

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.

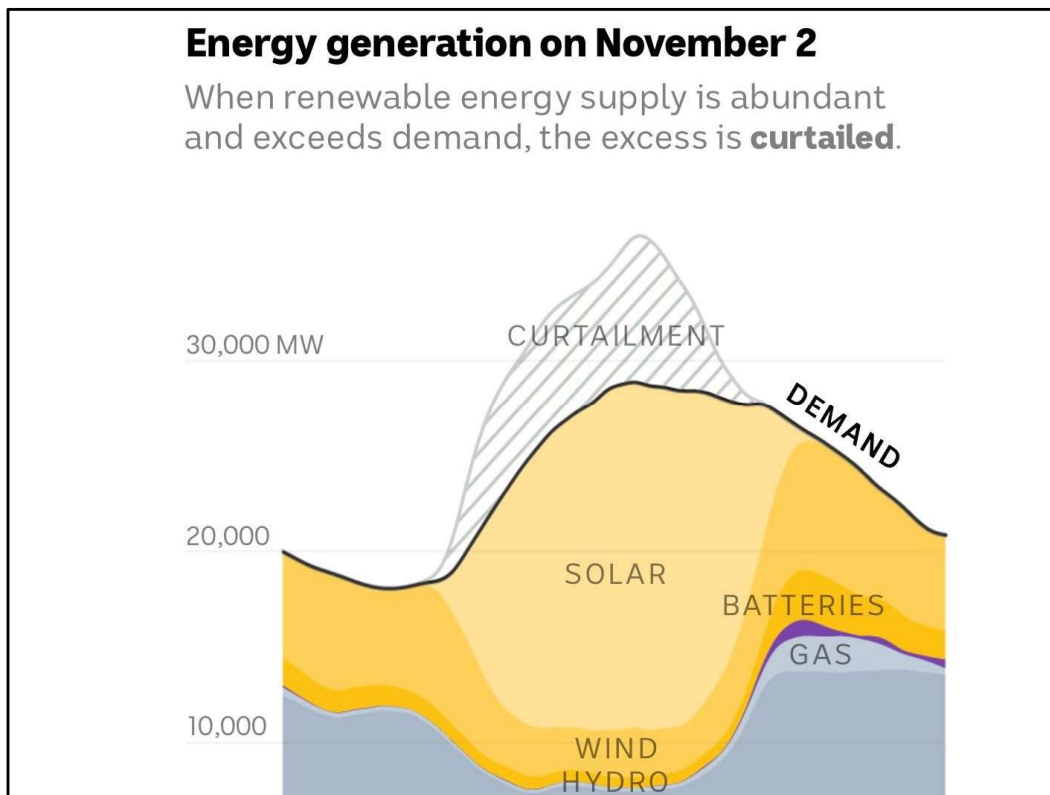
This is what you would call an “inverse investment”. Every dollar into this projects means you have to pay more now and even more in the future.

When was the last time someone suggested that you join a project going for a reverse investment?

They are pretty rare.

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

May that be the reason no one talks about it?



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/>

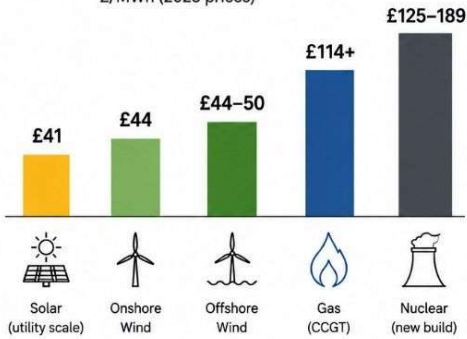
“This means that only 63% of the energy which could have been generated made it to the grid.”
<https://felicitymartin.substack.com/p/why-we-dont-need-more-wind-turbines>

What Is the Real Price of UK Wind and Solar?

Cheap to generate. More to build a reliable system.

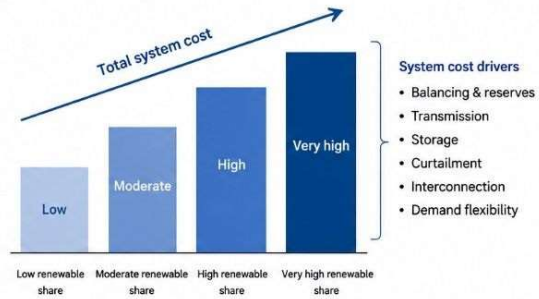
1. GENERATION COSTS (LCOE)

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

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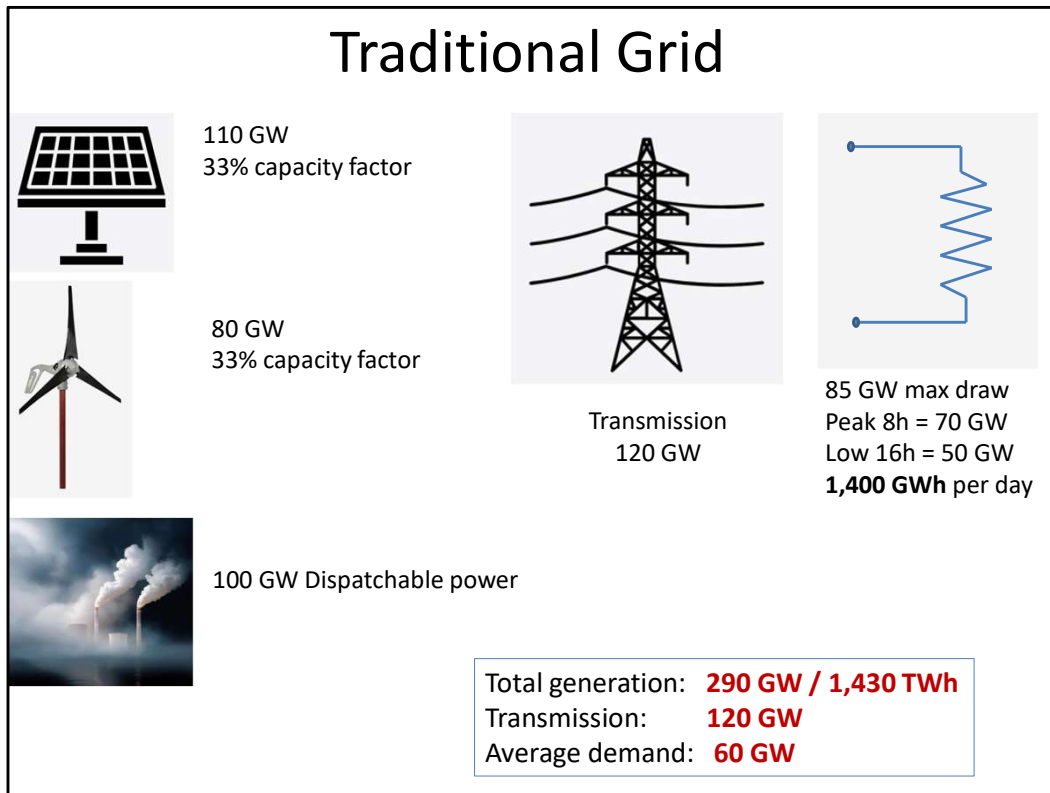
Grid B

- 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 generation 2026 = 280,000 MW
 Total annual production = 1,430 TWh

Dispatchable power Coal 15,308+14,808MW = 30,116MW, Hydro 9,402MW+5,542MW= 14,944MW, Gas 35,619MW, Other conventional 9,680MW, Biofuel 8,771MW = 99,500 MW

Solar = 103,260 MW

Wind = 67,693+9,226 = 77,000 MW

<https://www.smard.de/page/en/wiki-article/5884/6038/installed-generation-capacity>

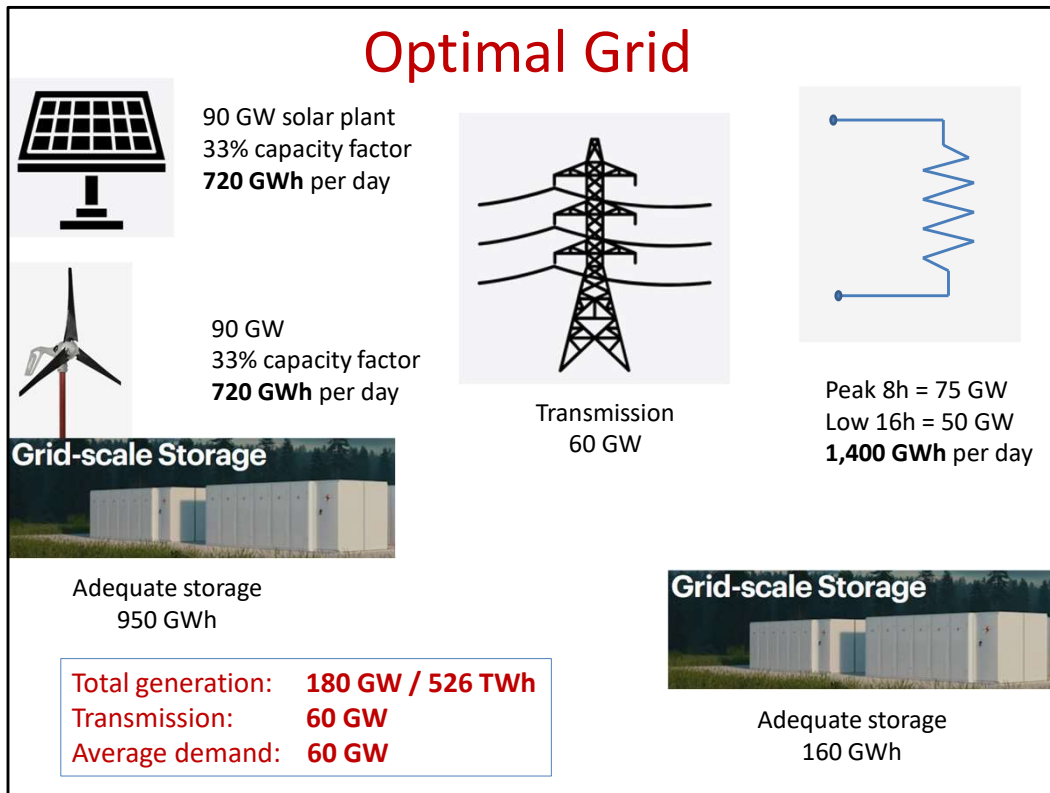
507.5TWh production in 2025 => **60 GW average demand.**

Peak demand ~ 85 GW

Total generation = 100 GW + 190/3 = 163 GW = 3.92 TWh per day = 1,430 annually.

<https://www.destatis.de/EN/Themes/Economic-Sectors-Enterprises/Energy/Production/Tables/gross-electricity-production.html>

Trad RE = 550 TWh
Dispatchable = 880 TWh
Total = 1,430 TWh



Total annual production = $180 \times 0.33 \times 24 \times 365 = 525.6$ TWh

Production side:

8h x 180 GW = 1,440 GWh

66% to storage = 950 GWh

Demand side:

Peak needs 8x 15 GW = 120 GWh from storage

Low demand provides 16x 10 GW to storage = 160 GWh

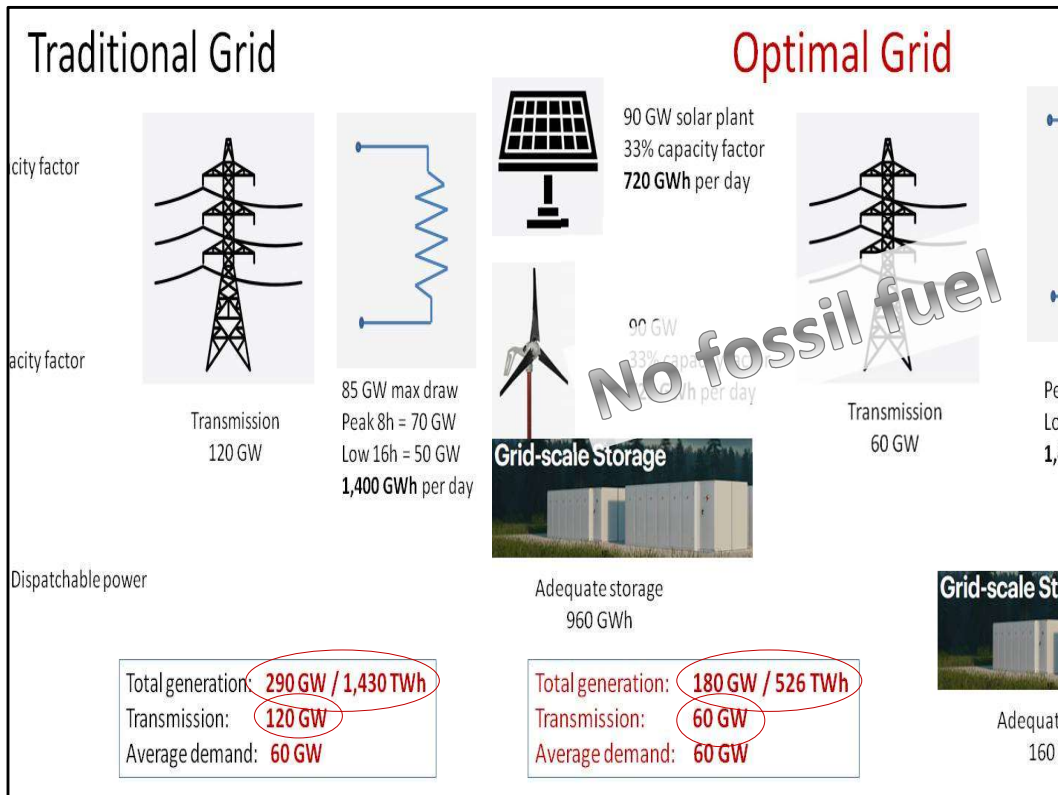
Production 120 GW excess, 8 hours per day = 960 GWh into storage.

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.



Annual production capacity in the traditional grid is almost 3 times that of the Optimal Grid.
A lot of waste!

Transmission, equipment and land are twice that of the optimal grid.
Big savings to be had!

Seasonal variations and “Dunkelflaute”

Generally 10-15% seasonal variation

510 TWh annual demand, 15%, +/- 8% => storage need = 8% x 510 = 80 TWh

Adequate seasonal storage
for the German grid:

80 TWhrs

80,000 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 German grid with
Hydrogen

160 TWhrs

= 535 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

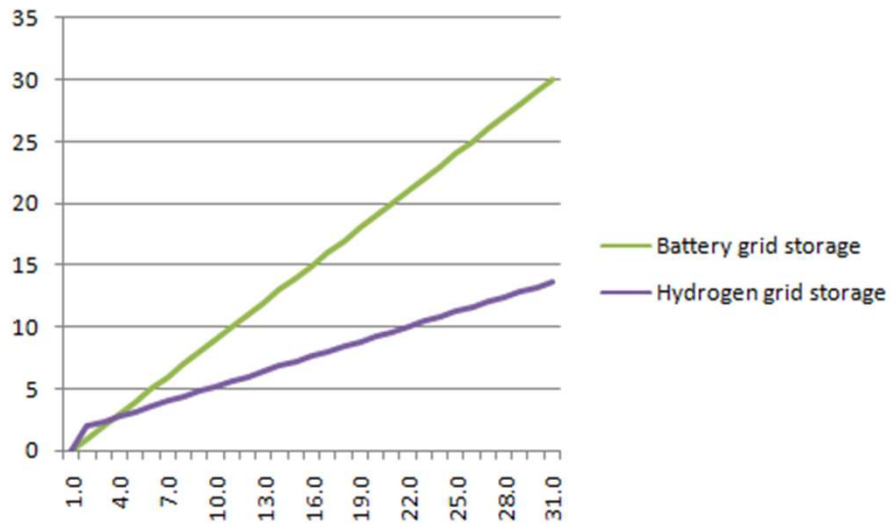
Bunnings is approx. 10,000 sq.m.

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

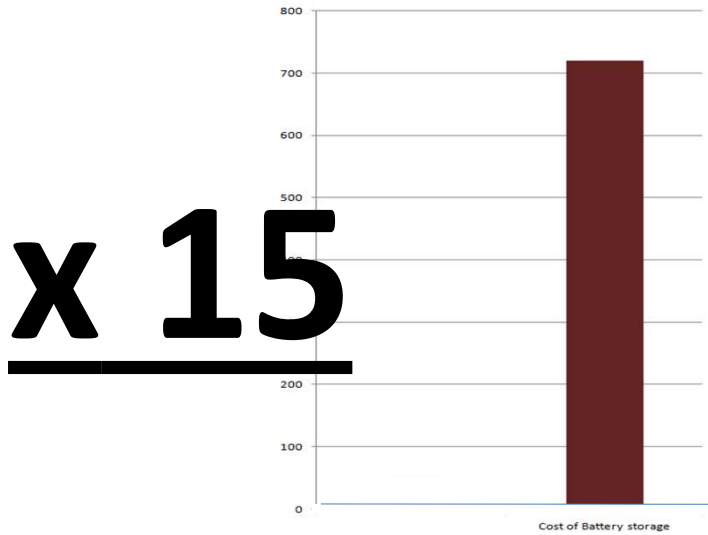


Batteries are simple. If we need twice the storage, we need to double the amount of batteries.

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 grid expansion projects in the pipeline, generation, transmission, equipment and land, that will simply become redundant on the day we decide to go for the Optimal Grid and so that funding will be freed up.

A bit like getting your first solar panel for free.

Finally:

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



You will find all supporting data and calculations on:

theoptimalgrid.com

Together with case studies for Australia, Sweden, Germany, UK and California.