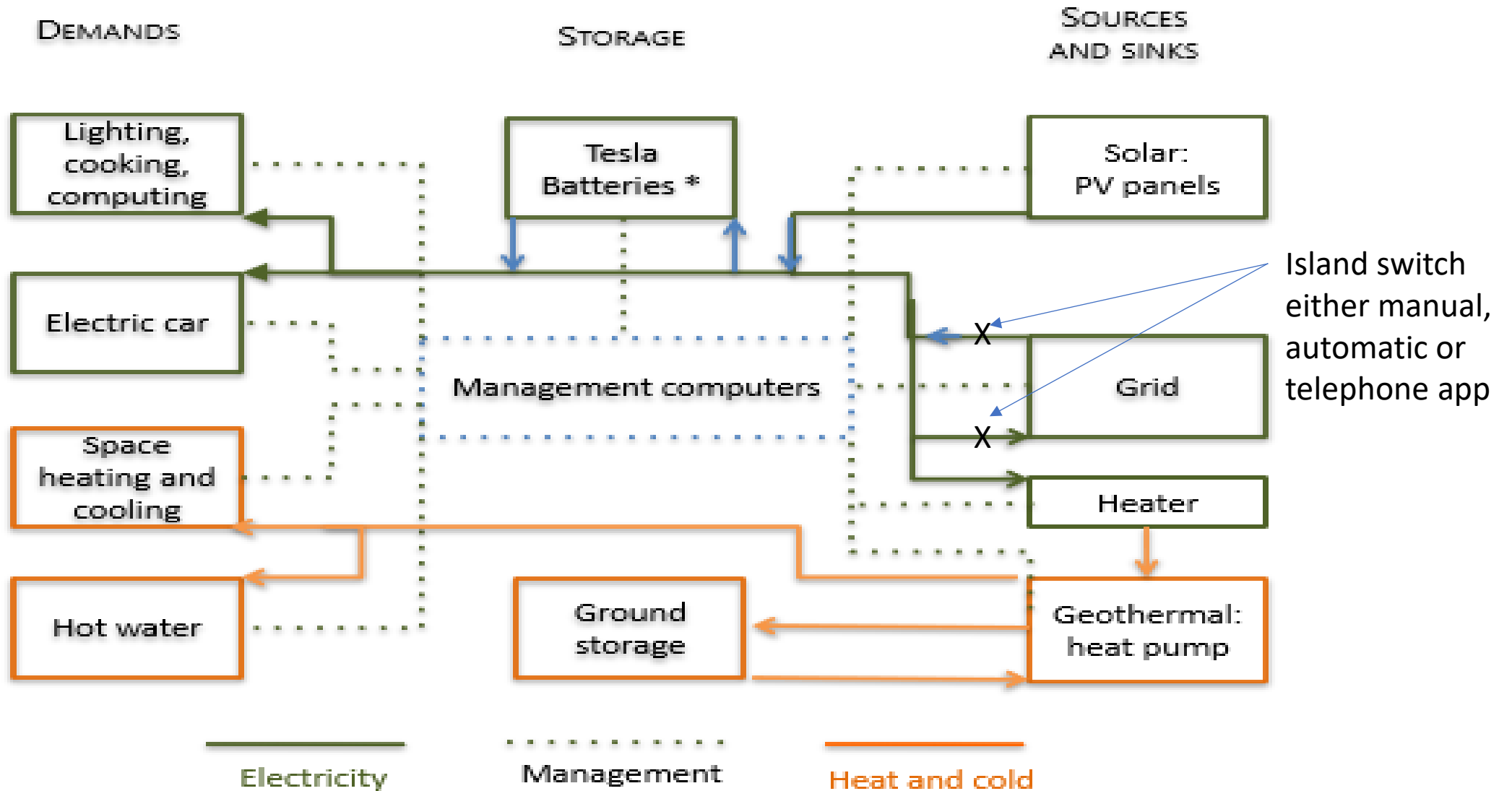
Leading to better decision making - regenerative
ecological techniques

How Net Metering Works



Showcasing the Manotick Microgrid (no burning)

Demand Energy = 82% **Thermal** + 18% **Electricity**



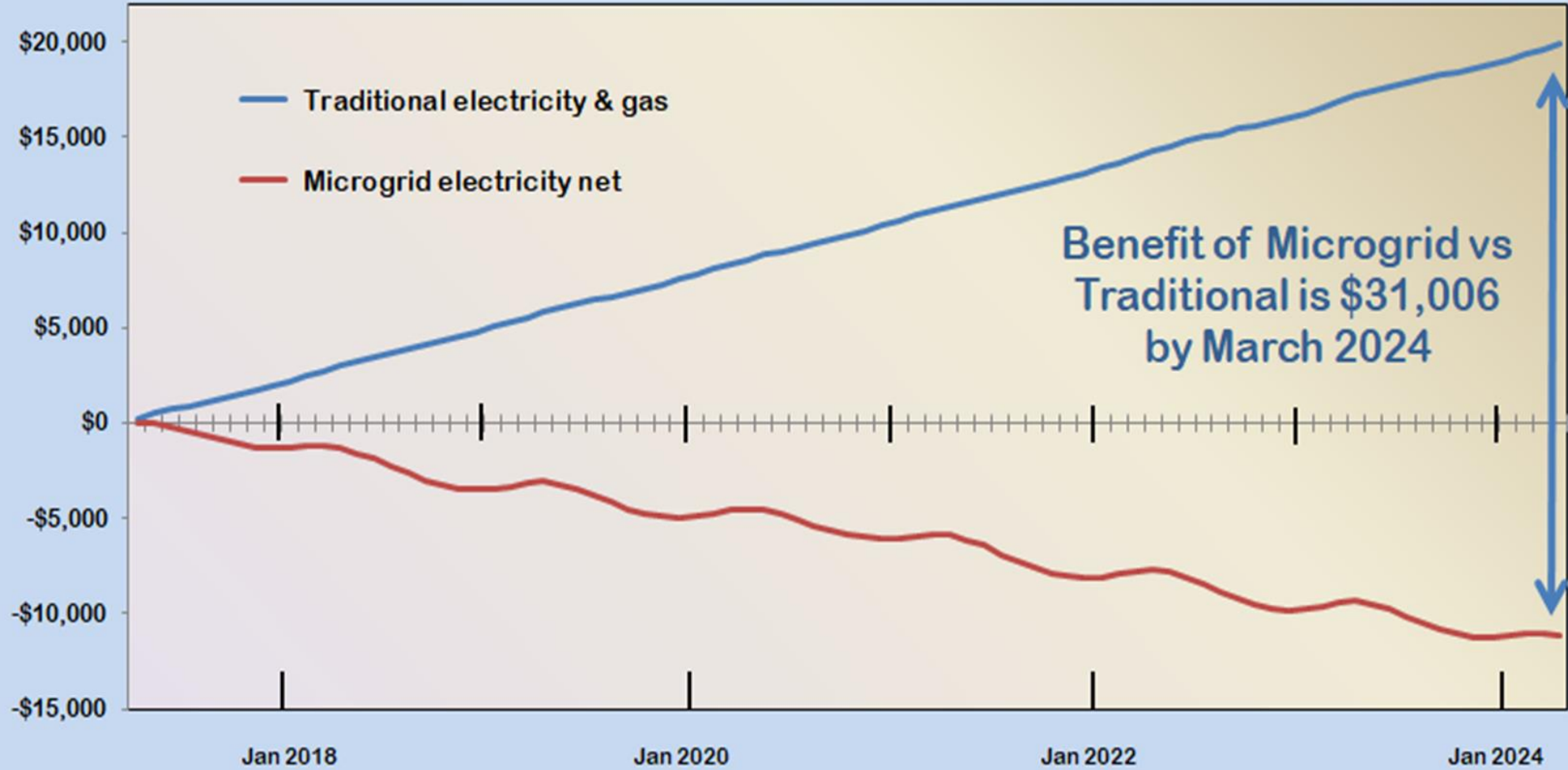
* 2021 Tesla 3 triples the storage

Section 6: Stop Burning

Frontiers of the new climate economy are rapidly expanding

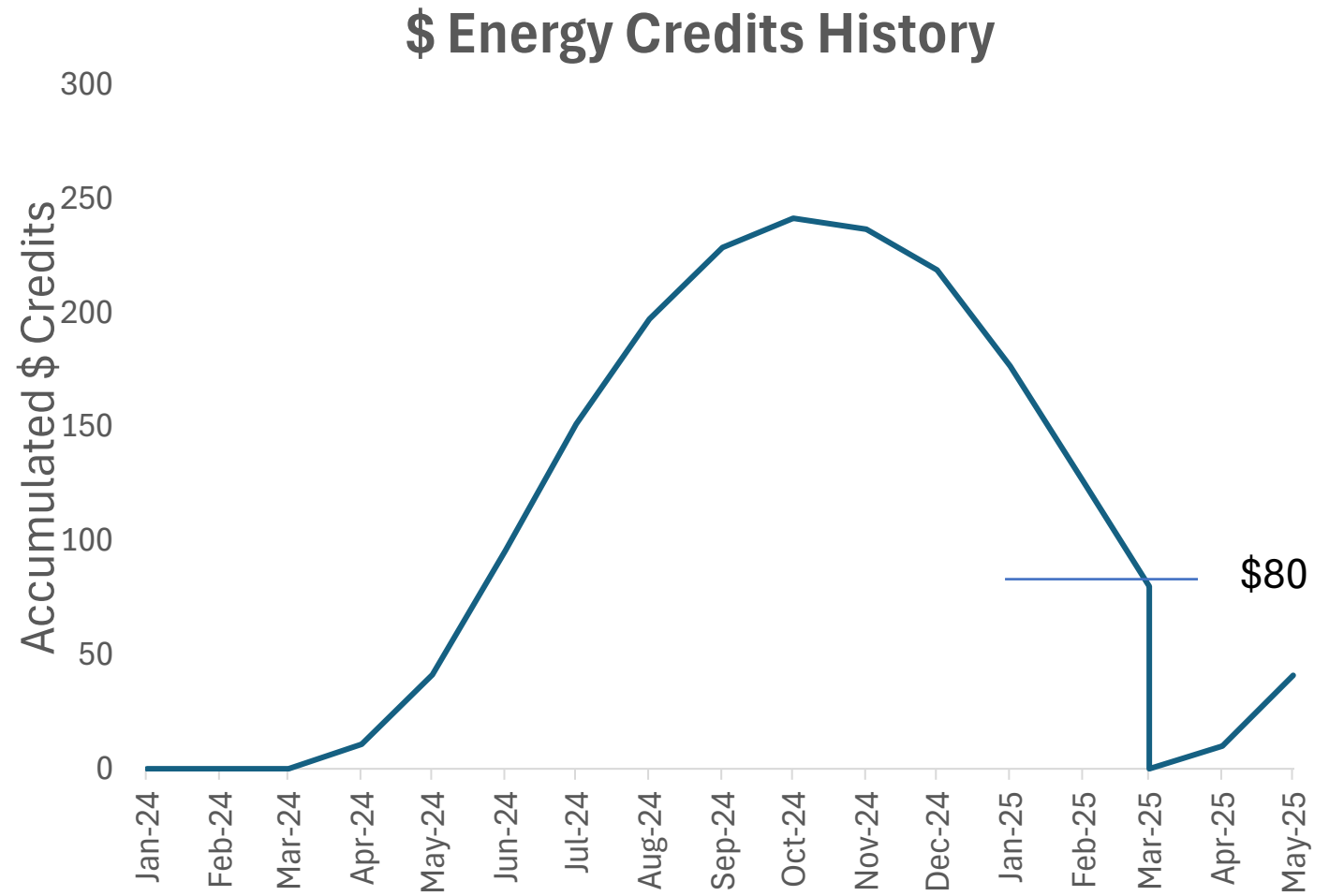
In the beginning, it is all about installation money to most burner people but show people how to save on their utility bills = the environmental renewable energy revolution

Total \$ Paid Over Time



Energy Credit Accumulation and Use

1. First 3 winter months of 2024 there were no excess credits and aggregation reserve remained \$0.0
2. Rapid growth of reserve through the summer due to excess earned credits
3. Autumn and Winter starts the consumption of credits
4. Reserve credits drop to low point of \$80 in March 2025
5. The 12-month rule released the \$80 credit back to the utility.
6. April 2025, credit reserve starts to grow again



Thanks for Your Attention



THE END



Of the Old Way