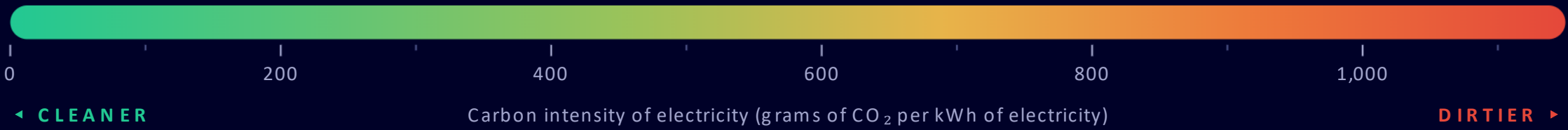
Emissions reductions from electrifying now

Unlocking immediate benefits that can scale over time

Every grid in the world sits somewhere on this line.

The question is where electric beats fossil.



Analysis by Dave Jones, Ember

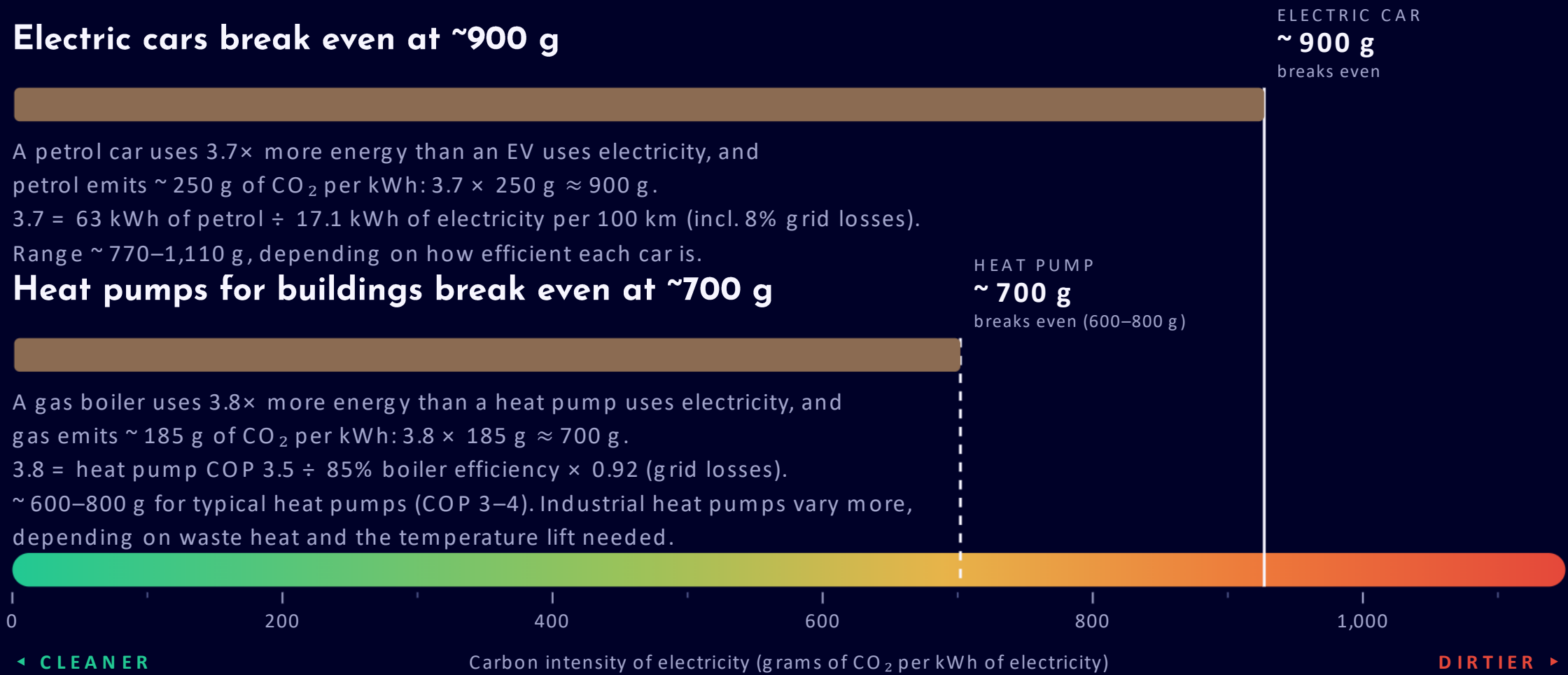
How clean does electricity need to be to deliver emissions reductions when electrifying?

Electric cars break even at ~900 g

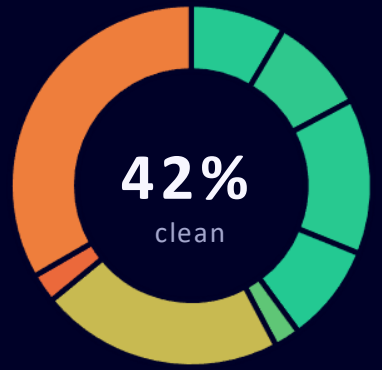
A petrol car uses 3.7× more energy than an EV uses electricity, and petrol emits ~ 250 g of CO_2 per kWh: 3.7 × 250 g ≈ 900 g.
3.7 = 63 kWh of petrol ÷ 17.1 kWh of electricity per 100 km (incl. 8% grid losses).
Range ~ 770–1,110 g, depending on how efficient each car is.

Heat pumps for buildings break even at ~700 g

A gas boiler uses 3.8× more energy than a heat pump uses electricity, and gas emits ~ 185 g of CO_2 per kWh: 3.8 × 185 g ≈ 700 g.
3.8 = heat pump COP 3.5 ÷ 85% boiler efficiency × 0.92 (grid losses).
~ 600–800 g for typical heat pumps (COP 3–4). Industrial heat pumps vary more, depending on waste heat and the temperature lift needed.



Combustion CO_2 only. Full method: breakeven methodology note, Oct 2026



On the world's average grid, an EV cuts CO_2 by half and a heat pump by a third

Global average electricity mix

461 g

ELECTRIC CAR
~ 900 g
breaks even

HEAT PUMP
~ 700 g
breaks even (600–800 g)

Nuclear 9%
Wind 8%
Hydro 14%
Solar 9%
Gas 22%
Coal 33%

461 g
466 g more

0
200
400
600
800
1,000

◂ CLEANER

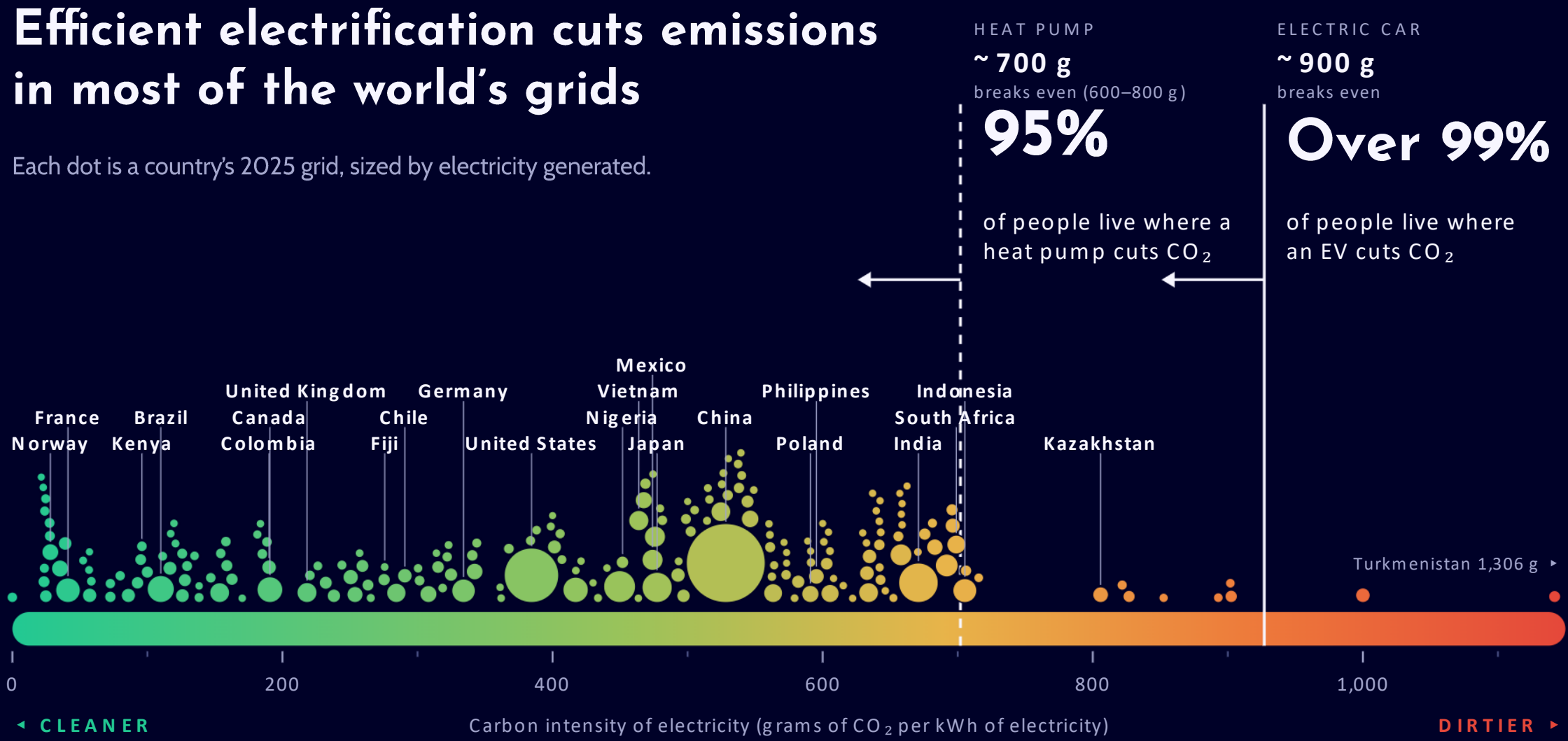
Carbon intensity of electricity (grams of CO_2 per kWh of electricity)

DIRTIER ▸

Data: yearly electricity data, 2025; life-cycle emission factors

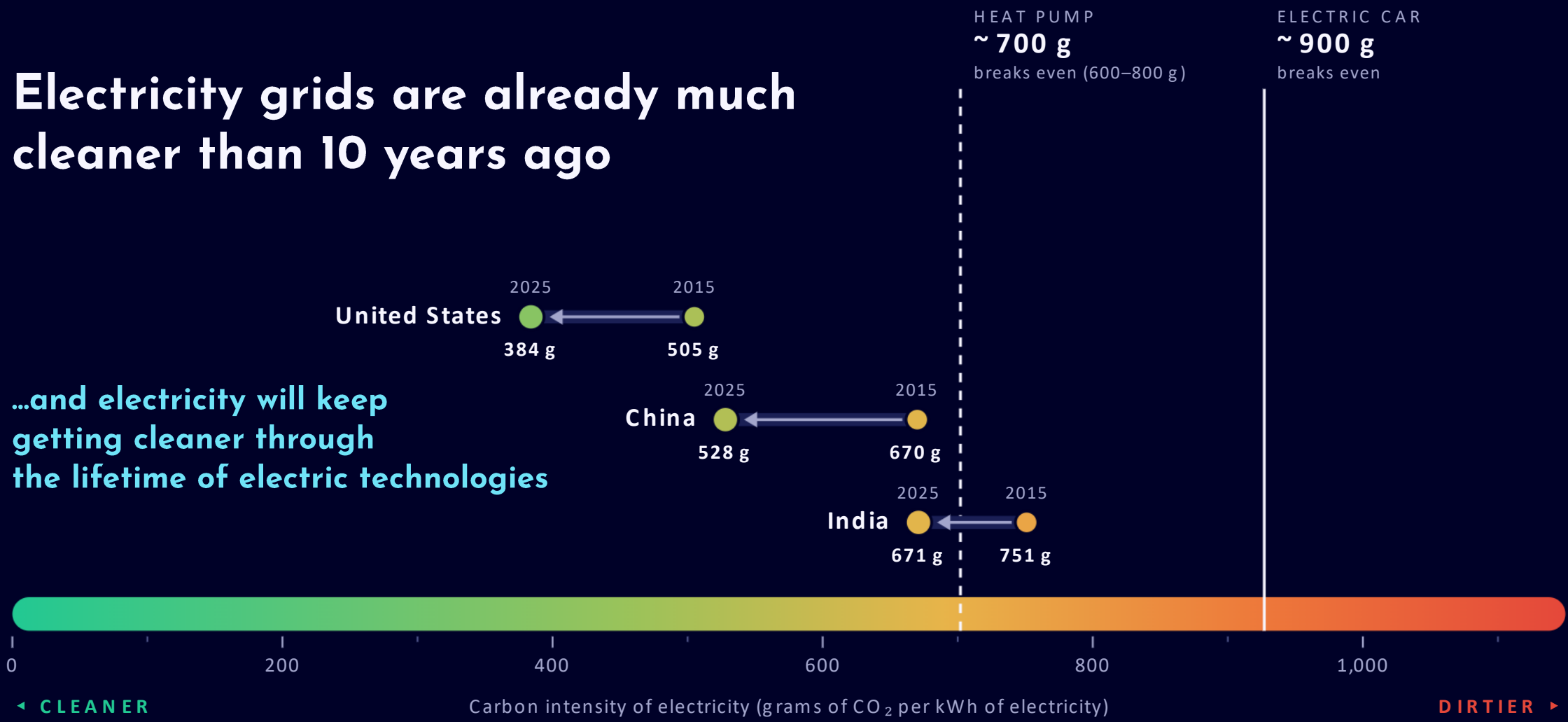
Efficient electrification cuts emissions in most of the world's grids

Each dot is a country's 2025 grid, sized by electricity generated.



Data: yearly electricity data, 2025 (Sept 2026 release)

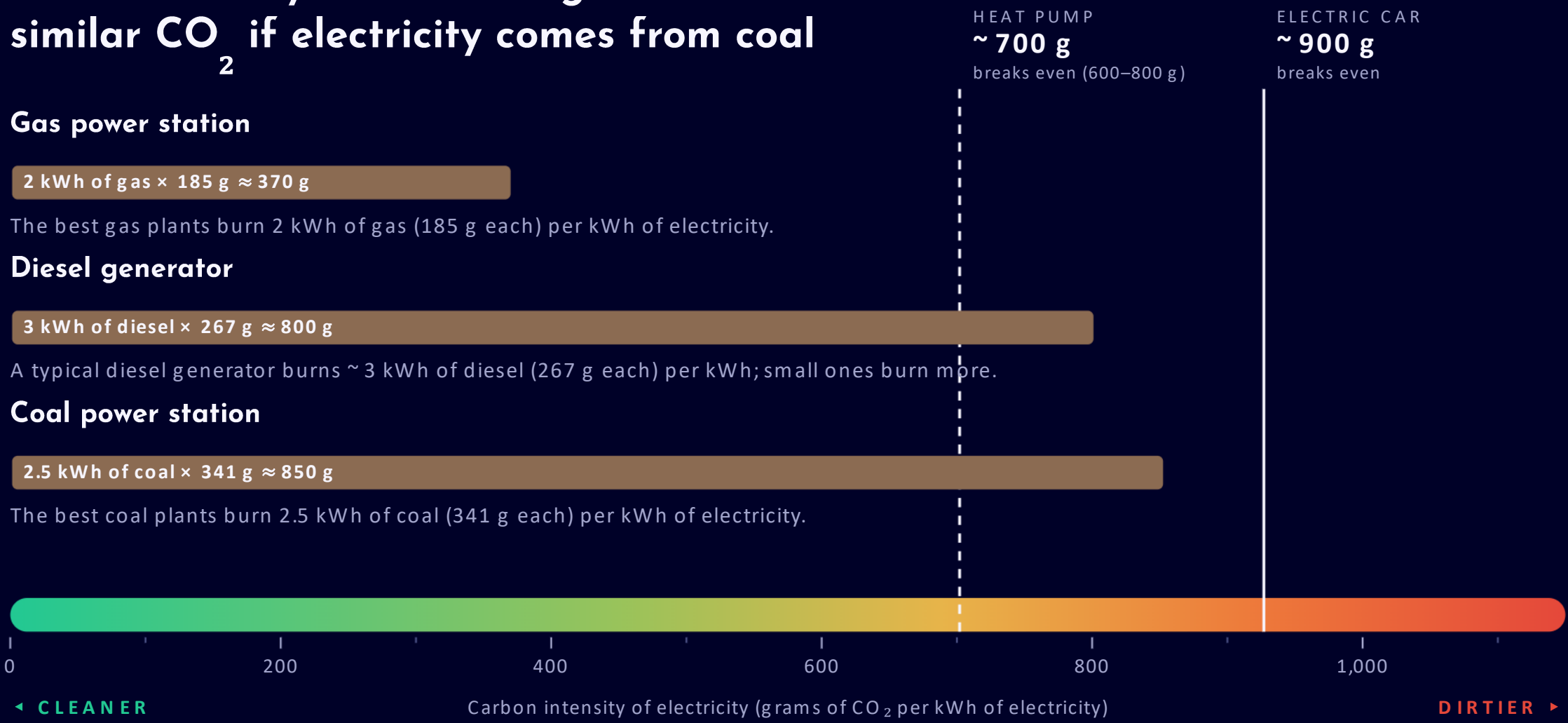
Electricity grids are already much cleaner than 10 years ago



...and electricity will keep getting cleaner through the lifetime of electric technologies

Data: yearly electricity data, 2015–2025

Efficient electrification is cleaner even if all electricity comes from gas – and similar CO_2 if electricity comes from coal

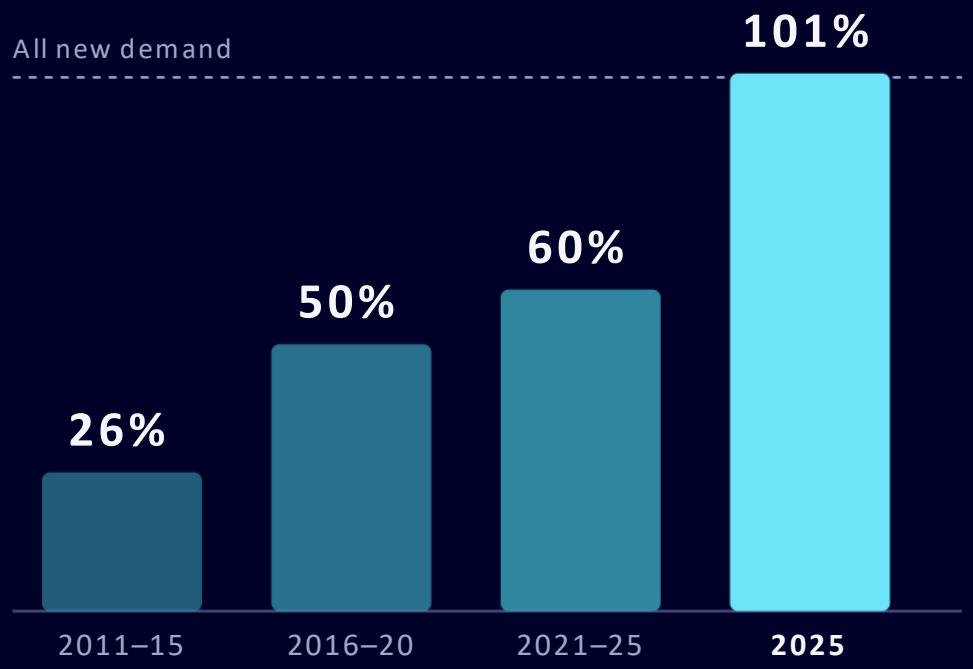


Combustion CO_2 only. Diesel: 74.1 kg CO_2/GJ (IPCC), ~ 33% generator efficiency

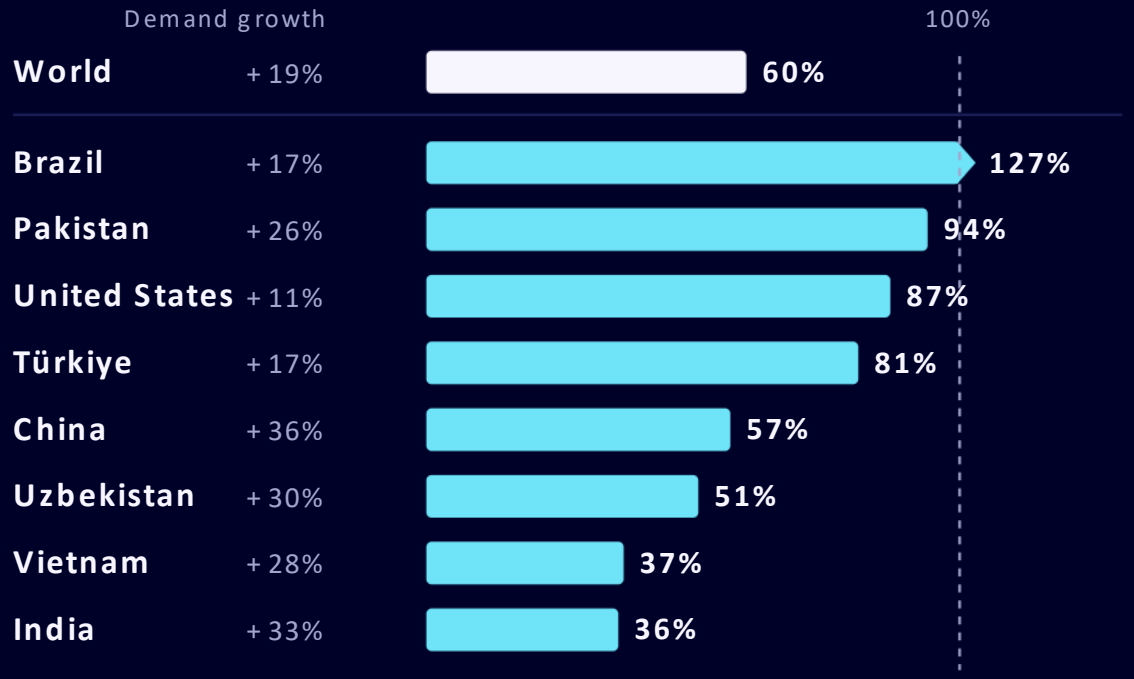
Electrification spurs more renewables

Wind and solar now meet most new electricity demand, and in 2025 they met all of it.

World: share of electricity demand growth met by wind and solar



Countries with rising demand, 2021-2025: share of electricity demand growth met by wind and solar



How to read: India's demand grew 33% from 2020 to 2025, and wind and solar met 36% of that growth.

Source: Ember yearly electricity data (September 2026); Ember analysis.

Clever electrification can make renewables integration cheaper

EVs

Charge EVs when it's sunny

Smart charging moves car charging to the middle of the day, soaking up solar that would otherwise be wasted.

HEAT PUMPS

Preheat your home when electricity is plentiful

A well-insulated home holds its heat for hours, so a heat pump can run when wind and solar are strong.

EVs

Keep EVs plugged in to balance the grid

Parked cars can pause charging or send power back, acting as a giant battery on wheels.

HEAT STORAGE

Store heat, not just electricity

Hot-water tanks and thermal stores are a cheap way to bank spare renewable power.

TARIFFS

Pay less when power is cheap

Time-of-use tariffs reward homes and businesses for using electricity when it is plentiful.

COOLING

Cool buildings with the sun

Air conditioning peaks on sunny afternoons, just when solar output is highest.

Plus: More electricity use spreads the grid's fixed costs over more units, lowering costs for everyone and encouraging more electrification.

Ideas from IRENA (2023), Innovation landscape for smart electrification

Electrifying now unlocks immediate benefits that can scale over time

01
EVs cut CO_2 on any grid below ~900 g/kWh, heat pumps below ~600-800 g

They use 3–4× less energy than petrol cars and gas boilers.

02
Over 99% of people live where an EV already cuts CO_2

And ~95% where a heat pump does.

03
On the world's average grid, an EV halves CO_2

The world's electricity is 42% clean, averaging 461 g/kWh.

04
Grids are getting cleaner every year

So every EV and heat pump gets cleaner through its life.

05
Electrification spurs renewables, and can make them cheaper to integrate

Electrify now, and build clean power alongside it.

Analysis by Dave Jones, Ember (2026)