Welcome to
Calgary Renewable Energy Meetings
March 21, 2026

BALCONY SOLAR SYSTEMS
Benefits and Risks

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OVERVIEW

- What is Balcony Solar
- Germany’s expansion of Balcony Solar
- Risks of DIY solar systems
- Utah’s experiment in Balcony Solar
- Alternatives to Grid tied solar systems
- Cost and Benefits of small DIY solar
- Alberta’s electricity grid carbon emission intensity

What is Balcony Solar?

Definition

Compact, modular photovoltaic units designed for limited spaces like balconies or patios.

Key components

PV modules/panels, microinverter (DC→AC), wiring, and non-roof mounting hardware.

Typical output

About 600 -800 watts per unit for small-scale residential generation.

Typical German Balcony Solar Diagram

- **Solar Panels (PV Modules):** Usually 1-2 panels, producing DC power.
- **Microinverter:** Converts DC to AC (max 800W, previously 600W).
- **AC Cable/Socket:** Plugs directly into a wall outlet (Schuko plug).

Germany

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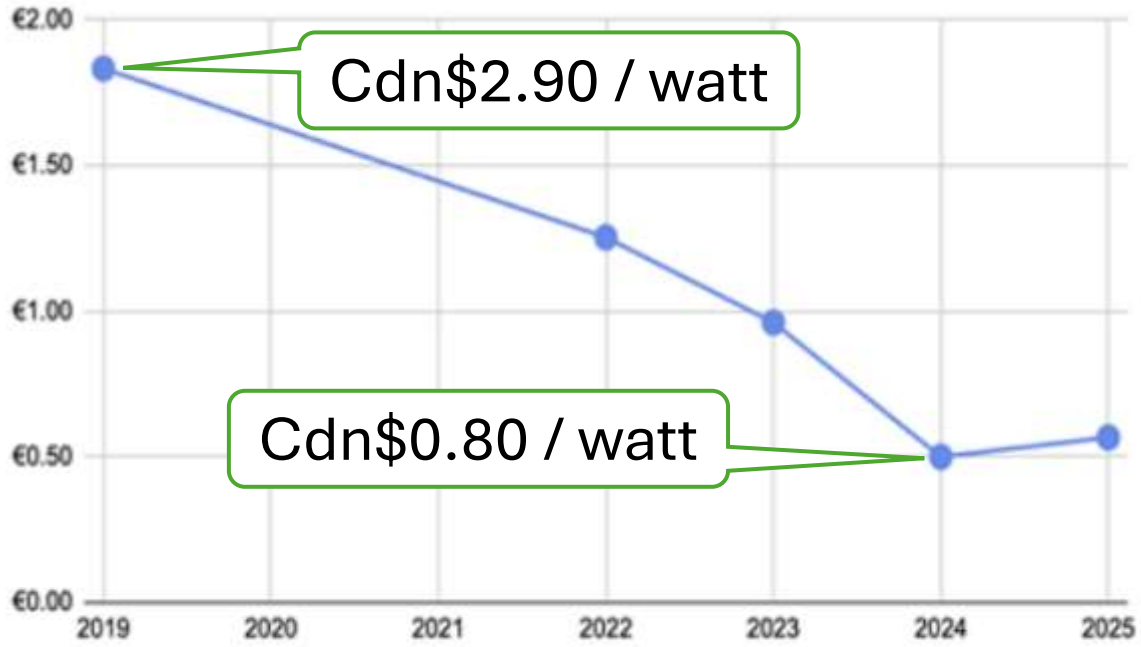
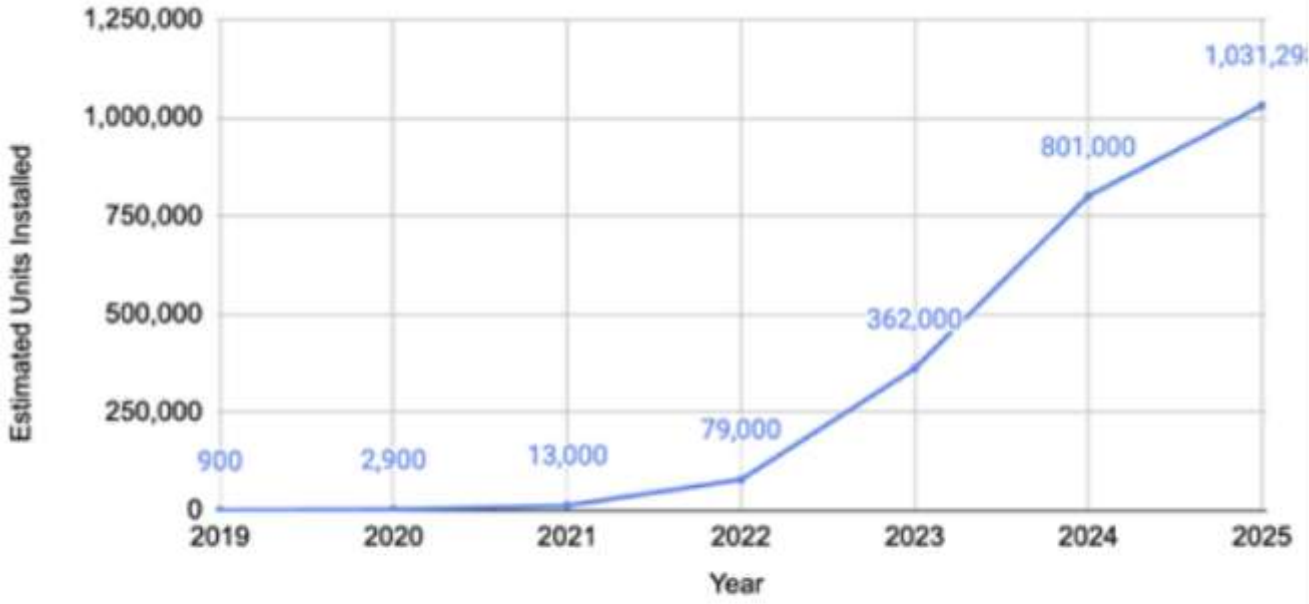
Balcony PB kit spot price in Germany (€/Wp, documented ranges 2019-2025



Source: Priwatt, HTW Berlin, Business Insider, Heise Online, ADAC, Finanztip

Registered Balcony Solar Units in Germany, 2019-Q2 2025



Source: Umweltbundesamt (UBA) 2025, Bundesnetzagentur MaStR 2025, BSW-Solar (2025)

Falling prices, improved technology and political support have helped drive a German balcony-solar boom

Image: Hendrik Schmidt/dpa/picture alliance

Key advantages of balcony solar in Germany

- Ease of Installation and portability
- Specifically designed to fasten on balconies to save space
- Approved to be plugged into a standard wall outlet
- Can reduce electricity costs by up to 30%
- Accessibility to apartment renters or condo owners
- Low cost ($300 to $1,200) allows payback in 3 to 4 years
- Reduces carbon emissions and reliance on fossil fuels

Risks

1. Backfeeding and Fire Risk (The "Breaker Masking" Concern)

- **What is it?** Balcony solar devices send power into a household socket, feeding it into a circuit. If you have other appliances drawing power on that same circuit, the total power draw at the outlet could theoretically exceed the capacity of the wiring, even if the circuit breaker doesn't trip. This is because the circuit breaker only measures power leaving the breaker box, not the power being injected midway.
- **Why it rarely happens in Germany:** Germany has strict standards. The limit for plug-in solar devices was recently increased to **800 watts**. This amount is low enough that, even in older homes, the wiring can typically handle the heating that occurs in worst-case scenarios.
- **When a fire could happen:** Fire risks are associated with using cheap, non-certified components, using extension cords, or tampering with the device to add illegal batteries.

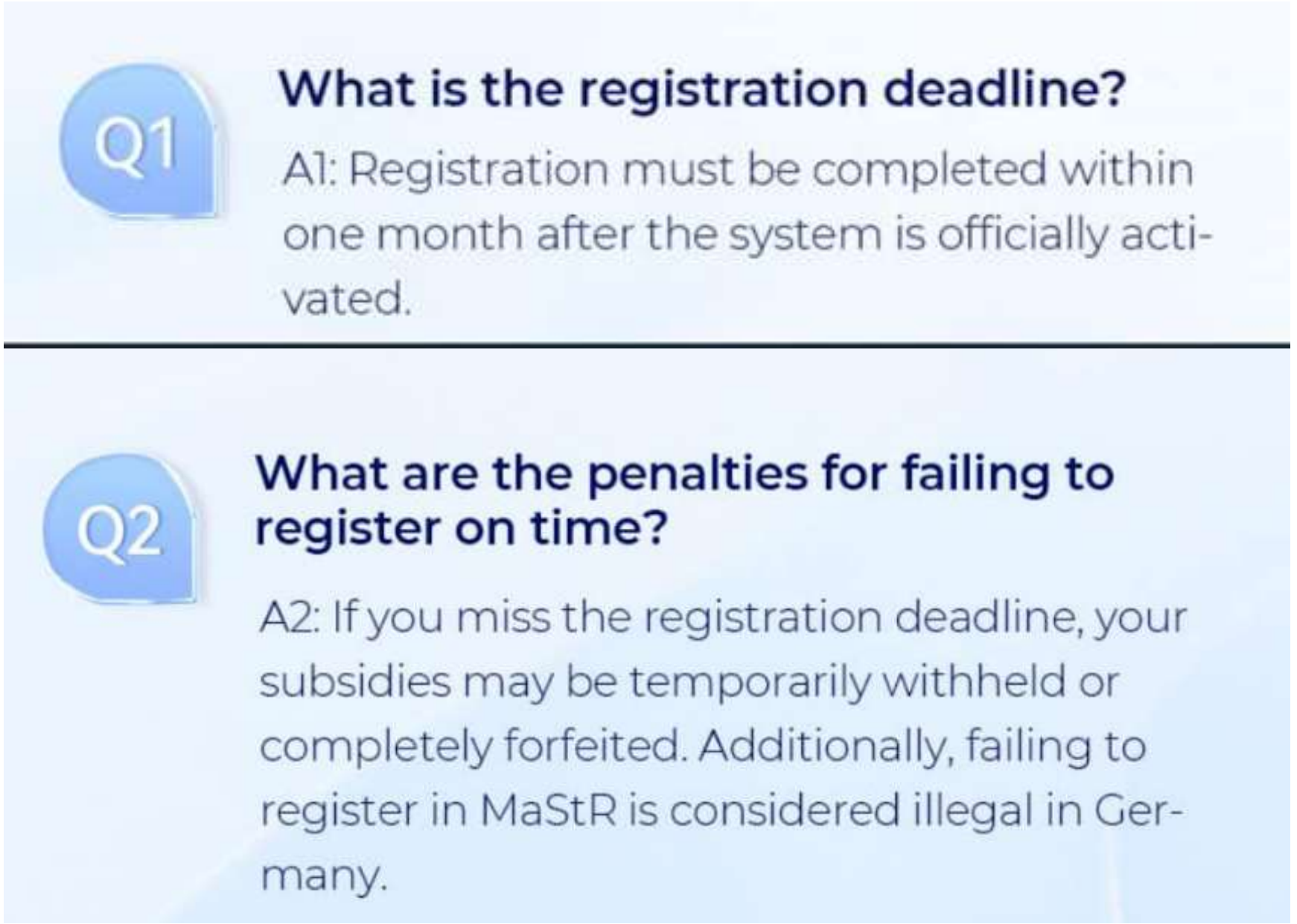
2. Mandatory Safety Features

- **Anti-Islanding Protection:** All legal balcony solar inverters must meet VDE standards (e.g., VDE-AR-N 4105). This requires the inverter to shut down within a fraction of a second if the grid loses power (e.g., a power outage or if the unit is unplugged). This prevents electric shock for utility workers and prevents feeding power into a dead circuit.
- **Dedicated Circuits Recommended:** While many use standard "Schuko" sockets, using a dedicated circuit for the unit eliminates overloading risks.

3. Regulations and Safe Usage in Germany

- **Limits:** The maximum inverter capacity is **800 watts**.
- **Registration:** Units must be registered with the *Bundesnetzagentur* (Federal Network Agency) to ensure grid compatibility.
- **Component Quality:** It is recommended to use products with a CE certification and VDE standards to ensure safety.
- **Installation:** Only one unit per outlet/circuit should be used to prevent additive overcurrent.

Balcony solar systems must be registered in Germany

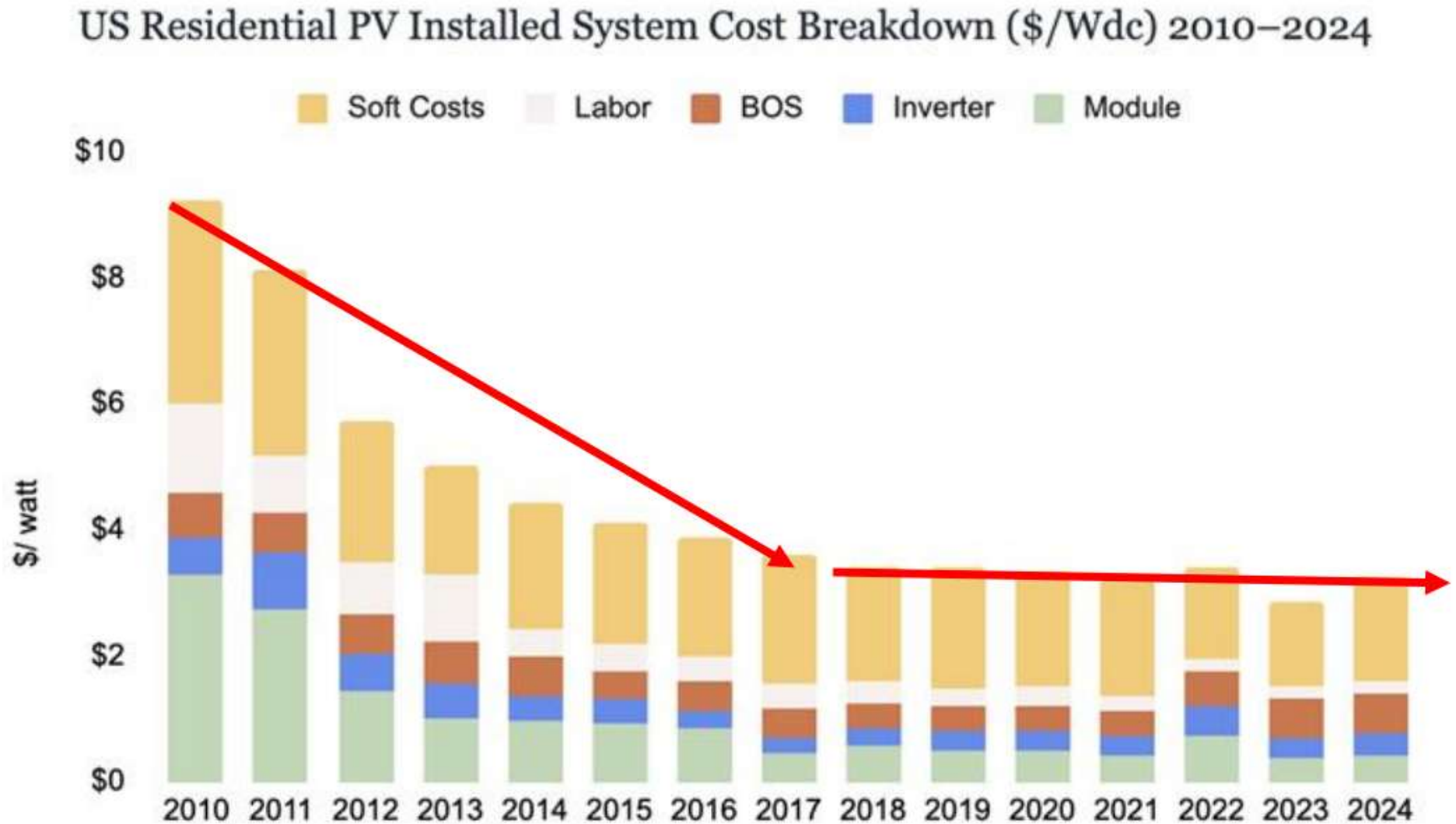


Balcony solar systems must be registered in Germany

Where we are in the U.S.

- Average rooftop solar system costs of **$18K.**
- **An $18K system in Utah,** would save a home **≈ $1,000/yr** with a payback period **≈ 18 yrs.**
- **≈ ½ of system costs are soft costs –** which plug-in solar eliminates.

Rooftop Solar Prices Have Stagnated



Source: NREL (2025)

Plug-in Solar = Energy Affordability

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Renewable energy grows fastest when it saves people money.

Solar hardware has decreased significantly in the last 50 years, by roughly **99.7%.**

As the # of global installations double, the price continues to drop by **≈20%.**

Around **2021-23,** solar + battery overtook natural gas as the cheapest form of electricity.

Global solar prices are currently at **$0.26/watt.**

Utah is leading the way with the solution.

Given the political environment in the U.S. and divisiveness over climate change, it might come as a surprise that a red state like Utah is leading the charge. Ward says it was a matter of offering residents an opportunity to save money, and his legislation gets "the government out of their way."

He says it wasn't that plug-and-play solar units were prohibited, but rather that the regulations only covered rooftop solar panel systems, which weren't allowed to be plugged directly into an existing electrical system and had a contract with the local utility.

"That makes sense if you're going to cover your whole roof with them and expect the utility to pay you some money for that power," Ward said. "But it doesn't make sense if you're just buying something little and plugging it in and not asking [the utility] for anything."

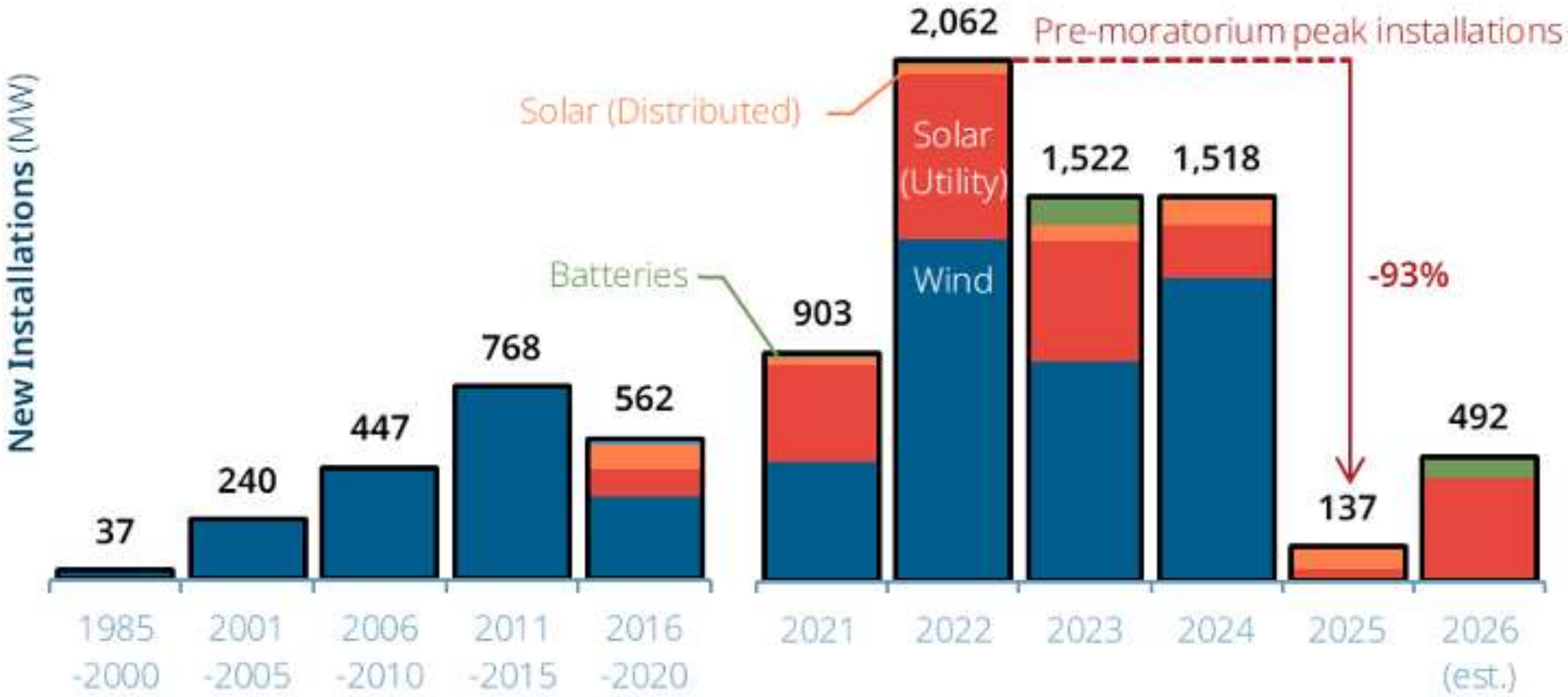
Utilities got on board, he says, once they realized they wouldn't have to compensate customers for the power they were generating.

Key Details on Utah Balcony Solar:

- **Legal Status:** Authorized under HB 340, bypassing typical utility approval processes for small, plug-in systems.
- **Capacity Limit:** Residents can install up to 1.2 kW (1,200 watts) of solar panels.
- **Safety Requirements:** Systems must comply with safety standards (UL listed).
- **Ease of Installation:** Designed for apartments and condos, these systems typically involve mounting panels on a balcony railing and plugging them into an exterior outlet.
- **Cost and Savings:** Kits can cost between $\$400$ and $\$2,000$. A 800W system can cover 15%–25% of an apartment's electricity needs.
- **Mechanism:** The panels feed power directly into the home circuit, reducing the reliance on the grid and lowering electricity bills.

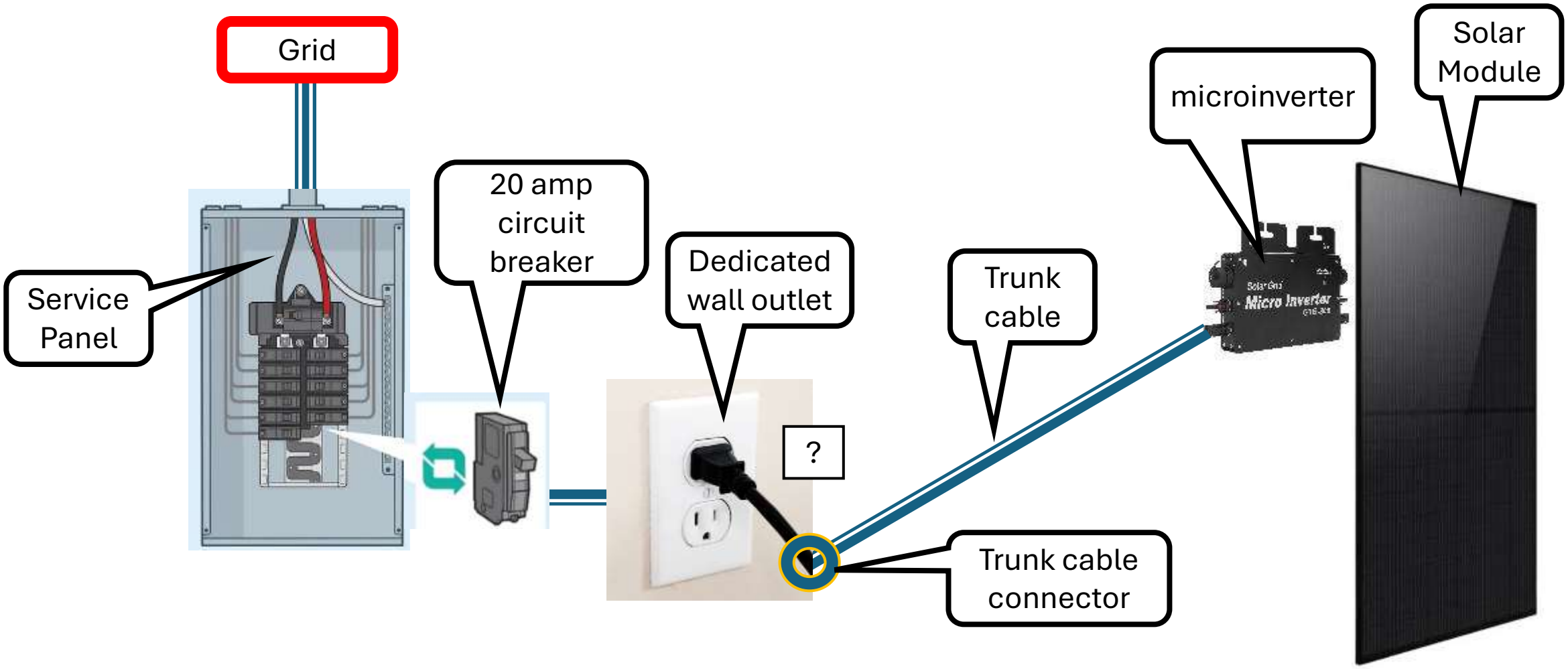
This legislation was designed to make solar accessible to apartment dwellers and homeowners who cannot install traditional rooftop solar.

Pembina Release on Renewables Moratorium



Alternative solar PV systems

Small DIY Solar System requiring City approval



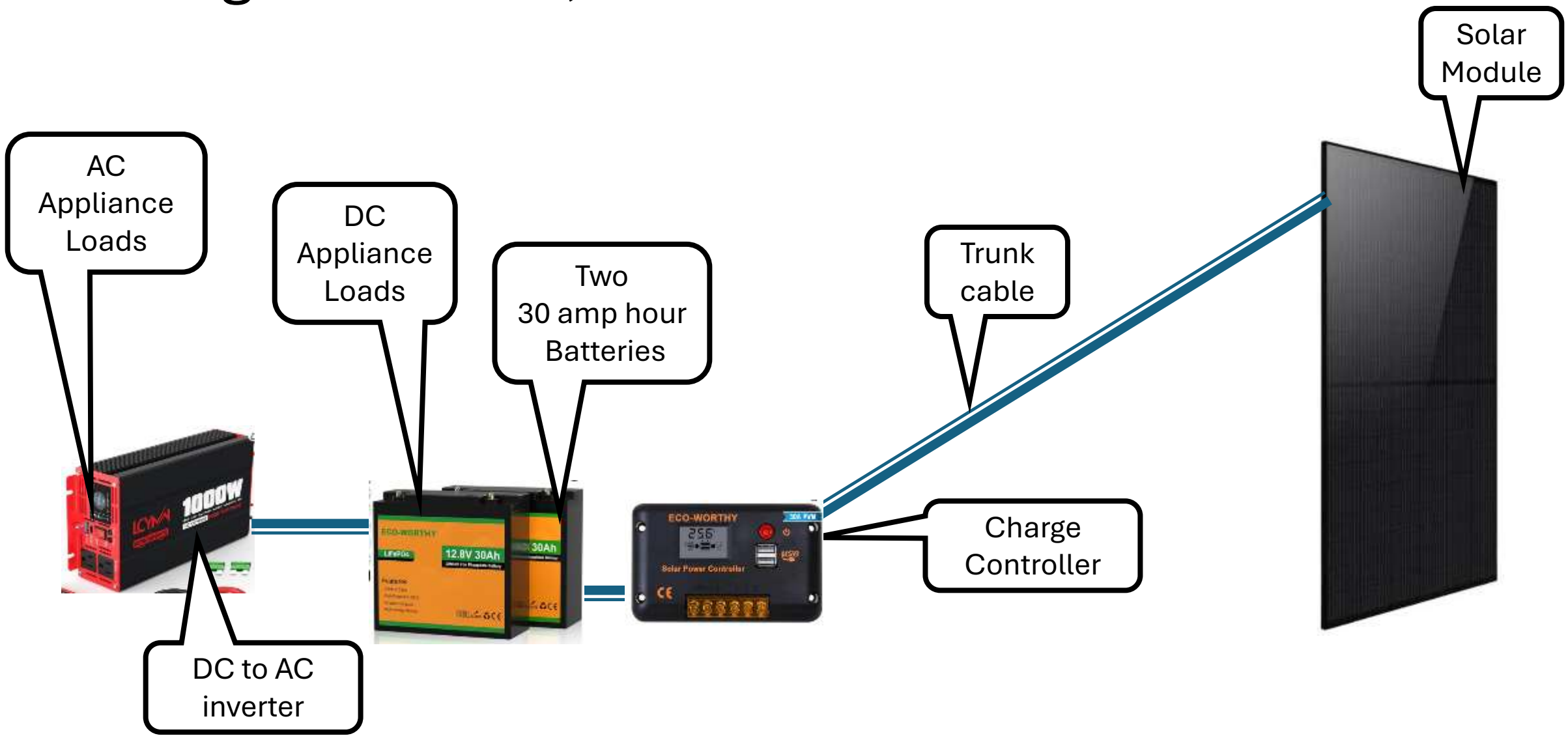
Small DIY Solar System requiring City approval

Annual Value	
watts	450
kWh/yr/kWdc	**1250**
kWh/yr	563
Energy per kWh	$ 0.09
Transmission per kWh	$ 0.039
Distribution per kWh	$ 0.049
Total price per kWh	$ 0.1777
Total Annual Value	$100.00

Costs	
Longi Solar module	$ 250
Microinverter	$ 150
Wiring and wall outlet	$ 50
Install circuit breaker	$ 150
Permitting/inspection	$ 250
Total Costs	$ 850

First Year ROI	**11.8%**

Small DIY Off Grid Solar System with charge controller, batteries and DC to AC inverter



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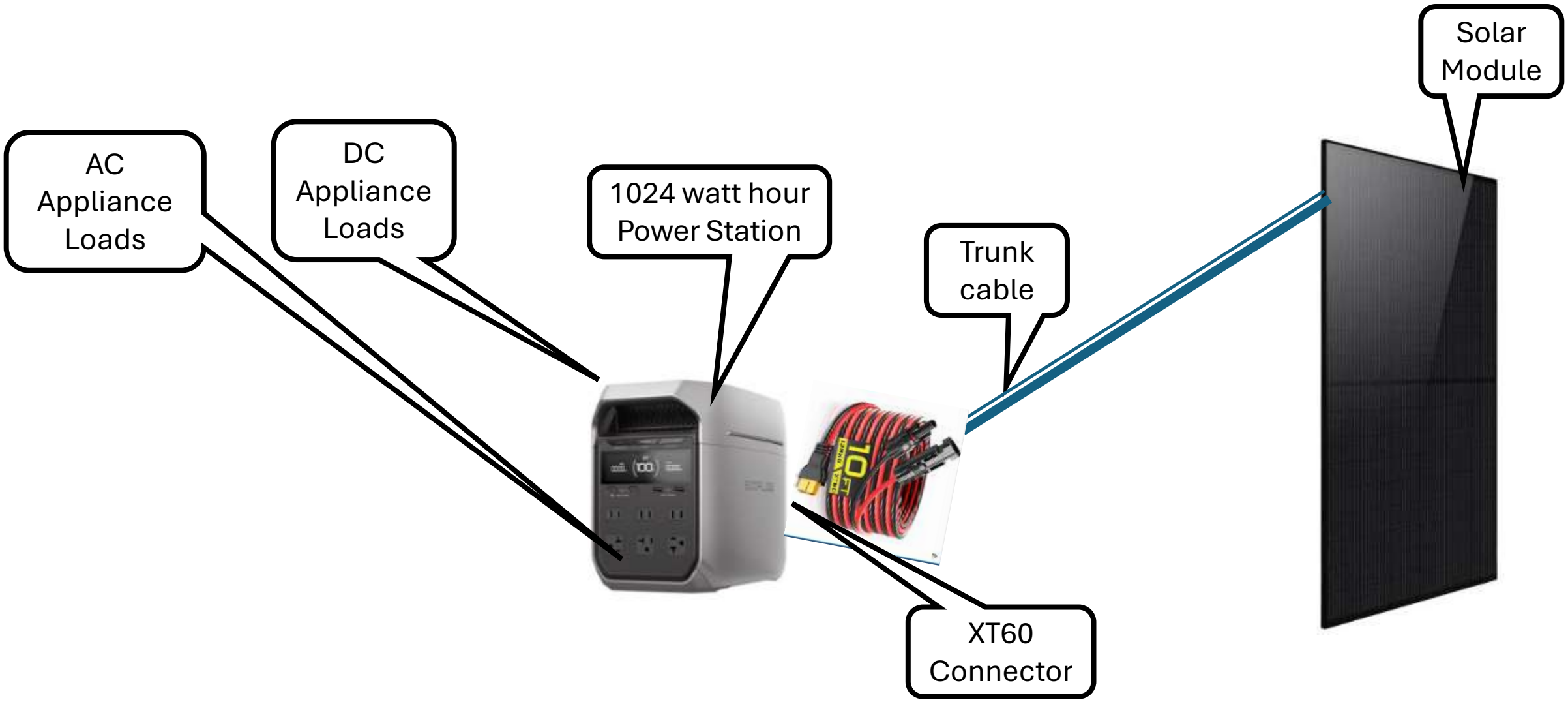
Costs

Longi Solar module	$ 250
Trunk Cable	$ 50
Charge Controller	$ 50
Two 30 ah batteries	$ 250
Pure sine inverter	$ 130
Total Costs	$ 730

First Year ROI	**13.7%**

Small DIY Off Grid Solar System with Power Station



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Total Annual Value	$100.00

Costs	
Longi Solar module	$ 250
Trunk Cable	$ 50
XT60 connector	$ 20
1024 Wh Power Station	$ 850
Total Costs	$ 1,170

First Year ROI	**8.5%**

4.0 kWdc Rooftop Solar System

4.0 kWdc Rooftop Solar System

Annual Value

watts	4,000
kWh/yr/kWdc	**1100**
kWh/yr	4400
Energy per kWh	$ 0.09
Transmission per kWh	$ 0.039
Distribution per kWh	$ 0.049
Total price per kWh	$ 0.1777
Total Annual Value	$ 782

Costs

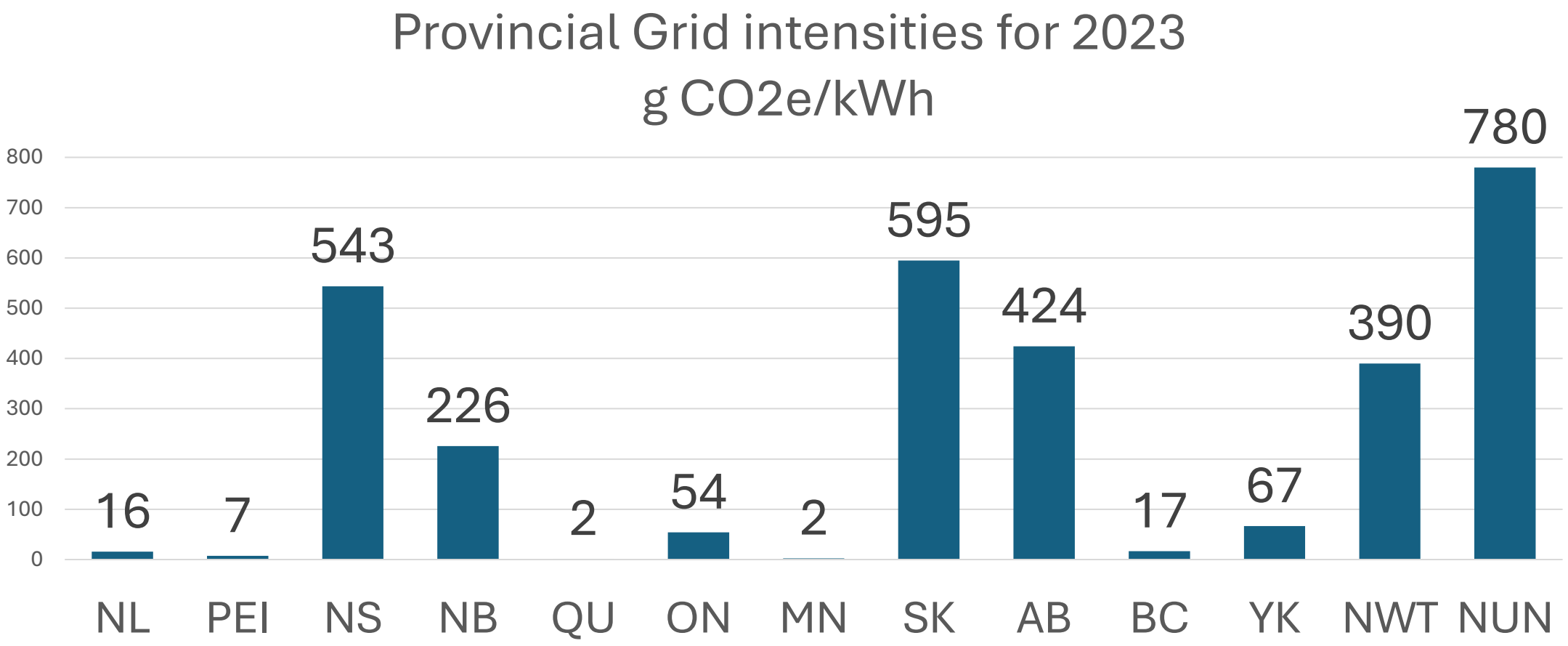
Current Cost per watt	$ 2.50
Total Costs	$ 10,000

First Year ROI	**7.8%**

First Year Return On Investment & Simple Payback Time in Years

Technology	Total Cost	Annual Savings	Return on Investment	Payback (years)
Rooftop 4.0 kWdc Array (Professional Installer)	$ 10,000	$ 782	7.8%	12.8
450 Watt PV array with XT60 connector and Power Station	$ 1,170	$ 100	8.5%	11.7
450 Watt PV array with microinverter and dedicated circuit	$ 850	$ 100	11.8%	8.5
450 Watt PV array with charge controller, batteries and inverter	$ 730	$ 100	13.7%	7.3

Which Province has the dirtiest grid ?



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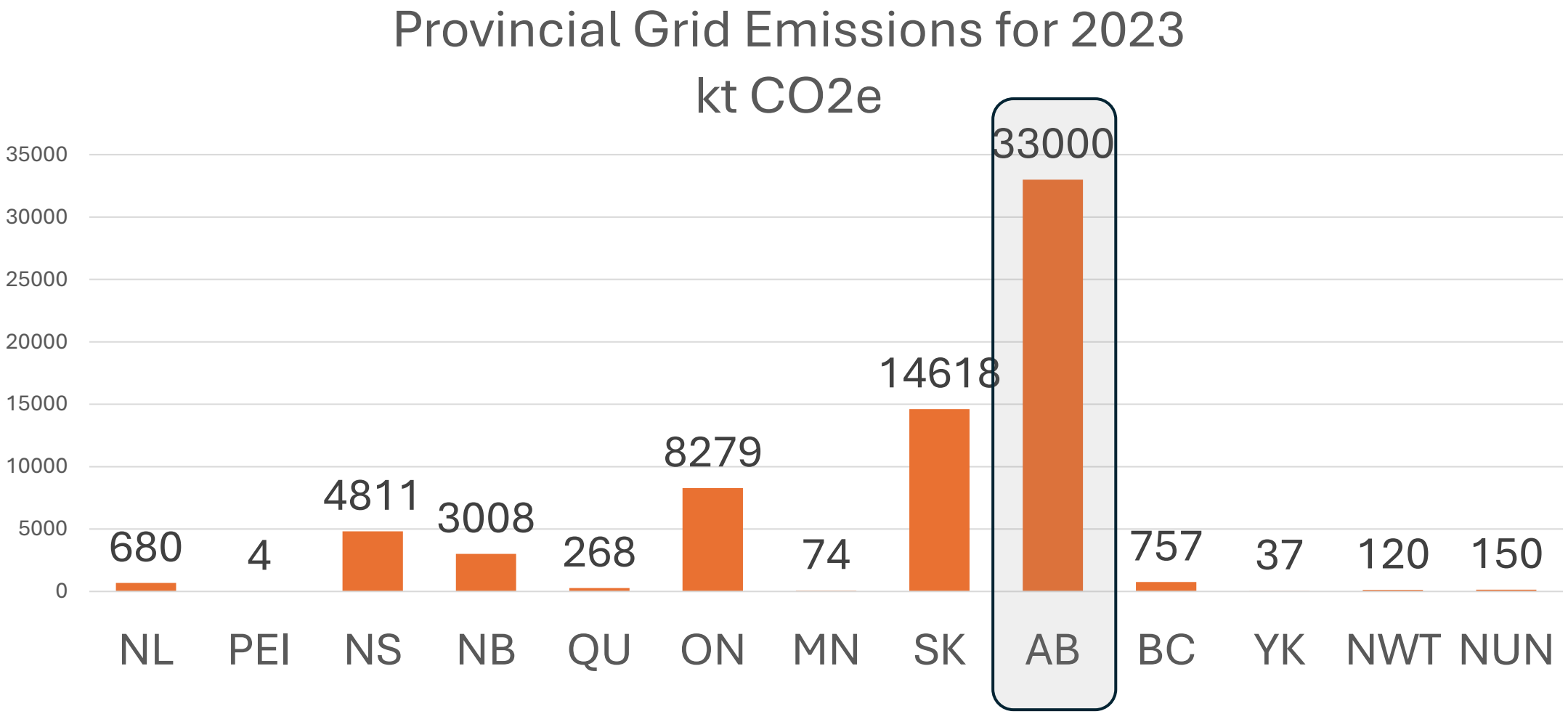

Reducing Carbon emissions generates offsets

- Alberta’s grid emission intensity = 424 g CO2/kWh

Intrinsic carbon offset value of a $10,000 solar array

- Assume $2,500 per kWdc
- Therefore system size is 4.0 kWdc
- Assume 1,100 kWh/yr/kWdc yields 4,400 kWh/yr

- Alberta's grid emission intensity = 424 g CO2/kWh
- This array offsets 424g x 4,400 kWh/yr = 1,865,600 g CO2/yr
- Equivalent to 1.87 tnes CO2 / year
- Current offset value is roughly $30 per tne CO2
- Equates to a **personal** carbon offset value of $56 per year

- **NOTE: Alberta will not validate solar PV offsets if any subsidies have been applied to the installation costs of the PV array.**

Potential in Calgary

- Permitting will be onerous and protracted if DIY
- PV Array must be 8 feet above ground
- Current systems are limited to last year's consumption
  - assume 6,000 kWh per year
  - Without EV car
  - Without Heat pump
- PV system can generate 6,000 kWh/yr
- At 1000 kWh/yr/kWdc requires 6.0 kW system
- At $2,500 per kilowatt, **cost will be $15,000**
- **So why not invest circa $1,000 and have some DIY fun**