

Electricity

- With every added share of RE the price of electricity goes up!

Pause. Does this make sense to you?

The price of electricity creates ripples across our entire society. It goes up, everything gets dearer and harder. For businesses and people alike.

Global phenomenon.

You see it often reported in media as “Network constraints”.

If you add RE to our legacy grids, you will introduce three problems.

Congestion, instability and timing problems.

Congestion means curtailment. We will immediately get a higher price of electricity.

And then we have to compensate for all three problems by upgrading and expanding our grid. This raises the price of electricity PLUS it will increase our taxes.

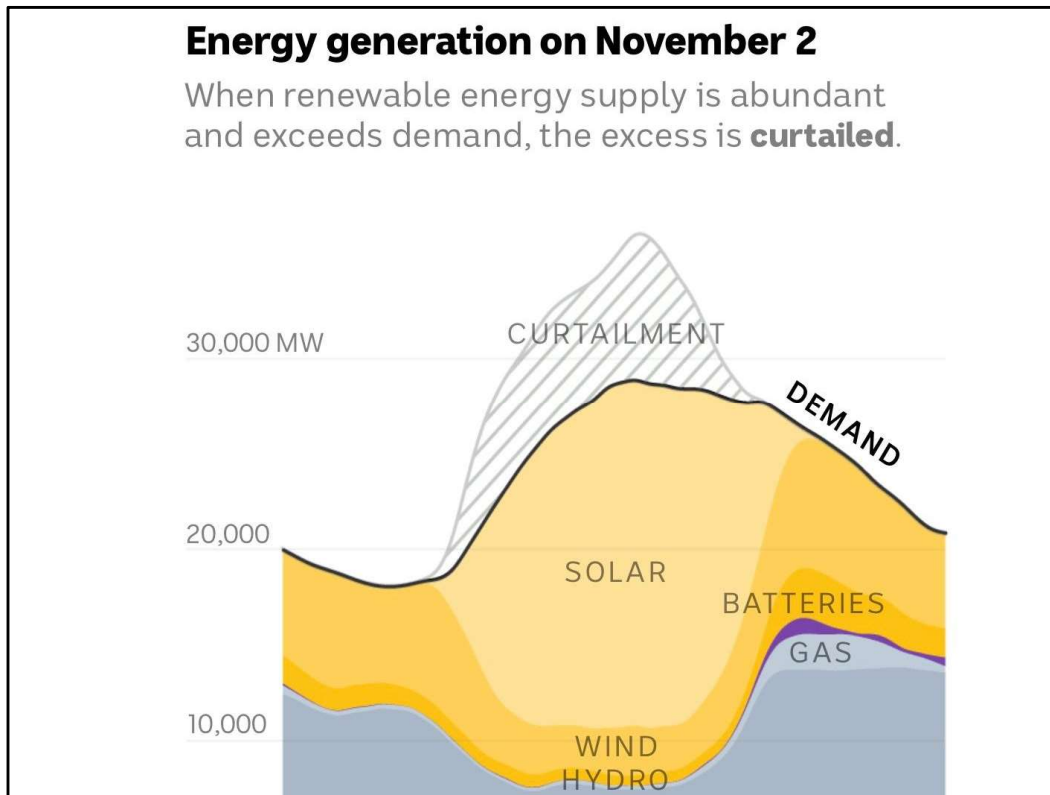
This is what you would call an “inverse investment”. Every dollar into this projects means you have to pay more now and even more in the future.

When did some last suggested to you to join a project going for a reverse investment.

They are pretty rare.

But, it is happening here, right before our eyes.

The reason no one talks about it perhaps?



Graphic representation of curtailment.

Shows the NEM. We have a lot of solar in Australia. 35% to 65% curtailment.
<https://www.pv-magazine-australia.com/2025/07/14/aemo-forecasts-increased-solar-curtailment-in-nem/>

Scotland has the same problem with wind, 37% curtailment.
<https://www.theferret.scot/why-are-scottish-wind-farms-paid-billions-to-switch-off/>

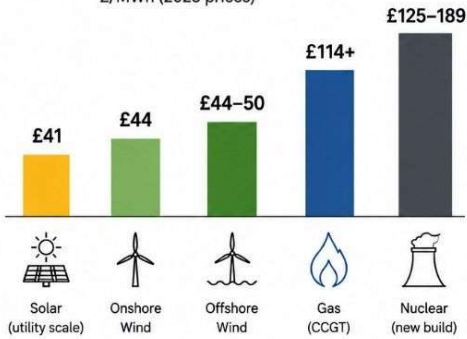
“This means that only 63% of the energy which could have been generated made it to the grid.”
<https://felicitymartin.substack.com/p/why-we-dont-need-more-wind-turbines>

What Is the Real Price of UK Wind and Solar?

Cheap to generate. More to build a reliable system.

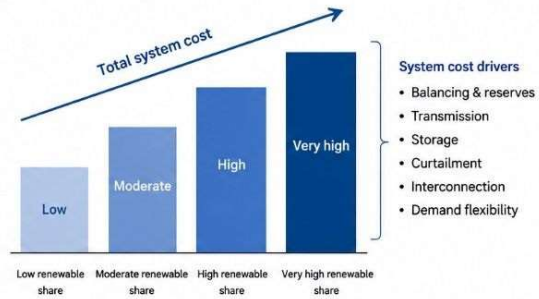
1. GENERATION COSTS (LCOE)

Average cost to produce electricity
£/MWh (2025 prices)



2. SYSTEM COSTS

Additional costs increase as more wind and solar
are added to the system.



Wind and solar are low-cost sources of electricity,
but the *real price* is what it costs to build a reliable, secure, low-carbon system around them.

And this is how Tom Baxter in the UK described the phenomenon on LinkedIn on the 17 May.

Grid A

- Becomes more **expensive** and **unreliable** the more renewable energy we put into it.
- With every addition of RE, the **transition becomes slower.**
- **Can never become 100% RE**

Grid B

- Becomes less expensive and more reliable the more renewable energy we put into it.
 - Will become 100% RE
 - Speeds up the transition as every step forward becomes easier and cheaper.

Grid A

- Becomes more expensive and unreliable the more renewable energy we put into it.
- With every addition of RE, the transition becomes slower.
- Can never become 100% RE

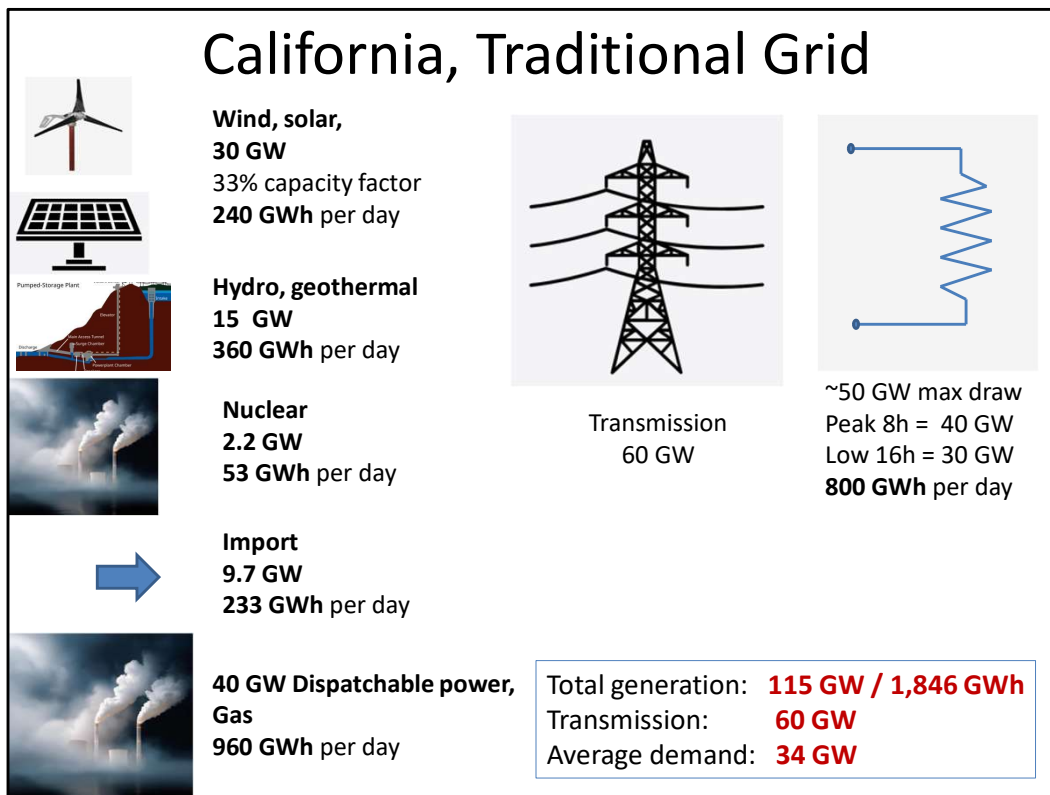
Grid B

- Becomes less expensive and more reliable the more renewable energy we put into it.
- Will become 100% RE
- Speeds up the transition as every step forward becomes easier and cheaper.

Which one do we want?

Do we want the grid that gives us everything we want?

Or do we want the grid that gives us everything we don't want?



Installed capacity in 2018 80 GW

AI:

Total In-State Capacity Mix

California's installed generation capacity is dominated by natural gas and an aggressively expanding portfolio of clean energy technologies: [1, 2]

Natural Gas: ~35–40 GW (serving as the primary base-load and grid-balancing resource)

Solar (Utility-scale): ~21 GW

Large Hydroelectric: ~12 GW

Wind: ~6–8 GW

Geothermal: ~3 GW

Nuclear: ~2.2 GW (via the Diablo Canyon Power Plant)

Battery Storage: >15 GW [1, 2, 3]

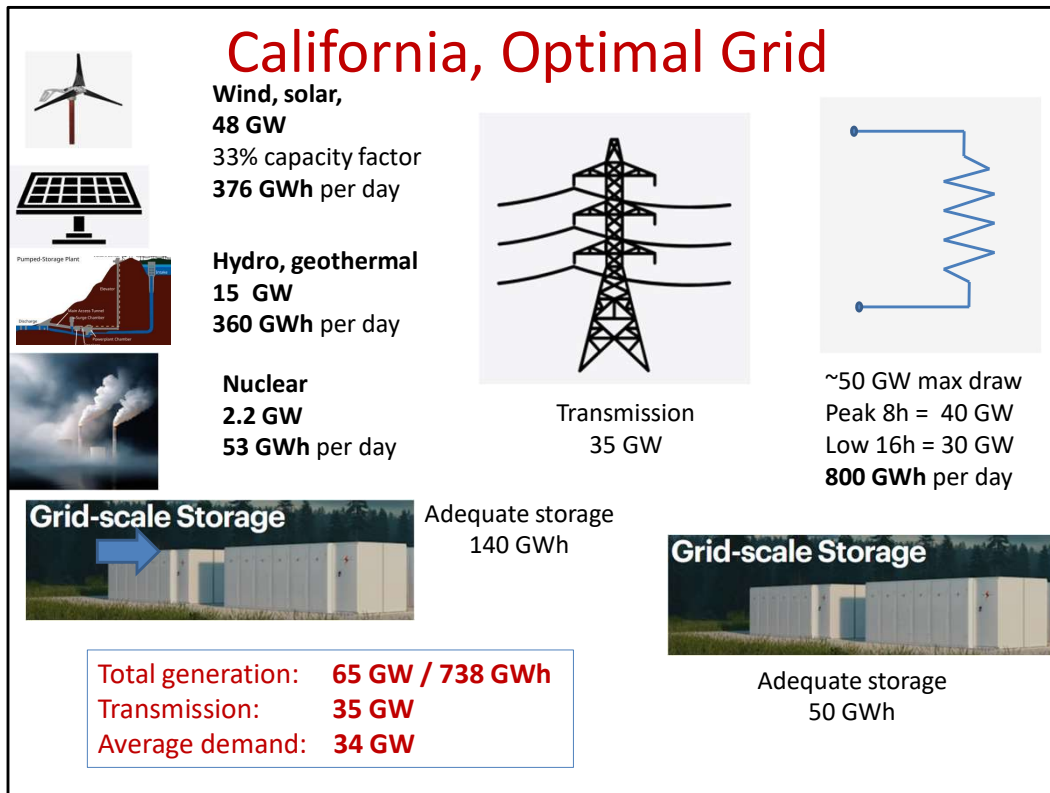
= 40+21+12+8+3+2.2 = 86.2 GW

California imports about **30% to 33%** of its total electricity supply, making it the largest net importer of electricity of any U.S. state. In total, the state relies on out-of-state grids for around **80 to 85 Terawatt-hours (TWh)** annually to meet its total demand of roughly 278 TWh

Total capacity = 87 + 28 (import) = 115 GW = ~1,000 TWh

Demand = 290 TWh => **767 GWh average** daily demand = 33 GW average demand

<https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/california-electrical-energy-generation>



Adequate storage:

Production side:

Surplus: $(65.2 - 34) \times 8 = 31.2 \times 8 = 250$ GWh -> storage

Draw from storage:

Available power over 16 hours = $360 + 53 = 413$ GWh or 25.8 GW.

Deficit = $34 - 25.8 = 8.2$ GW $16 \times 8.2 = 132$ GWh required from storage.

Annual production **291 TWh** (Annual demand = 288 TWh)

Demand side:

8 hours of 40 GW demand will require $8 \times (40 - 34) = 48$ GWh from storage

16h will add $16 \times 4 = 64$ GWh into our storage.

Required storage = 50 GWh

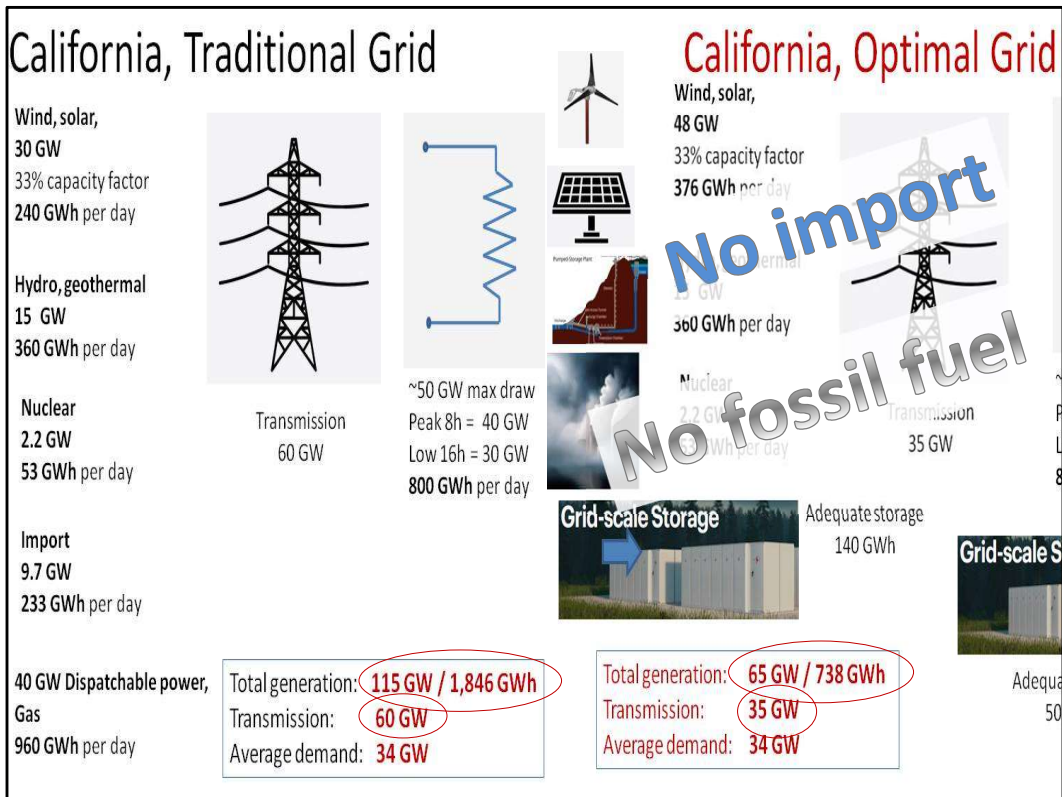
Production 120 GW excess, 8 hours per day = 960 GWh into storage.

60 GW from storage over 16 hours = 960 GWh

Total demand = 1,400 GWh

Demand 75 GW over 8 hours. 15 GW to be covered by storage = 120 GWh

16h with 10 GW less than average demand = 160 GWh into storage.



Even though we have a lower capacity factor in the Optimal Grid, we are still able to meet demand with a lower generation than in the Traditional Grid!

And almost half the transmission, equipment and land!

And NO fossil fuel and NO import!

Seasonal variations 30%

30-50% seasonal variations.

+/- 15%

TWh annual demand. Storage needs to cover 6 months 20% = $\frac{1}{2} \times 0.2 =$ TWh

Adequate seasonal storage
for the German grid

29 TWhrs

29,000 sq. kms. of Li-ion batteries

To counter seasonal variations, how much storage would we need?
About 1 month worth.

1 GWh LI-ion covers about 1 sq. km.

1 TWh => 1,000 sq. kms.

80 TWh => 80,000 sq. kms.

Adequate storage in the UK grid with
Hydrogen

58 TWhrs

= 390 Costco warehouses

Underground

“Costco warehouse” for international reference.

Underground.

We can dig holes, we can bore tunnels.

We wouldn't even see this.

Costco in Ardeer = 16,653 sq m x 10 m = 166,530 cu. m.

A ten m cube holds 40 tonnes at 700 bar = 1.33 MWh

166.5 cubes = 220 GWh

34 TWh => 154 Costco warehouses filled with 700 bar H2

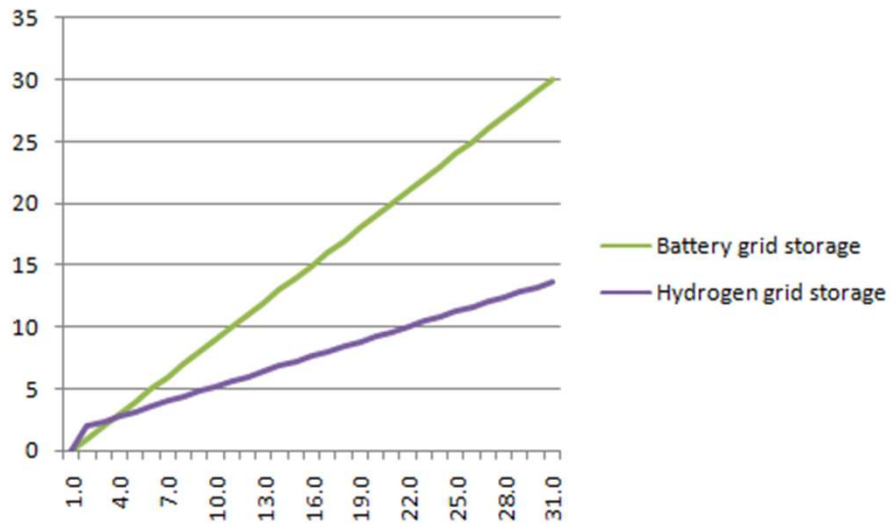
Bunnings is approx. 10,000 sq.m.

About 200 Bunnings warehouses.

Pilot for 90 tonnes underground H2 storage in Germany:

<https://www.hydrogenfuelnews.com/hydrogen-storage-pilot-at-etzel-completes-90-tonnes-underground-filling/>

Battery vs hydrogen grid storage CAPEX



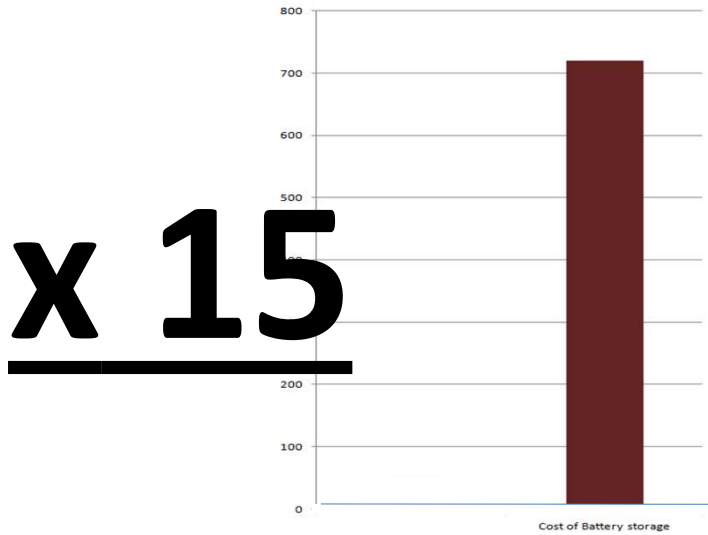
Batteries are simple. If we need twice the storage, we need to double the amount of batteries.

Hydrogen storage however, has three components:

Electrolysers, fuel cells and a tank.

Now to the interesting view, OPEX:

Battery vs hydrogen grid storage OPEX



The hydrogen storage will provide electricity competitive with the cheapest generation.

The difference here comes from that when it comes to ongoing costs, we are essentially comparing a 720 hour battery solution with a 16 hour hydrogen solution.

The Optimal Grid will give us:

- ✓ Cheaper price of electricity
- ✓ Lower taxes
- ✓ Accelerated transition to renewable energy
- ✓ Pathway to RE growth,
RE fuels
and renewable energy security.

And it won't cost a cent to kick it off ...

It won't cost anything to kick it off because there will already be projects in the pipeline, generation, transmission, equipment and land that will simply become redundant on the day we decide to for for the Optimal Grid.
A bit like getting our first solar panel for free.

Finally:

If renewable energy is worth going for, then surely cheap RE is better?



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