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US Electricity Demand is Rising Faster than US Electricity Supply

We offer a strategic solution to mitigate the challenge and create jobs

The US Department of Energy Should Read this White Paper!

June 8, 2026

By William Strauss, PhD

Introduction

One June 4, 2026, the US Department of Energy (DOE) announced that it will provide $350 million to build and/or support four coal fueled power stations[1]. In their statements, both the Secretary of Energy and the Under Secretary of Energy referenced jobs in the coal mining sector along with grid resilience and affordability as motivators for the government's actions. At a White House event, also on June 4, it was announced that government support for the coal sector will be even more at $800 million[2].

As this white paper will make clear, the US needs to significantly increase generation capacity; and it must happen quickly. This challenge is amplified by the aging baseload fleets of power plants. Nearly 200 coal-fired generating units representing over 105 gigawatts (GW[3]) of capacity are scheduled to retire: most of them between now and 2030. Others will likely be scheduled to retire in the next decade. The actions of the DOE and the White House (if implemented) will impact only a few stations.

The loss of capacity from retirements is contrasted with a massive increase in demand. Even if there are no retirements in the aging nuclear or hydro generation fleets, a gap of between 1,260 to 2,500 terawatt-hours (TWh) of needed capacity exists between today's output and expected demand 9 years from now in 2035[4].

To put that in perspective, a 1,000 MW power generating unit (typical for a nuclear station) running at 85% capacity will produce about 7.5 TWh's per year.

In this context, the government's support to build and keep power stations operating makes sense.

However, if jobs are a part of the decision-making process (as was illustrated in the DOE statements), the "pellet fuel" strategy described in more detail later in this paper and in the appendix yields much better results (see Figure 1 below which shows the number of jobs needed to supply fuel to a 1,000 MW power generating station).

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[1] See HERE.
[2] See HERE.
[3] One Terawatt (TW) = 1000 gigawatts (GW's). 1 GW = 1,000 megawatts (MW's). One MW = 1,000 kilowatts (kW's). One kW = 1,000 watts.
[4] The range is based on the difference between the median and the 80th percentile estimates for US power demand in 2035. See Table 2.

Furthermore, the strategy offered in this paper is just as important for rural areas that are seeing their jobs in the forestry sector disappear as it is for rural areas that are seeing coal mining jobs disappear.

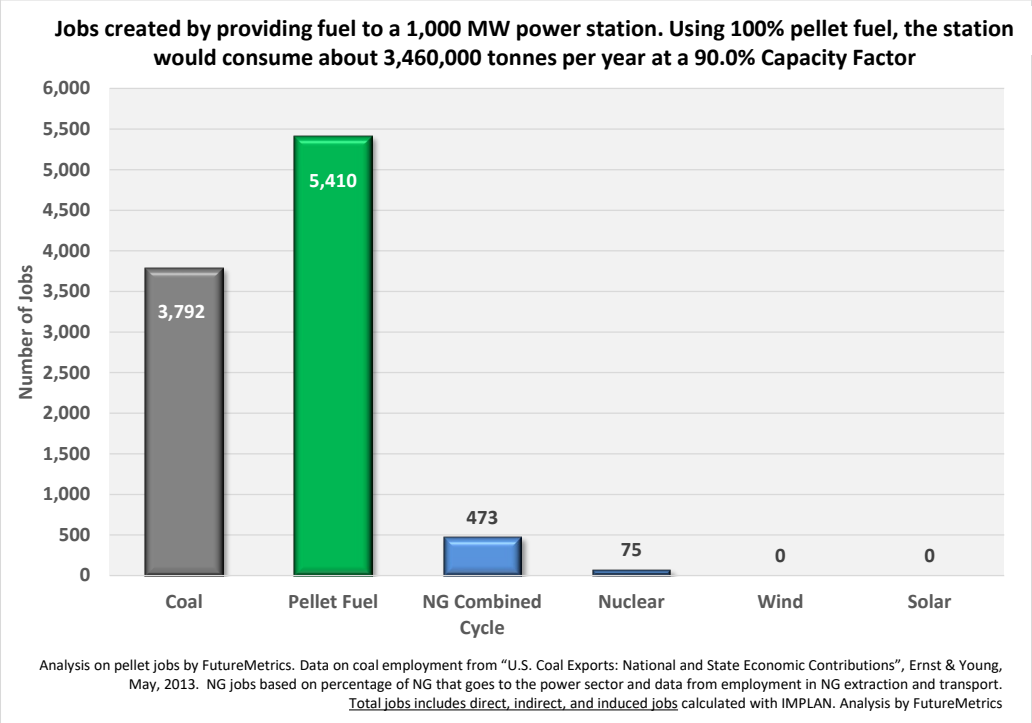

Figure 1 - Jobs Created to Supply Fuel to a One Gigawatt Generating Station

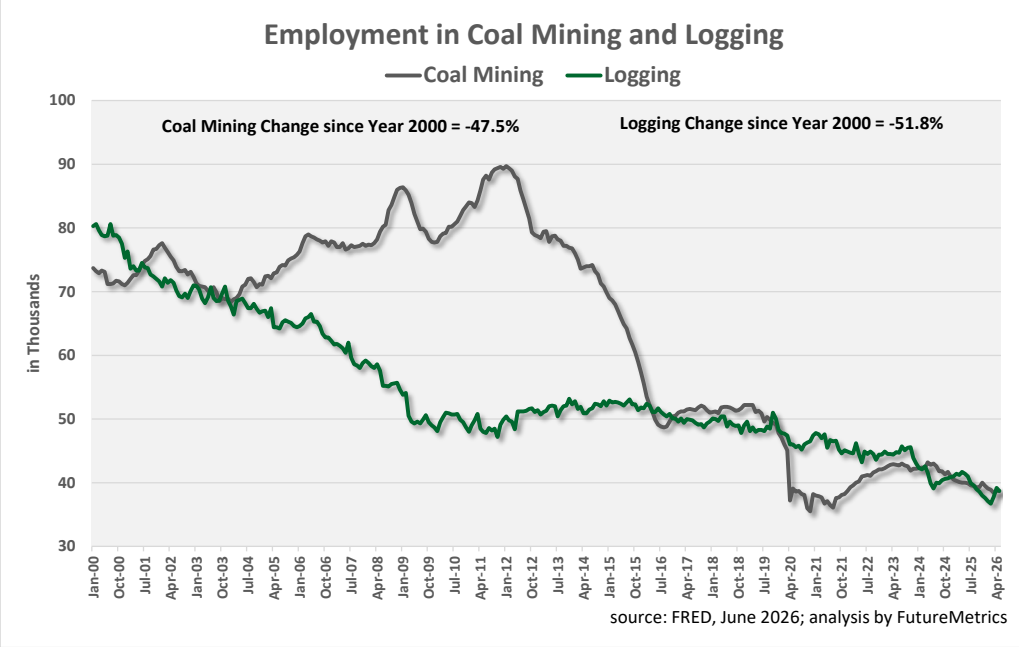

Figure 2 - Employment in Coal Mining and Logging

It is not just jobs that matter. The need for 24x7 baseload power is growing rapidly.

As is shown below when comparing Table 1 and Table 2, the pace of the build-out for hyperscale datacenters is accelerating. And despite current US policy, the electrification of cars and trucks in the US will likely catch up with global trends by 2035.

The supply and demand challenges for power are described on the following pages.

Part of the solution is a strategy that is rational, pragmatic, and is deployable now. That strategy, in summary, is to replace coal in a select number of existing utility scale generating stations with US-produced fully compatible competitively priced replacement solid fuel that is produced from perpetually renewing forest resources. The result is the much needed 24x7 baseload power and significant job support.

There are almost 200 planned coal fueled generation retirements in the pipeline (see Figure 7). The current DOE policy mentioned in the opening paragraph is for four units. There are plenty of other planned retirements that could be candidates for a coal replacement conversion.

For the cost of building one new coal station, five to ten existing stations could be modified to use domestically produced coal replacement solid fuel[5].

The DOE, in parallel with saving "coal supply" jobs, should promulgate another program for saving the "wood supply" jobs that are also disappearing.

Those jobs, just like coal mining jobs, would provide fuel for the traditional power generation sector that will help to keep the lights on and mitigate the looming scarcity in the power sector.

Government support should be for the modifications to the existing coal-fired generating units. That would be a much better return on investment than building new coal stations. Datacenter operators should then step up and commit to buying the baseload "green" power for a long term at a price that works for the producer and the datacenter. That will also take pressure off of costs to general ratepayers.

The first question asked when shown this option is: Won't this strategy destroy our forests? Sustainability must be the foundation of the regulations for what is acceptable as fuel and what is not. This story makes no sense if the forest resources are not perpetually renewing. These safeguards, via third party auditing, are already in place for the existing global trade of pellet fuel[6]. And, as the appendix shows, sustainability is already baked into the forest products industry. The same primary resources that produce lumber, flooring, Amazon boxes, toilet paper, and many other products we take for granted also produce the inputs for pellet fuel production. If one is against producing wood pellets, then one should be against, amongst many other things, producing bathroom tissue!

[5] The cost of modification depends on the design of the unit, the type of coal that will be replaced, and whether the replacement fuel is traditional "white" pellets or upgraded "black" pellets.
[6] Fore example see https://sbp-cert.org/

Those industries' business models depend on perpetually renewing raw materials derived from managed forests (tree farms). And while carbon emissions are currently not part of the US decision making process, sustainably sourced bioresource derived fuel is highly carbon emissions beneficial[7]. That will matter to some datacenter operators.

Can US electricity supply rise to the challenge?

We do not pretend to have a solution to the overarching challenge. But we do have good ideas for how to keep some coal stations operating – just with a different but fully compatible solid fuel.

The overarching challenge is described in some detail below.

Demand for power in the US in 2035

There are two tables below. Table 1 is from FutureMetrics analysis in done August 2025. Table 2 is the same table but with updated estimates on growth in power demand from data centers, vehicle electrification, and the replacement of fossil fuel used for heating with electric heat pumps.

In less than one year the forecasts for US demand in 2035 have increased by about 8% over the forecast for 2035 from about a year ago. The accelerating pace of the build out for AI, and the expected increase in the electrification of cars and trucks and heating systems, continues to surprise analysts.

US Electricity Demand in 2035 - August 2025 Forecast

Scenario	Total 2035 Demand	Increase from 2025 Demand	Total Demand % Increase from 2025 to 2035	Data Centers & AI in 2035	Data Centers % of Total in 2035	Transport Electrification in 2035	Transport % of Total in 2035	Cooling and Heating in 2035	Heating and Cooling % of Total in 2035
Median	5,140	780	15.2%	450	8.8%	400	7.8%	75	1.5%
80th Percentile	6,200	1,840	29.7%	1,075	17.3%	700	11.3%	350	5.6%

Sources: EPRI "Scaling Intelligence: The Exponential Growth of AI's Power Needs" Augist 2025, EIA, 2025; Analysis by FutureMetrics

Table 1 – August 2025 Forecast for US Electricity Demand 2035

US Electricity Demand in 2035 - June 2026 Forecast

	Total 2035 Demand (TWh)	Increase from 2025 Demand (TWh)	Total Demand % Increase from 2025 to 2035	Data Centers & AI in 2035 (TWh)	Data Centers % of Total in 2035	Transport Electrification in 2035 (TWh)	Transport % of Total in 2035	Heating & Cooling in 2035 (TWh)	Heating & Cooling % of Total in 2035
Median	5,450	1,255	23.0%	700	12.80%	450	8.30%	125	2.3%
80th Percentile	6,700	2,505	37.4%	1,300	19.40%	800	11.90%	400	6.0%

Souces: EPRI "Powering Intelligence 2026. EIA 2026; Analysis by FutureMetrics

Table 2 – June 2026 Forecast for US Electricity Demand in 2035

[7] FutureMetrics has several white papers on this topic free to download from the FutureMetrics website.

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The forecasts for power demand growth have consistently been too low. Therefore, this analysis will use the 80th percentile estimate for 2035 US demand: 6,700 TWh's. Even at the median 2035 forecast there is still a significant gap to fill between current supply and future demand.

As Table 2 shows, total electricity demand potentially will increase by 37% in the next 10 years.

Supply of Power in the US

Figure 3 below illustrates the current baseload and/or on-demand utility-scale thermal generation capacity (natural gas, nuclear, and coal) in the US. Thermal generation means that fuel is used. For nuclear and coal plants, the fuel makes heat that makes steam and the steam drives steam turbines and generators. Natural gas typically powers a combustion turbine (essentially a jet engine) and the shaft power spins the generator. Many natural gas units also make steam from the hot exhaust of the combustion turbine, and that steam spins a steam turbine. This is called combined cycle and is significantly more efficient than a simple cycle plant.

Figure 3 shows that the known retiring coal units will subtract about 105.7 GW's (about 18%) of the total on-demand thermal generation capacity from the US's current capacity to produce electricity.

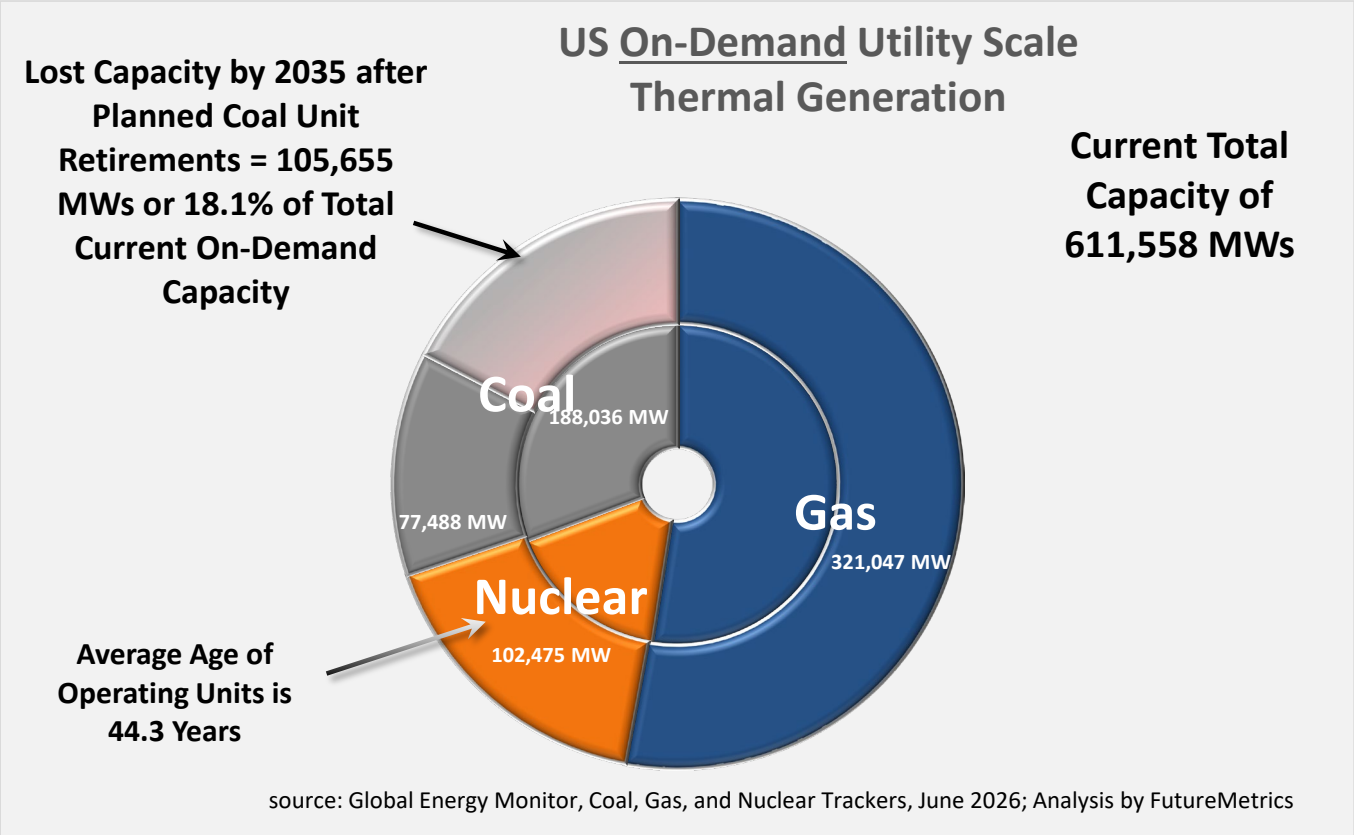

Figure 3 - Current On-Demand Thermal Generating Capacity

Wind and solar generation are not "on-demand". And due to the nature of nature, they are variable and intermittent. The goal over the next decades is to build buffer energy storage that can convert intermittent and

variable into a more reliable and consistent supply[8]. Someday that system may be classified as "on-demand"[9]. For this analysis, we assume that thermal generation will remain the foundation for reliable baseload generation.

Using data from the US Energy Information Administration for the average capacity factors, Table 3 shows the current effective total average US supply in terawatt-hours after subtracting the planned coal station retirements.

2026 Totals After Announced Coal Station Retirments

	Capacity (MW's)	Average Capacity Factor	Effective Supply (MW's)	Supply in TWh's
On-Demand Thermal	501,010	85%	425,858	3,731
Solar	152,875	25%	38,219	335
Wind	157,594	34%	53,582	469
Hydro	95,379	37%	35,290	309
		TOTAL	**552,949**	**4,844**

source: Global Tracker for Wind, Solar, Gas, Nuclear, and Coal; US EIA, US DOE, June 2026; Analysis by FutureMetrics

Table 3 - Effective Supply from All Utility Scale Generation AFTER Subtracting Coal Station Retirements

The gap from the 2035 estimate for demand in Table 2 is about 1,855 TWh's. Using the weighted average of the capacity factors, that is equivalent to about **350 GW's of needed new capacity by 2035.**

Power generated from biomass is not included in the accounting in Figure 3 or Table 3 because the total capacity for biomass generated power in the US that is available to the grid is only about 4,180 MW's[10]. This is about 0.44% of the total capacity of the sum of current capacity (excluding paper mill waste, as most of the power generated from pulp and paper mill waste is used internally by those mills). In other words, biomass for generating power to the grid in the US is currently insignificant.

Contrast that with other nations which are far more advanced in using sustainably sourced bioresources for power generation.

As an example, in the UK biomass (in the form of wood pellet fuel) has been producing on average around 11% of England's power for a number of years. What were once coal fueled power stations have replaced 100% of the coal input with pellet fuel. See Figure 4 for a snapshot of the UK power supply mix and note the baseload contribution of pellet fueled generation almost matches nuclear in scale and consistency.

[8] See slide #7 in the appendix.
[9] As solar and wind increase and so-called "spinning assets" decline, if there are rapid change in demand, frequency control becomes more challenging. There is inertia and rapid responce in spinning assets that does not exist with wind and solar generation. To prevent the potential for load shedding and widespread outages, solving this issue is critical if the goal is for most of the power to be from wind and solar generation.
[10] To see the locations of the plants and data on each, use this map.

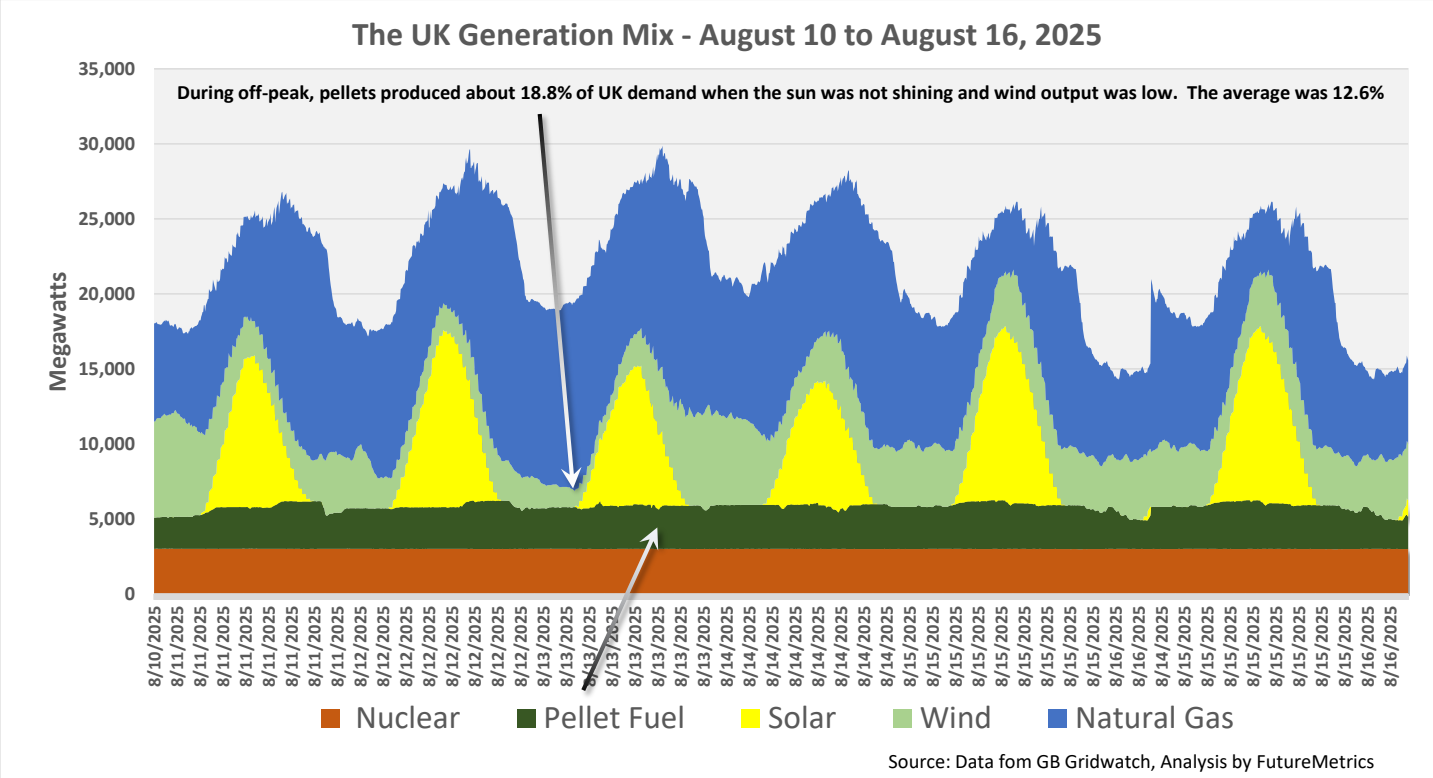

Figure 4 - UK Generation Mix Weel of August 10. 2025

Hydroelectric generation capacity in the US is significant at about 95 GW's[11]. About 35 GW's of new hydro capacity is in "pre-construction" status with a median start year of 2032[12]. It is unclear as to how many of those "pre-construction" phase projects will be built. There is increasing uncertainty about precipitation amounts, reservoir levels, and run-of-river rates.

As Figure 5 below shows, of the 411 operating hydro stations in the US, only 10 have been built in the past 30 years. The total capacity of those 10 new stations is about 2,250 MW's.

[11] To view the locations of the hydro plants and data on each, use this map.
[12] From Global Hydroelectric Tracker, June 2026.

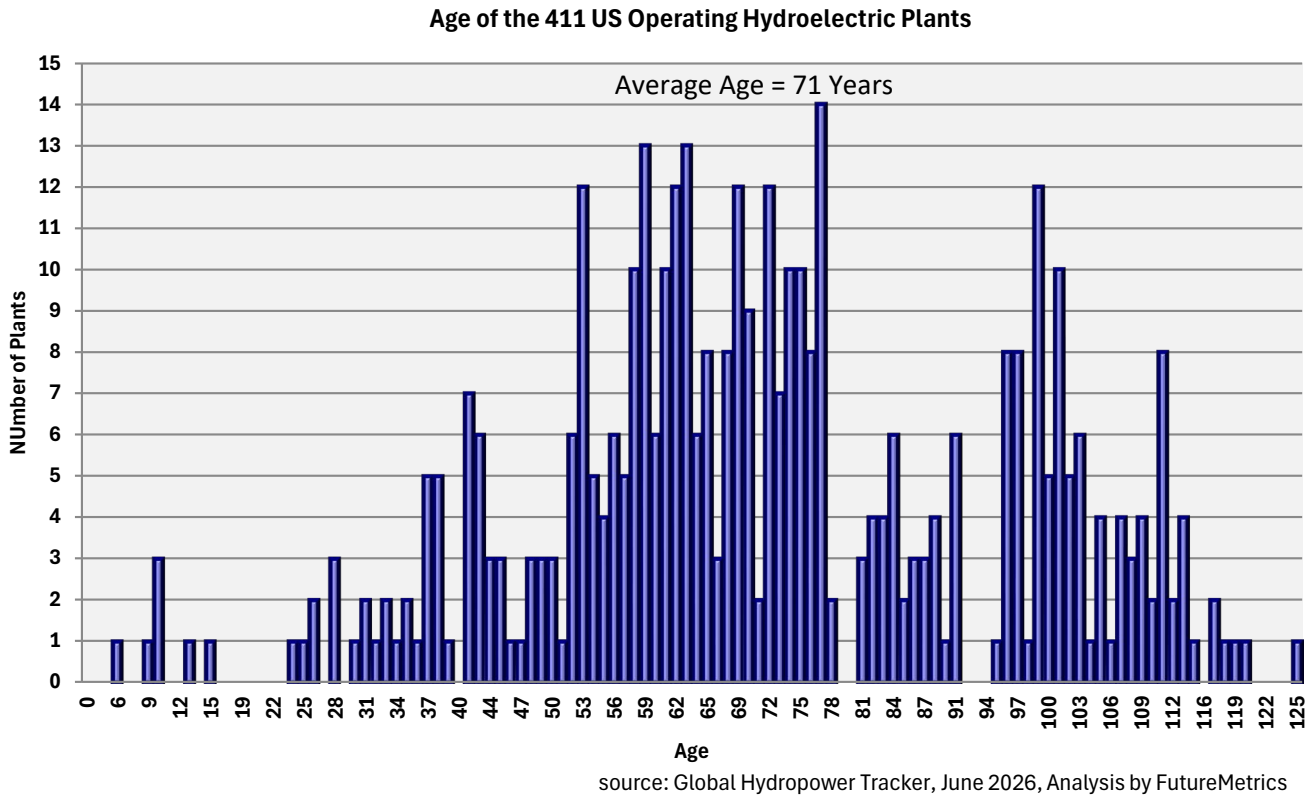

Figure 5 - US Hydroelectric Generating Capacity

The average age of operating hydroelectric plants is about 71 years. Many are much older. There are 55 hydro plants that are over 100 years old. Those still operating centenarian plants still have the capacity to produce about 4,100 MW's.

New hydro will not fill the coming gap between demand and supply.

The advanced age of the generation assets is not limited to hydro. Coal and nuclear generation assets in the US are also quite old.

Figure 6 shows the age distribution of US coal fueled power units[13]. As noted in the chart, the average age of currently operating units is about 46 years.

[13] Coal stations often have more than one generating unit.

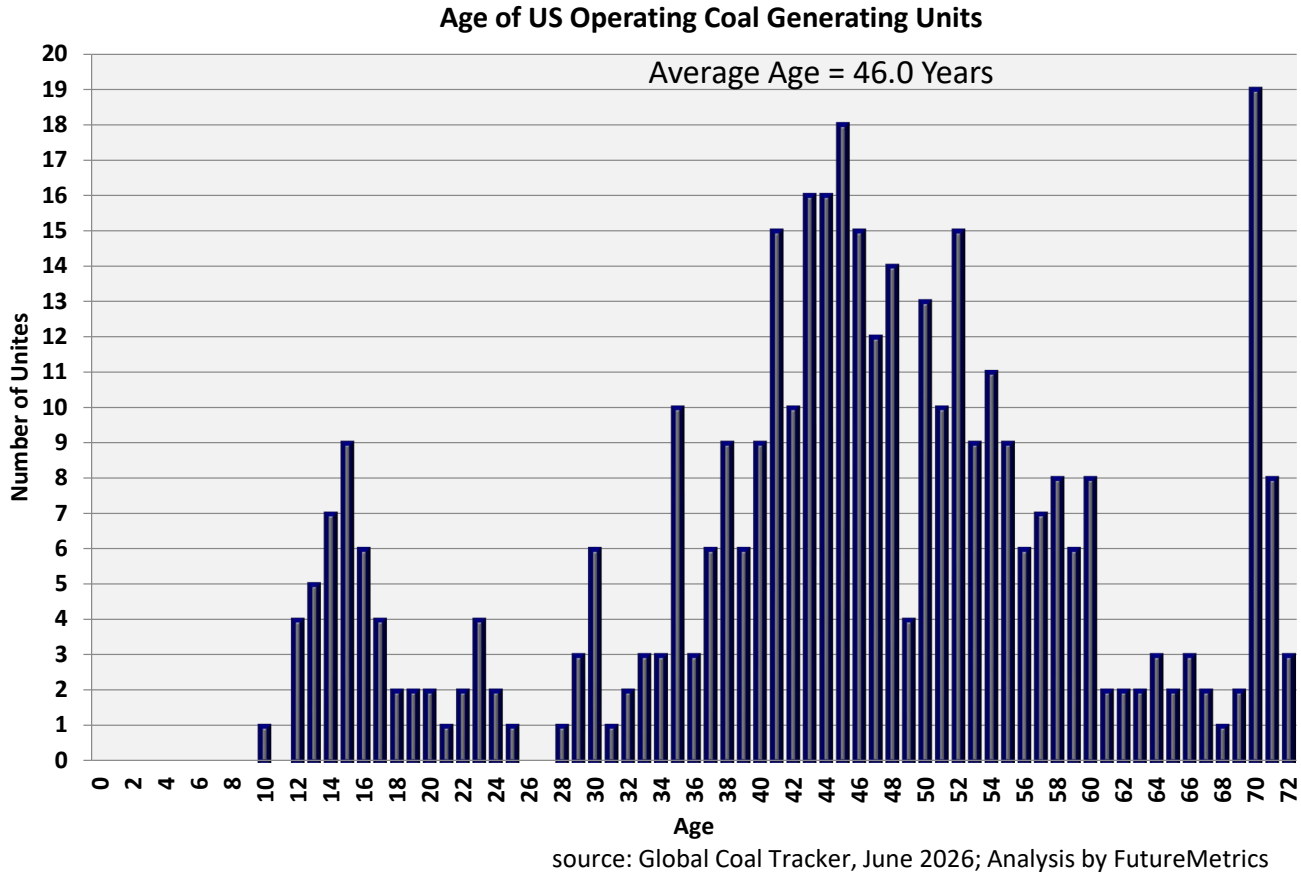

Figure 6 - Age of US Currently Operating Coal Generating Units

The large spikes at around age 70 years old are mostly from a number of Tennessee Valley Authority (TVA) projects that started producing electricity in 1954 and 1955[14]. Those plants continue to produce power.

However, as noted earlier in this white paper, almost 200 coal fueled generating units are scheduled to retire in the next few years. The median retirement date for the announced closures is just a few years away: it is 2029. See Figure 7 below.

[14] Rapid expansion of the power transmission and distribution systems in post-world war II caused the demand for electricity to outstrip TVA's capacity to produce power from hydroelectric dams. As a result, TVA began building coal-fired plants, and by 1955, coal surpassed hydropower as the system's primary power source. https://www.tva.com/about-tva/our-history/1950s

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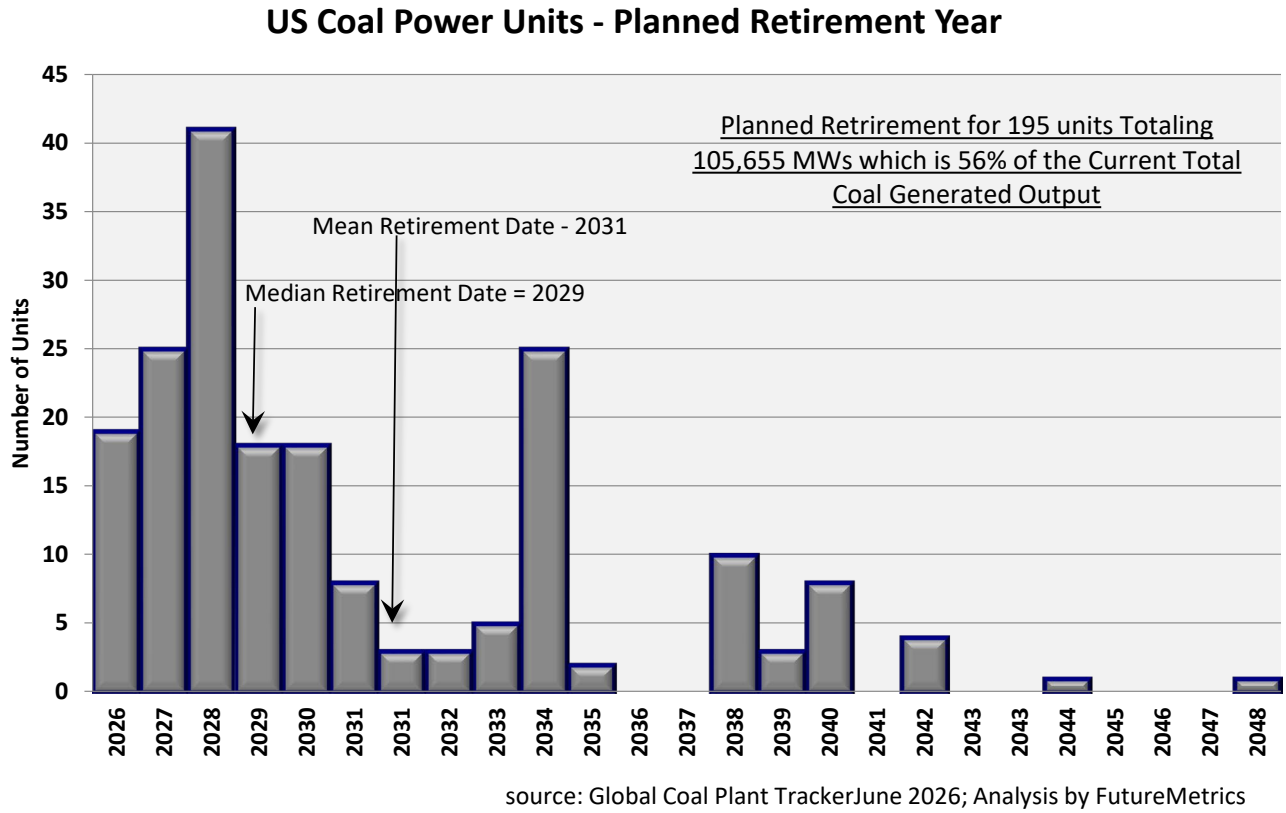

Figure 7 - Planned Announced Retirement Years for US Coal Power Generating Units

The capacity that will be lost from those coal fueled units that are retiring by the end of 2028 is about 46,000 MW's.

The supply and demand mismatch challenge at the core of this analysis is in part because a significant portion of baseload generation is dropping out while there is a huge increase in electricity demand between now and 2035.

Nuclear power also faces aging challenges. The average age of a nuke plant is about 44 years (see Figure 8).

Currently there are about 58 announced nuclear power projects[15]. Most are small modular reactors (SMR) with a median size of about 77 MW's. There are just two large scale units in "pre construction" phase[16].

Current total pre-construction plus announced new nuclear capacity is about 15,040 MW's. At an assumed 85% capacity factor, and assuming they all get built, that is about 112 TWh's. Recall from Table 2 that the expected needed new output by 2035 is about 2,500 TWh's. Even if they all come into operation, this will not fill the gap!

[15] From Global Nuclear Power Tracker, September 2025 release.
[16] Turkey Point in south Florida.is listed in the Global Nuclear Power Tracker as having units 6 and 7 (1,250 MW each) begin operations in 2027 and 2028. Authorization was given in 2018 (see HERE). But satellite imagery shows no construction at Turkey Point. See HERE.

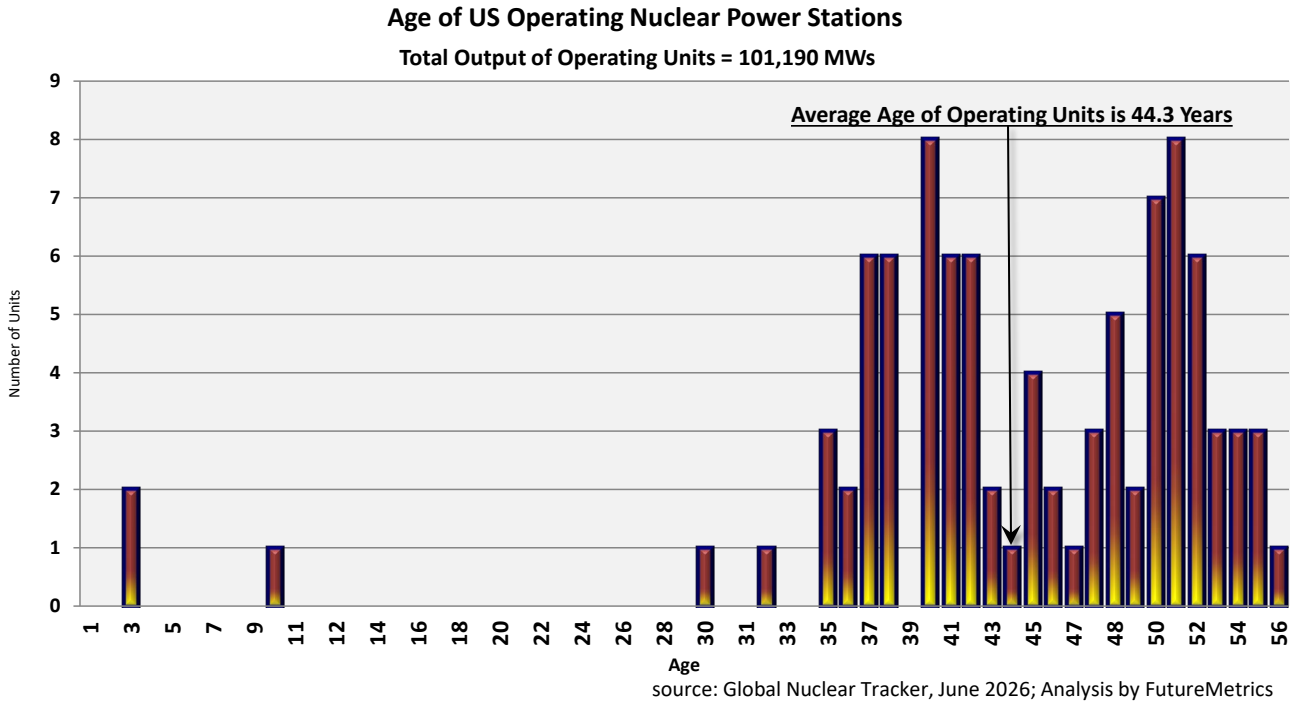

Figure 8 - Age of US Operating Nuclear Power Stations

The US will likely increase its nuclear power generation capacity over the coming decades. This is a rational strategy for low carbon baseload power. Time will tell as to how quickly these goals are met. But it should be noted that the levelized cost of electricity from nuclear generation is significantly higher than any other option discussed in this paper.

Finally. within the definition of "thermal" on-demand generation, there is natural gas (NG).

As Figure 3 shows, natural gas generation currently dominates the US electricity power supply. It also dominates the announced new capacity. Table 4 below shows that there are 305 projects in the pipeline totaling about 152 gigawatts of capacity. This is compared to the 215 projects in the pipeline totaling about 92.5 GW's about a year ago. There is a massive and accelerating rush to build new NG generation that has led to long lead times for new NG turbines.

Of the 305 up and coming units, 179 are simple cycle and 126 are combined cycle.

Natural Gas Electricty Generation Projects

Capacity (MW's)	Number of Projects	Status
15,242	43	Under Construction - Average start date = September, 2026
105,933	192	In Pre-Construction Phase - Average start date = January, 2028
30,866	70	Announced - Average start date = January, 2029
152,040	**305**	**<==Totals**

source: Global Oil and Gas Plant Tracker, June 2026; Analysis by FutureMetrics

Table 4 - Announced New US Natural Gas Generation

Simple cycle plants can be brought online quickly and are typically used to provide power at peak demand loads when the more efficient baseload generation is insufficient to meet demand. Their capacity factors are on average about 15% (that is, they are called to operate only about 15% of the hours in a year).

According to the US Energy Information Administration[17], the average capacity factor for combined cycle plants is between 50% and 70%. Based on these data, the 305 new NG power stations will add an effective 152 GW's of new supply by the end of the decade. Using the average capacity factors, they will contribute about 540 TWh's per year to the grid.

New US Natural Gas Fueled Electricity Suppy

	Capacity (GW's)	Average Capacity Factor	Effective Supply (GW's)	TWh's Supply/year
Simple Cycle	65.6	15%	9.8	86
Combined Cycle	86.4	60%	51.8	454
		TOTAL =>	**61.7**	**540**

source: Global Oil and Gas Plant Tracker, June 2026; EIA data on average capacity factors; Analysis by FutureMetrics

Table 5 - New Natural Gas Fueled Electricity Supply

Note also that if jobs are part of the decision-making process for policy, as Figure 1 shows, supplying fuel to a natural gas generating station is not job intensive.

[17] See HERE.

We see that there is lots more NG, much less coal, maybe more nuclear power, possibly some new hydro, and (despite policy headwinds) more wind and solar. But the net of all that is that the expected increase in demand will far outpace the expected increase in supply!

Using data from the Global Energy Monitor[18], we have added to the existing capacity the announced new capacity that is expected to be built for each major source of generation. The electricity supply build up is shown in Figure 9 below.

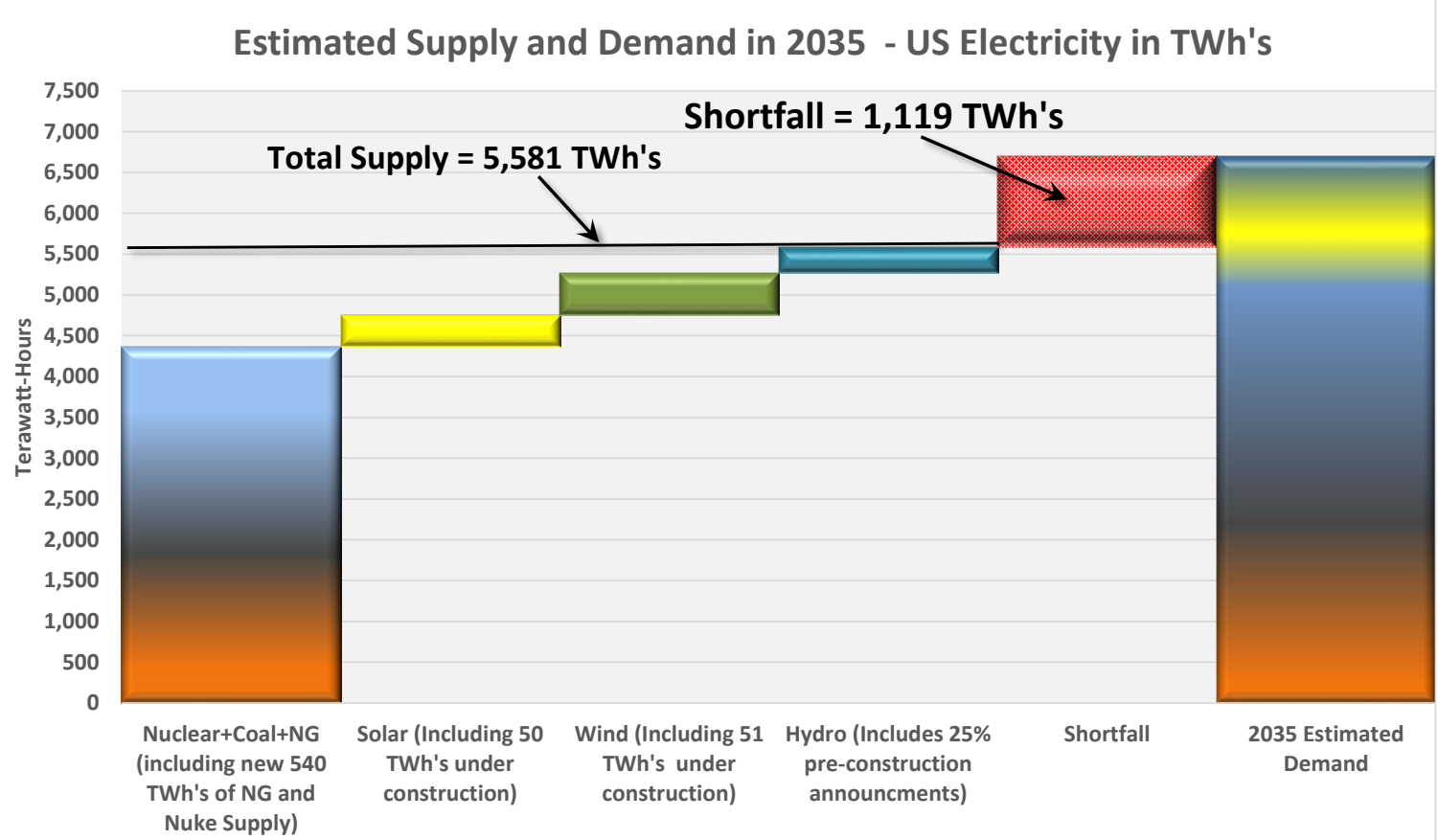

Figure 9 - Electricity Supply Build Up Versus Demand

Based on this analysis, the US still needs to install generating capacity that can produce almost 1,120 TWh's per year by 2035.

Given current US policy that is stalling wind and solar generation, we have only included those wind and solar projects that are under construction. 54 GW's of wind are in the pre-construction phase and may be built before

[18] Homepage is HERE.

2035. If added that would lower the estimated shortfall by about 160 TWh's. About 77 GW's of solar is in pre-construction. Those, if built, will take another 168 TWh's off the estimated shortfall.

If wind and solar projects that are currently in the development pipeline are encouraged to proceed and are built the shortfall would be lowered to about 790 TWh's (about a 30% improvement).

There is no doubt that new projects that are not currently known will emerge to try to fill the gap. But the challenge is daunting.

The prospect for shortages is troubling. The excess demand and insufficient supply will put significant upward pressure on power prices[19]. Scarcity in the power sector is usually a condition relegated to developing nations. Prolonged scarcity of any essential good or service generates social unrest.

We will not see hundreds of new 1 GW nuclear power stations built in the next 9 years. Perhaps if policy changes, more wind and solar generation will be deployed.

While natural gas is currently the "go to" solution, it is unlikely that natural gas will fully fill the gap for the following reasons.

First, lead times from conception to operation for new NG combined cycle plants are currently at least 5 or more years[20]. To hit the 2035 mark, a massive number of projects would have to be out of the gate in the next few years. The flood would likely push lead times on turbine delivery out farther. The build-out probably will not happen fast enough.

Second: What are the constraints on natural gas production and distribution in the US? We are not experts in this area but it would seem that the rapid increase in NG demand would require higher extraction rates and perhaps investment in new pipelines. The increase in demand and the costs associated with the increased needs for extraction infrastructure would likely put upward pressure on NG prices. This would not only make power generation more costly, but it would also impact the millions that heat their homes and businesses with NG.

And third, NG is a fossil fuel. And fossil fuels are a depleting resource. Peak NG is inevitable (when we hit peak in the US is highly uncertain – EIA forecasts peak supply in 2032![21]).

➔Is it strategically wise to depend heavily on an energy source that will become increasingly scarce?

[19] See HERE in which the authors suggest both households and industry will pay much higher prices for their electricity.
[20] See HERE.
[21] See HERE.

What is the Solution?

If data and AI center growth combined with the electrification of transportation and the growth in heat pumps, not only happens as currently predicted, but, as has been the case in recent years, is underpredicted, then the goal for supply to equal demand is a moving target. Even with the increased supply coming online, the expected demand is growing too fast to make a significant dent in the supply/demand gap. As the gap between supply and demand increases, Econ 101 tells us that this will push the cost of electricity for everyone higher.

We hope that a pathway emerges that achieves a solution with optimal outcomes for everyone. But it seems, that to achieve success, either miracles happen on the supply side, or the demand for power from AI and the general electrification across the transportation and heating sectors will be much less than currently forecast (a combination of the two could be needed!).

Now for the good news: There is something that can be done to mitigate the shortfall and produce competitively priced and reliable baseload power and support jobs in struggling rural areas in the US.

How about Renewable Baseload Power that Can be Deployed at Scale almost Immediately?

The solution is to not close some coal fueled generating units (and not remove them from the supply base). Convert those existing utility scale power stations that use coal to a compatible coal-replacement solid fuel produced from the by-products (used to be called "wastes") of the industries that produce lumber, paper, and many other common products made from wood (more on sourcing and sustainability in the appendix at the end of this paper). The upgraded and densified coal-replacement solid fuel may have the low-tech name of "wood pellets", but with minor, or in some cases no modification to a large utility power boiler, it can seamlessly replace coal.

The modifications needed to switch from coal to pellet fuel are modest, they are very low cost compared to building new generation capacity, and they require minimum or no downtime while the modifications are being implemented at the power plant.

Figure 4 shows how the UK has replaced coal with pellet fuel with great success for supplying baseload power. Interestingly, the UK imports the majority of its coal-replacement solid fuel from the US. About 80% of the 9.8 million tonnes of pellet fuel imported into England in 2025 were from the US[22].

But if some coal stations in the US do what has been done in England, where will the pellet fuel come from if so much of US production is being shipped overseas?

The answer to that question is: From the US from those pellet fuel manufacturing plants that are currently supplying England with wood pellets - because pellet fuel demand from England is about to drop significantly.

The US exported over 10,000,000 metric tonnes of pellet fuel in 2025 and FutureMetrics forecasts that the US will export almost 11,000,000 metric tonnes in 2026. That is going to change in 2027. The UK's policy is evolving and in

[22] This is shown on the interactive Sankey map at the FutureMetrics website. Direct link is HERE.

April 2027 it will shift to the so-called "bridge" policy[23]. The change in UK government policy is part of the transition from subsidizing the price paid for power to increased support for the price of carbon via BECCS (bioenergy carbon capture and storage). The change is also a response to the how the UK's supply of power and demand for power are highly seasonal (much higher demand in winter months but much lower solar generation).

The policy change will result in a drop in UK demand for wood pellets of nearly 5,000,000 tonnes per year beginning in April 2027. A significant portion (~80%) of the drop will impact current US suppliers.

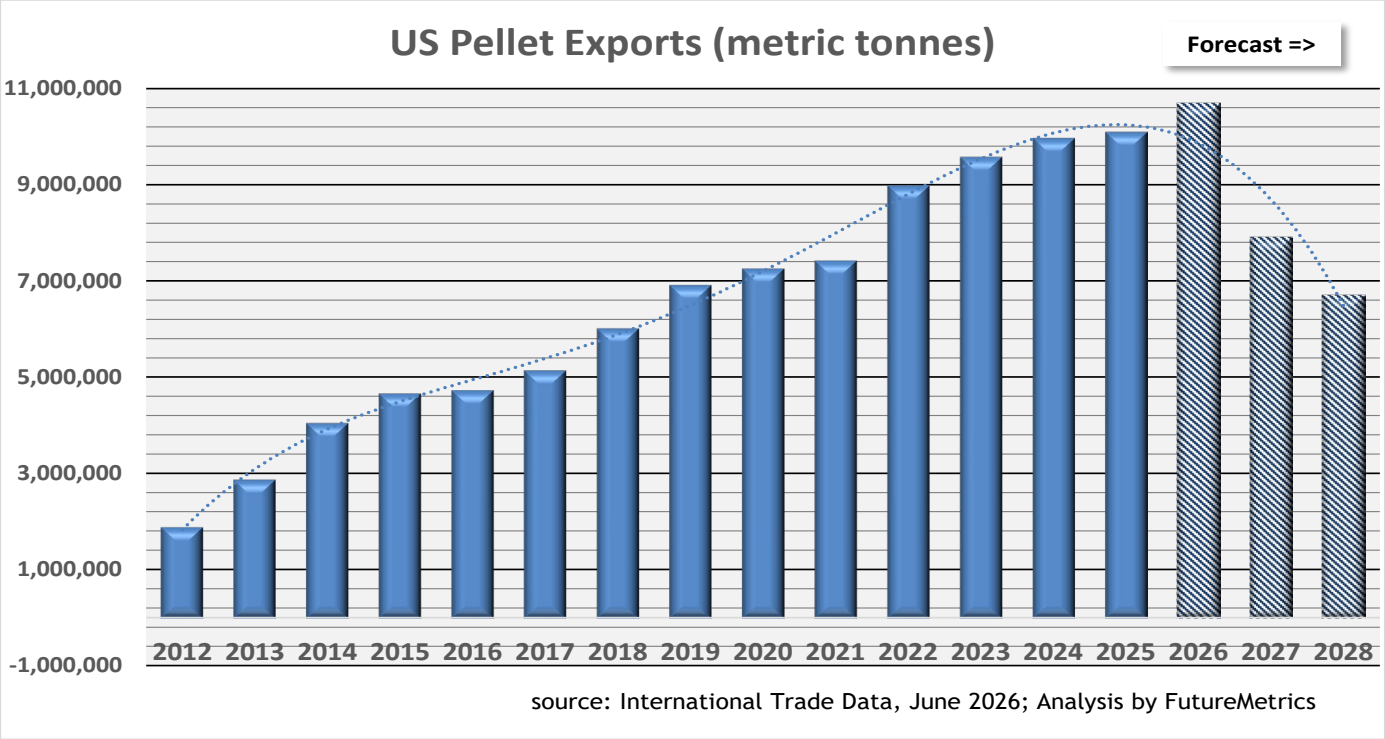

Figure 10 - US Pellet Exports with Forecast to 2028

There is also uncertainty regarding Durch demand after 2030. The US exported about 500,000 tonnes to the Netherlands in 2025. Recent statements by the new Danish government coalition adds uncertainty to their imports from the US going forward. The US exported about 700,000 tonnes to Denmark in 2025.

The drop in UK demand is certain. US pellet fuel producers will likely have massive excess capacity beginning in less than a year from now.

Other markets may increase demand. But when and by how much is uncertain.

Beyond current production in the US, there is significant room for growth in US production beyond current levels. This is in part due to challenges in other areas in which so-called "low grade" wood is used. The demand for the type of wood that makes pulp for paper production has fallen dramatically. Wood pellet producers can step into those

[23] FutureMetrics has a white paper on this topic that is free to downloads from the FutureMetrics website.

supply chains and sustain the jobs and the economic well-being that was traditionally supported by pulp and paper production.

US output of sustainably produced pellet fuel can be much higher than it currently is.

For an illustrated review of how the pellet fuel supply side exists and how the US could produce GW's of power from pellets, look at the **appendix** to this white paper. It is a copy of the PowerPoint used in a speech in London in April 2026 (it was focused on datacenters). The PPT makes it clear that coal replacement with biomass derived solid fuel is a viable and sustainable strategy. The PPT also shows how pellet producers are the users of the leftovers from higher value uses such as lumber production and also take the scraps from the primary harvests that have no higher and better use. Their "bottom feeding" role provides value to what otherwise would be a waste disposal problem for most sawmills[24].

Conclusion

US operators of power-hungry AI data centers, especially those that care about CO_2 emissions, should take advantage of this proven strategy and benefit from reliable, always-on power that is highly carbon emissions beneficial. Anchoring this strategy with a long-term offtake agreement will allow the utility to move forward with the modifications and to enter into contracts for fuel supply with US producers.

US government policymakers should support this strategy for using homegrown (literally!) fuel to keep coal stations operating. Government should, just like they are doing with coal, provide direct support to the generators for the capital costs of modifying selected currently operating coal-fired units. The electricity is needed. This strategy will help to close the supply/demand gap. And using this strategy will support the pellet fuel supply chain and the tens of thousands of rural jobs that procure, transport, and upgrade woody biomass into coal replacement fuel.

This strategy helps to solve these real challenges and, even better, is ready to go now.

[24] The Pellet Fuels Institute estimated that 8,800,000 tons of sawmill residues were purchased by pellet producers in 2020.

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Appendix

PowerPoint used in a speech by Dr. Strauss in London in April 2025 at the Argus Biomass Conference

AI Datacenters Can Help Close the Gap between Electricity Demand and Electricity Supply by Using the Solar Energy Stored in

Sustainably Sourced Biomass

How Much Biomass-Derived Fuel will it Take?

Presented by William Strauss, PhD – Founder and President of *FutureMetrics*
Presented on April 22, 2026

First a few slides about FutureMetrics

FutureMetrics™ services include:

FutureMetrics™ LLC

- Due diligence services to investors and lenders,
- Market information and analysis,
- Operations guidance and optimization,
- Project development,
- Feasibility studies,
- Strategic advice in the pellet sector.

***FutureMetrics* is the go-to consultancy when considering the production or use of torrefied, highly carbonized, or steam exploded biomass.**

FutureMetrics - Consultants to Many of the World's Leading Companies

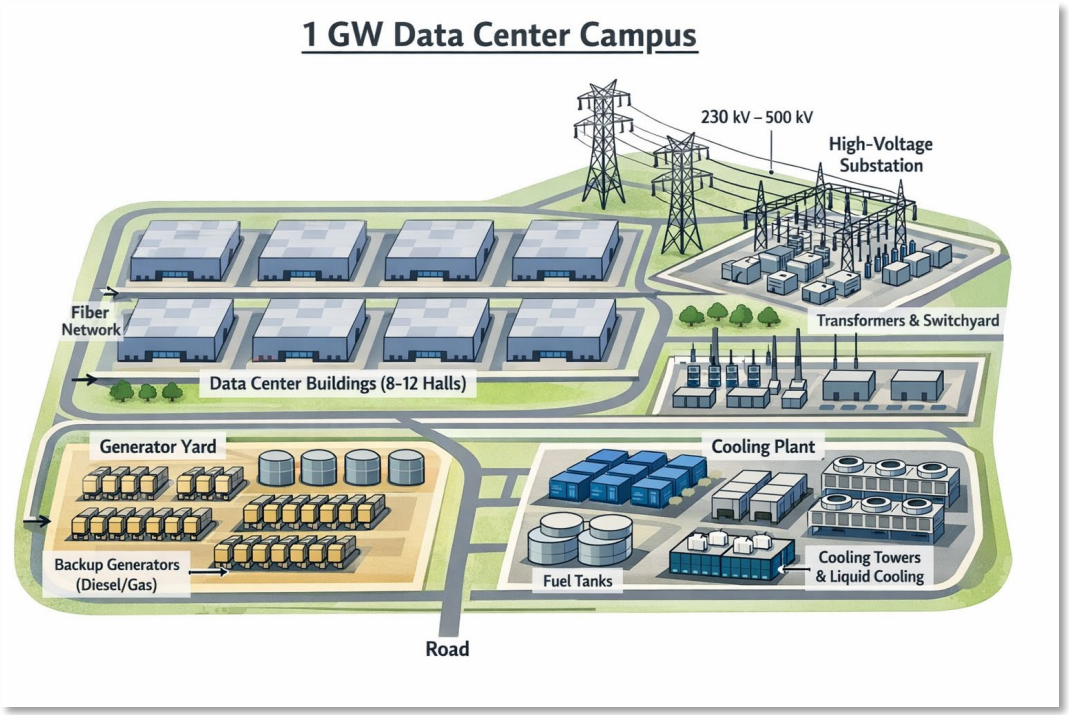
Now to the topic at hand!

The Challenge:
AI Data Centers Need Baseload Power

Hyperscale AI centers demand constant electricity -

some at gigawatt hyperscale!

- Wind and solar are intermittent and non-dispatchable
- Utility-scale battery storage to buffer wind and solar is insufficient at TWh scale other than functioning as an uninterruptable power supply until fossil fuel generation kicks in
- SMR's are at least a half a decade away and probably much longer



A scalable storage solution for green energy is required

What about batteries?

Perhaps in a decade or two there will be sufficient energy storage to produce reliable 24x7 power.

But not yet.

World's largest energy storage system is being built in Atacama Desert

Published November 28, 2023

Spanish green energy producer Grenergy has begun the construction of an energy storage facility in Chile's Atacama Desert. The Oasis de Atacama project, at 4.1 GWh, will be the largest in the world, the company said.

London Example

There is not enough power stored in batteries to keep the lights on for very long. Current battery storage is like a giant uninterruptible power supply (you have a small one on your computer).

It works for a while but has a limit.

The Atacama desert example is 4.1 GWh of storage. London needs about 110 GWh's per day. So the largest battery storage in the world would last (4.1/110)*24 = .89 hours (about 54 minutes) before the lights went out if there was nothing but a 4.1 GWh battery.

Mitigating the Baseload Demand Challenge with Steady Green Power

There is a sustainable non-carbon emitting energy storage solution that can play an important role in the transition from now to a decarbonized future.

And **the solution can be implemented NOW** with almost no lead time.

The solution leverages nature's natural solar energy storage and packages it into wood pellet fuel that can easily replace coal in already operating large utility scale generating units.

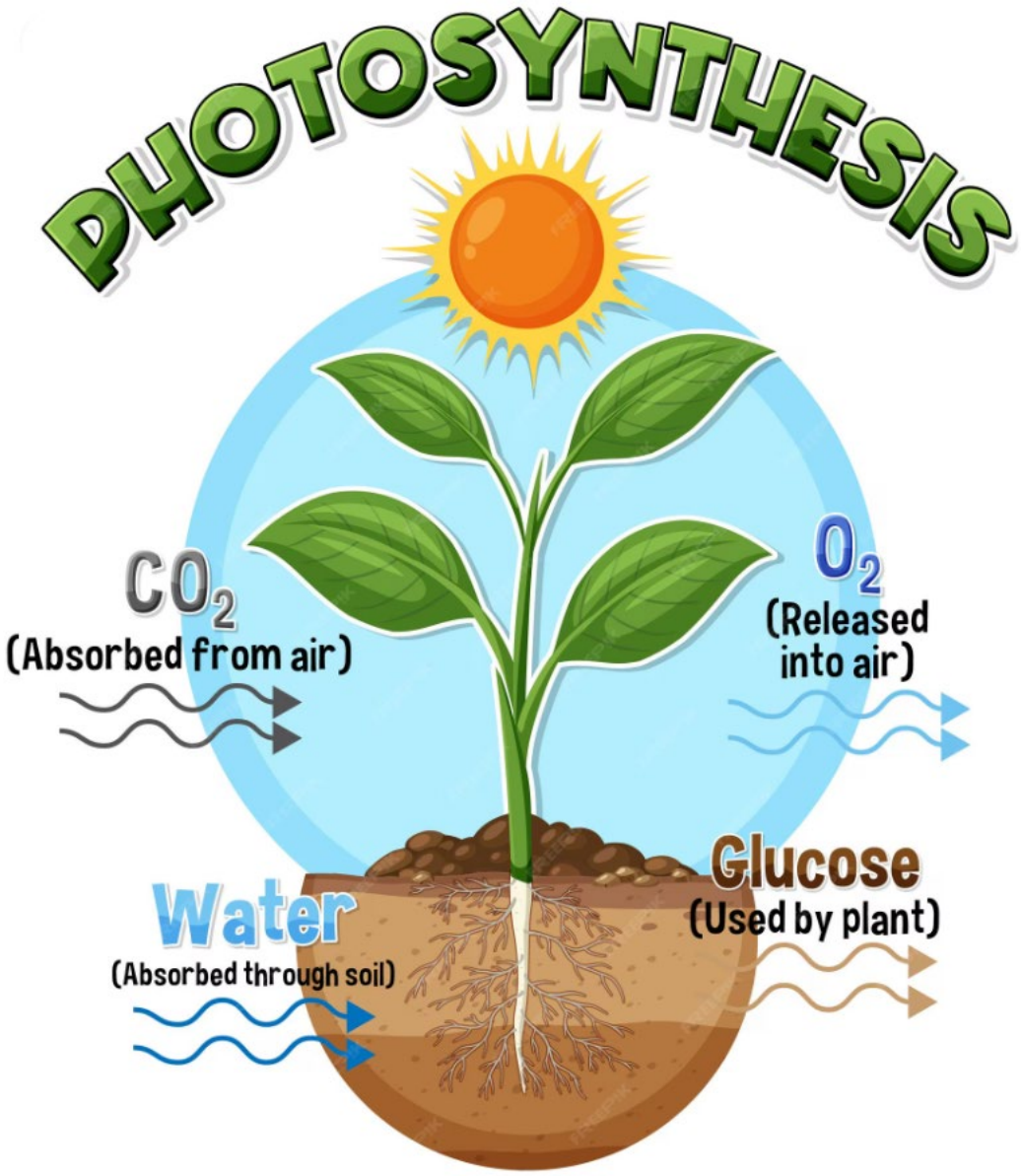
Nature's Natural Solar Energy Storage

Every year about 5.7 x 10^{24} joules of solar energy irradiates the earth's surface[1].

This is about 9,200 times larger than annual global energy demand.

Plants utilize that energy to convert large amounts of CO_2 into sugars like $C_6H_{12}O_6$ (glucose) that the plants convert into carbohydrates like cellulose.

Glucose from photosynthesis can be described by the simplified chemical reaction $6H_2O + 6CO_2 + \text{energy} \rightarrow C_6H_{12}O_6 + 6O_2$.

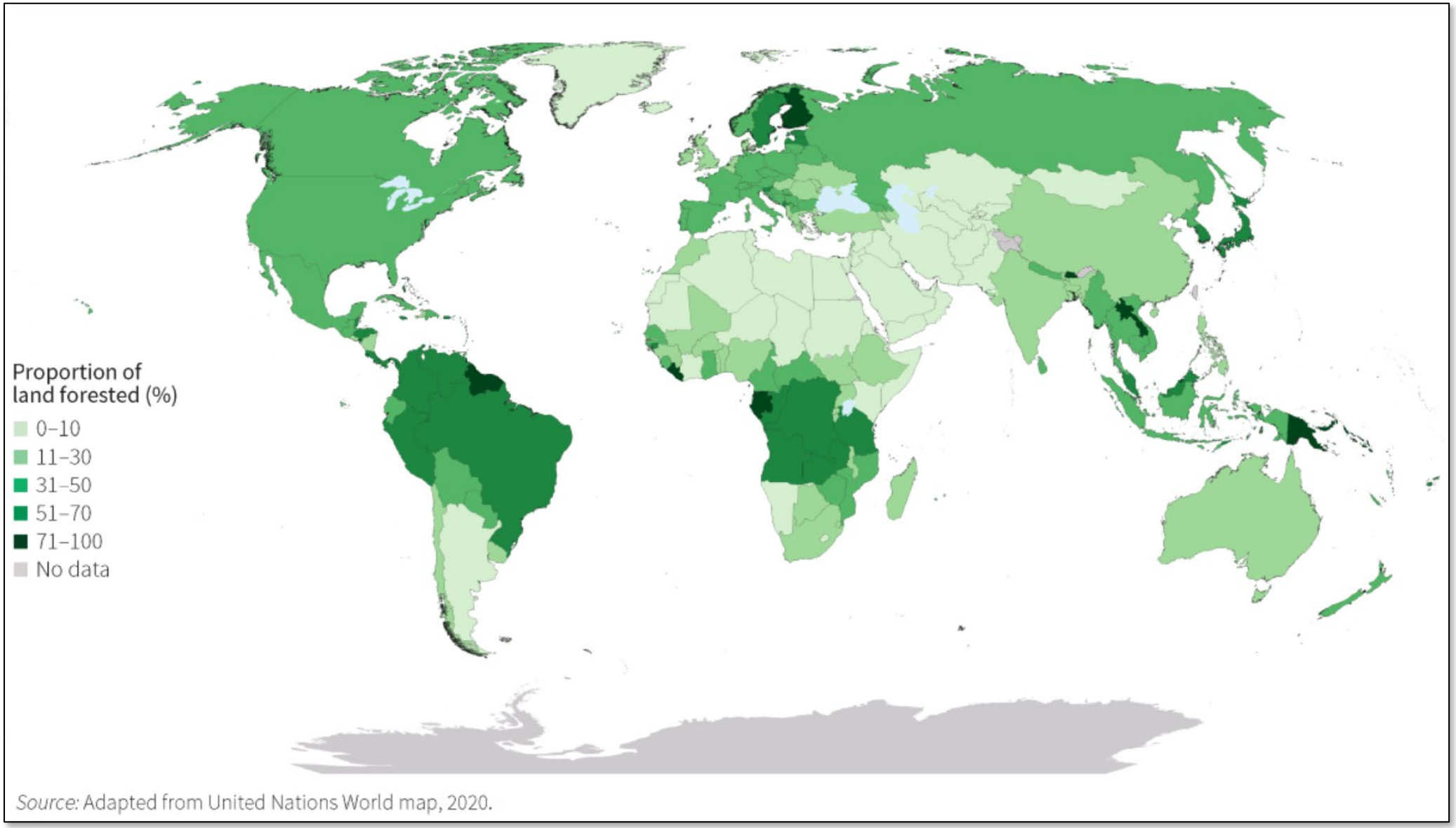


[1]Source: FAO http://www.fao.org/docrep/w7241e/w7241e06.htm#TopOfPage

Every year solar energy and photosynthesis converts billions of tonnes of CO_2 and water into plant matter and oxygen.

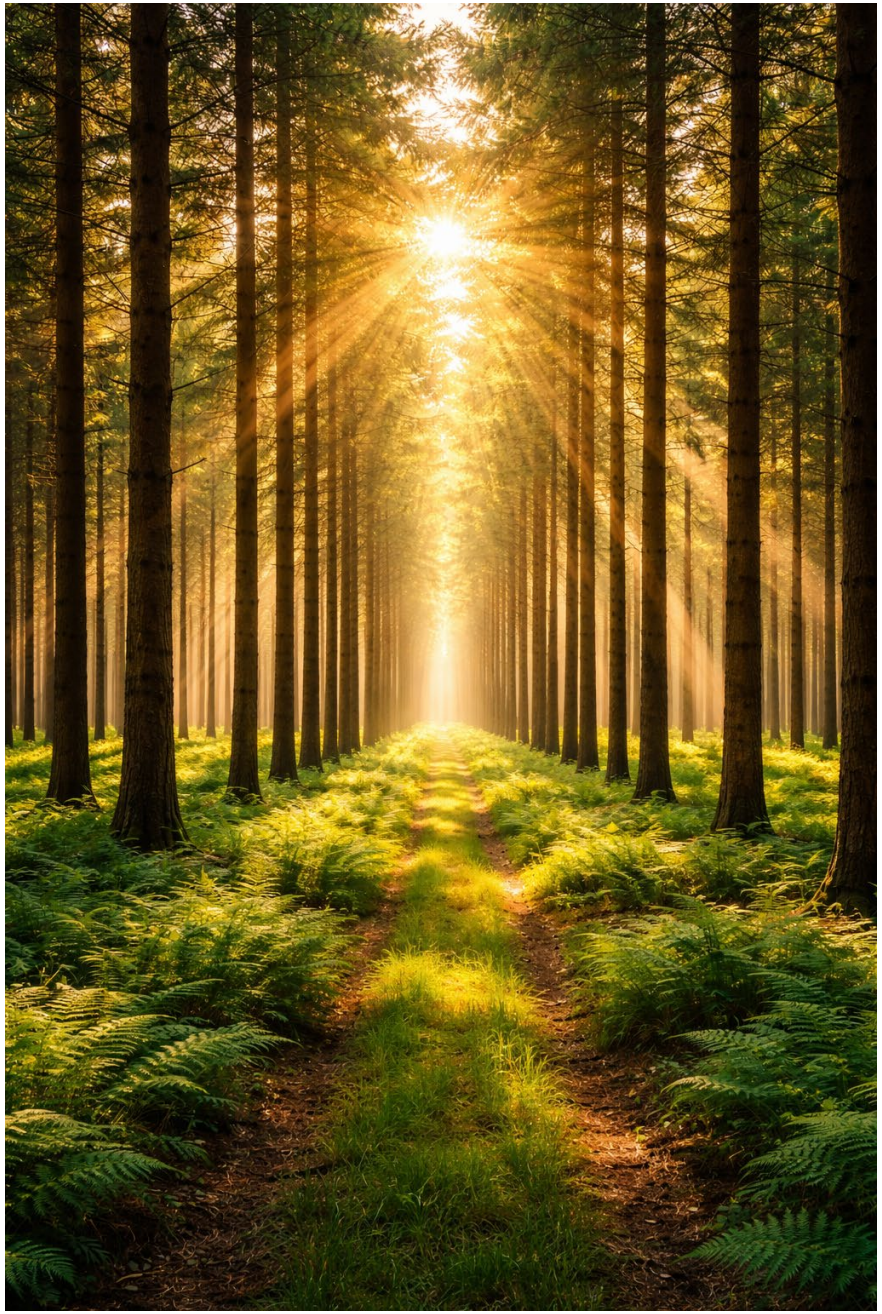
A portion of biomass produced every year is in the form of trees

Forests cover 31 percent of the world's land surface. That is about 4.1 billion hectares.



While some forests should not be used to supply the forest products industry, many millions of hectares of forests are managed and cultivated to **continuously** produce logs for lumber, wood chips for pulp and paper, packaging, tissue, and engineered wood products used in construction and furniture.

On average a managed forest will contain about 350-400 tonnes per hectare at maturity and will have grown at an average rate of about 12 tonnes per year per hectare.



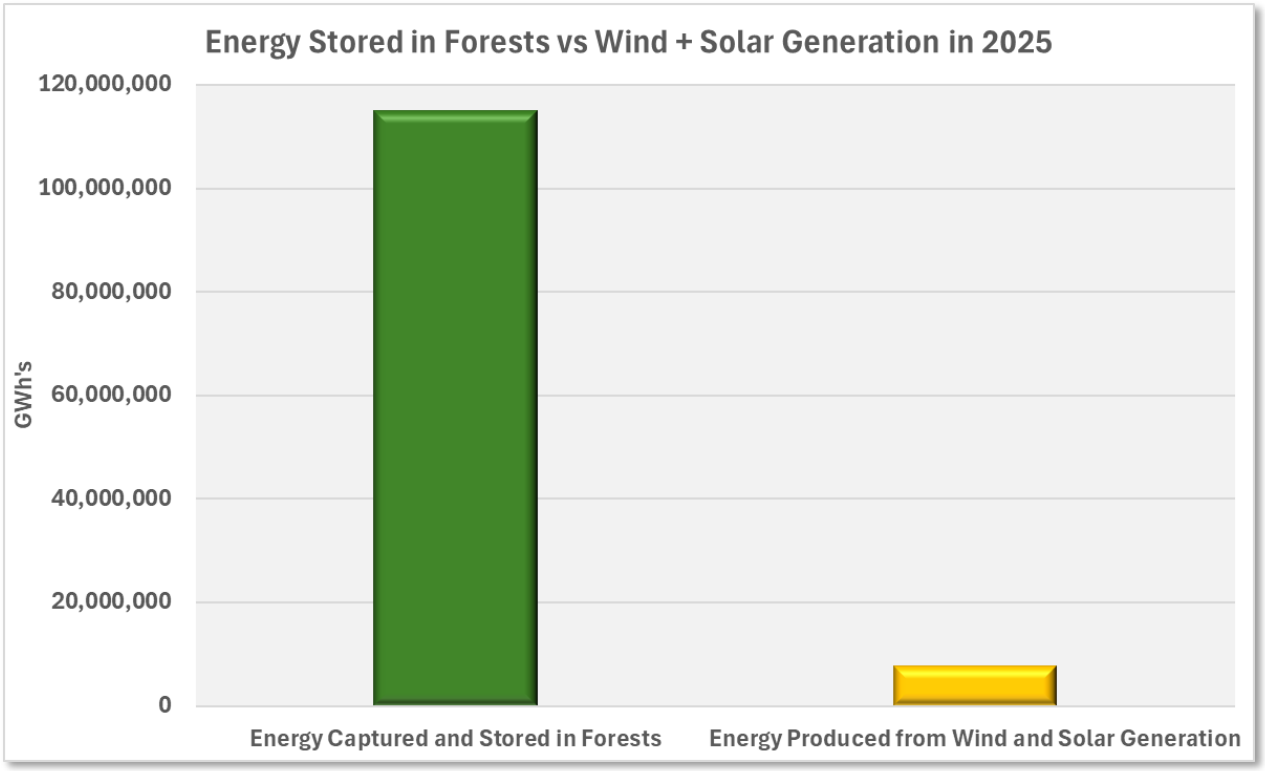
US Southern yellow pine plantation

The average energy content per tonne of wood is about 8.65 gigajoules (GJ)[1].

The world's forests store about 415 billon GJ or 115,000,000 gigawatt-hours (GWh's) per year.

Total solar and wind generation in 2025 was about 7,700,000 GWh's[2].

The earth's forests captured and stored about 15 times more energy in 2025 than what was produced by wind and solar generation in 2025.



[1]The gross energy content per tonne is based on wood with a moisture content of 50%.

[2]Source: Extrapolated from mid-2025 IRENA data HERE.

Without intermediate energy/battery storage,

solar and wind power are not dispatchable.

Whereas the solar energy captured by the world's forests is stored.

Forests are nature's natural solar energy battery.

And just like wind and solar, some of those

forests can be a

perpetually renewing resource.

Can We Sustainably Use the World's Largest Energy Storage System to Supply On-Demand Carbon Free Power?

Not all of the 4.1 billion hectares of global forested land is used to produce the primary feedstocks for the forest products industries.

About 1.15 billion hectares are formally designated for the production of wood and wood related products.*

*https://gfr.wri.org/forest-designation-indicators/production-forests

Sustainable forest management guarantees a perpetually renewing resource that is continuously available

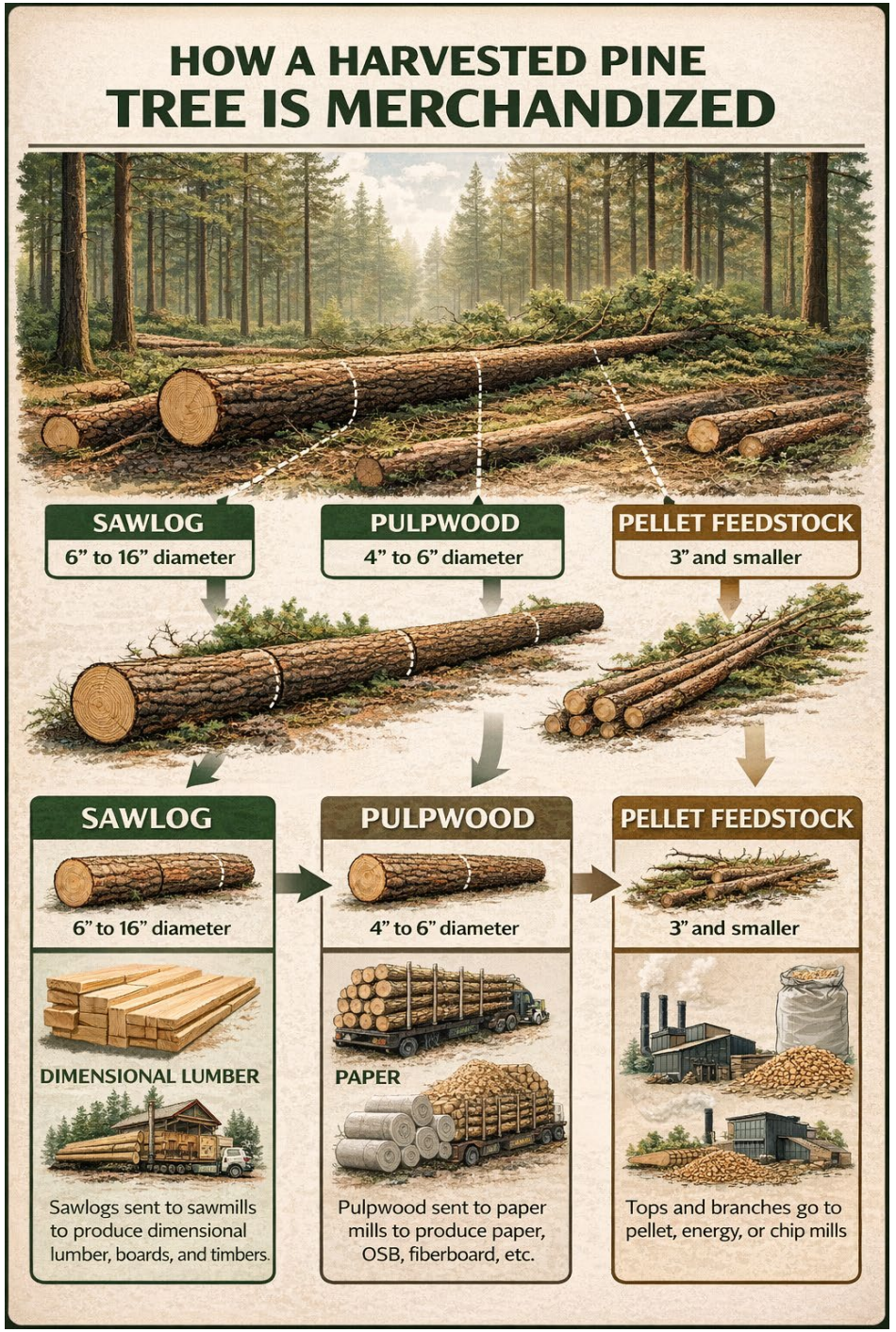
The US state of Georgia is the state supplying the highest tonnage per year of pellet fuel to the UK.

The sawmill in the upper left is receiving a continuous supply of mature sawlogs.

In the bottom left is a mature plot being harvested to supply the sawmill.

The cascading principle in the US southern pine plantations

Wood pellet manufacturing sector uses early growth rotation thinnings and the parts of the harvested tree that are not suitable for making lumber or other higher-value products.



Wood pellet producers are "bottom feeders" taking up the scraps.

Some 35% to 55% of the incoming wood to a sawmill does not become lumber, or flooring, or cabinetry, etc.

(depends on diameter and straightness of the sawlog and how modern the sawmill is)

Pellet manufacturers provide a value-adding outlet for the by-products of sawmills that were once called waste.

The sawdust, bark, and slabs were once burned in uncontrolled "beehive" burners. →

How Many Megawatts of Generation Capacity Can a Managed Forest Support?

To put pellet production into perspective in terms of the overall forest products industry…

FutureMetrics has created an **interactive dashboard** to show how to answer this question.

The dashboard is free to use at the *FutureMetrics* website.

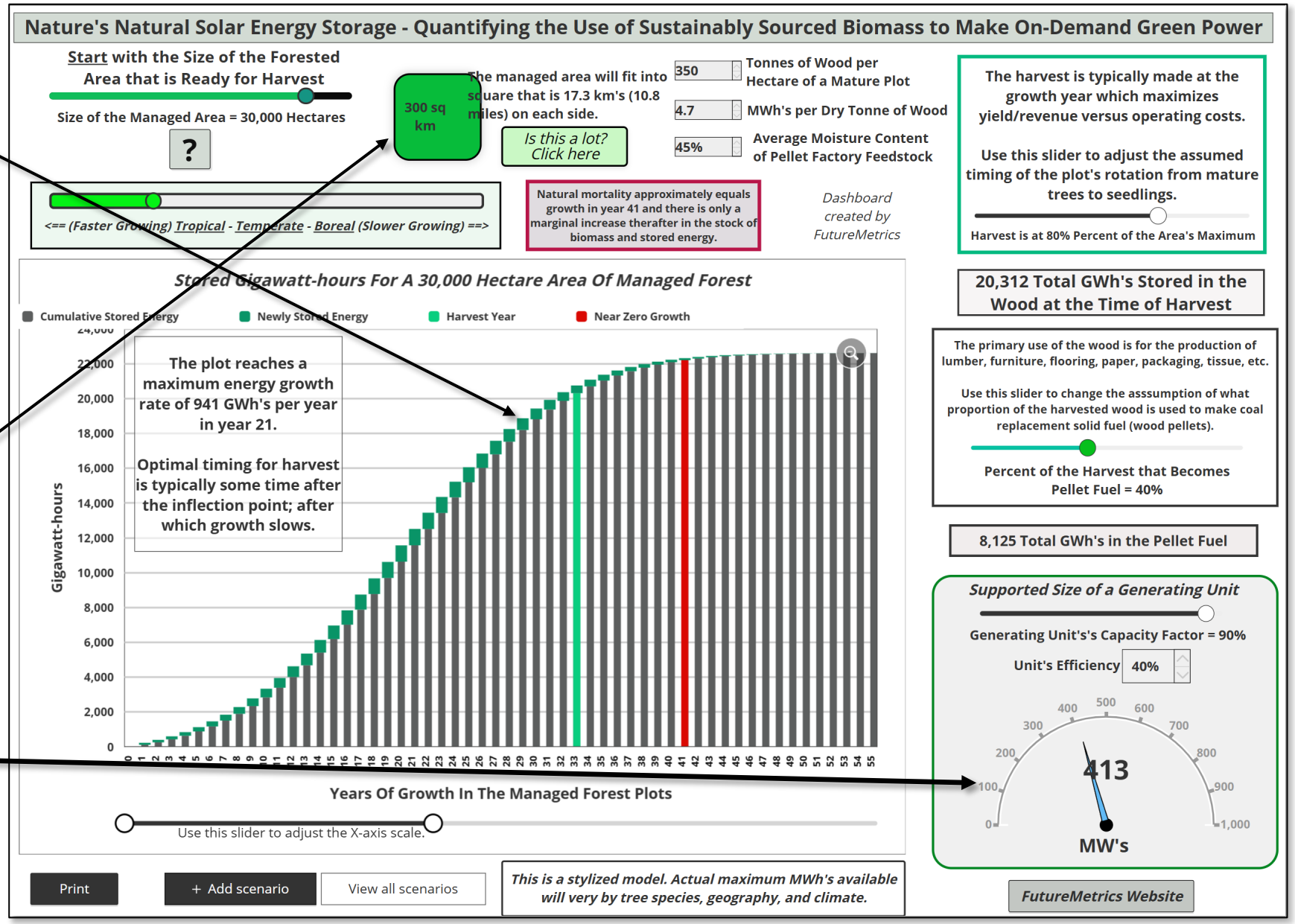
The dashboard tells the story of an area of forest that is managed to produce the wood needed by mills that convert it into boards, paper, cardboard, tissue, flooring, etc.

The "scraps", i.e., the leftovers from the thinnings and harvest and the sawmill by-products that have no higher value use, find their way to a pellet factory.

The chart shows how many GWh's of energy are stored in the plot.

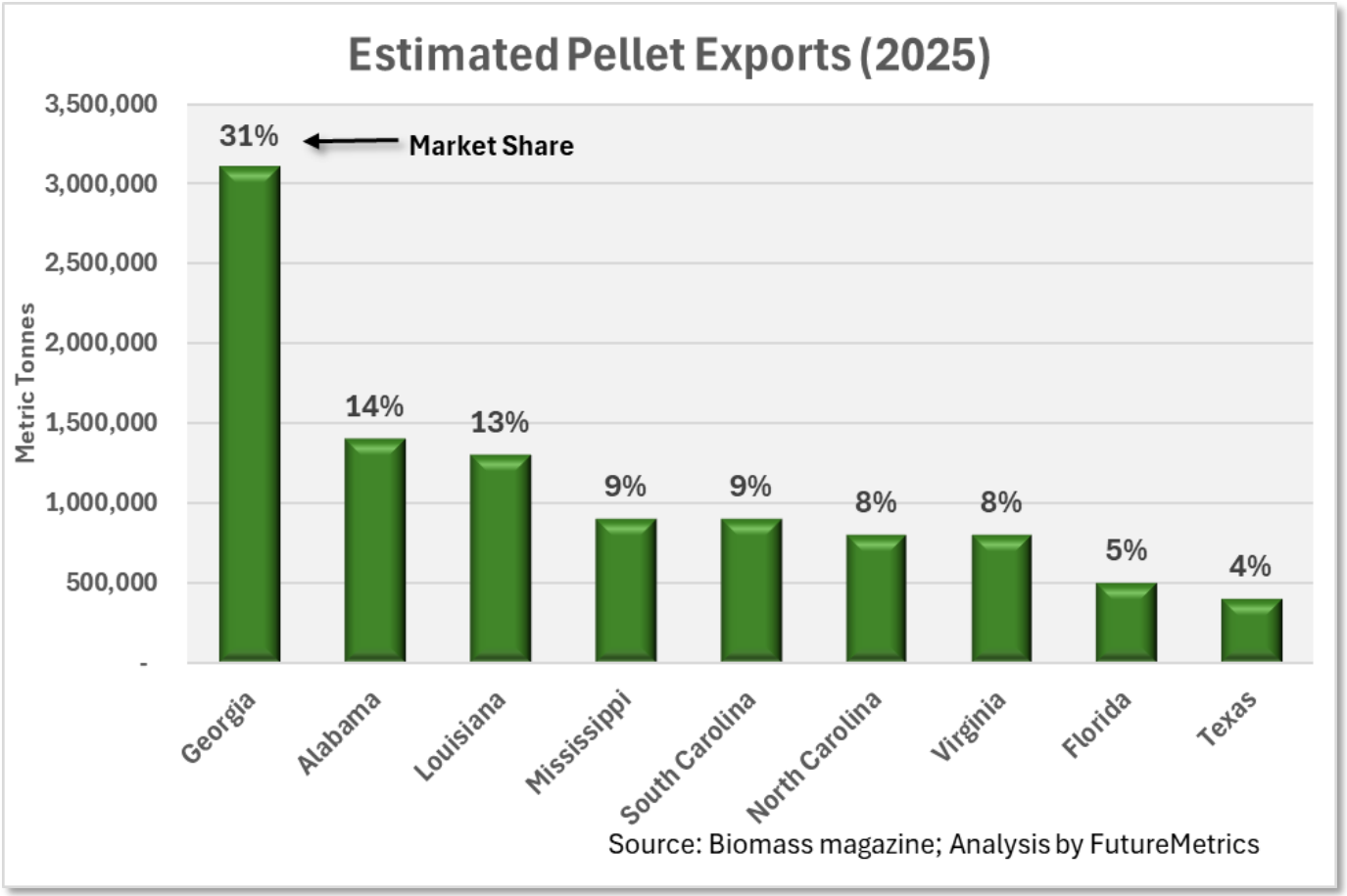
This is a screenshot of the dashboard. Live version is HERE.

At the settings shown, including a 90% capacity factor for the power station to match a hyperscaler's needs, a managed plot of 30,000 hectares, which fits into a square that is only 17 kilometers (11 miles) on a side, **will produce enough residuals to produce enough pellet fuel to generate about 415 megawatts of low carbon power.**



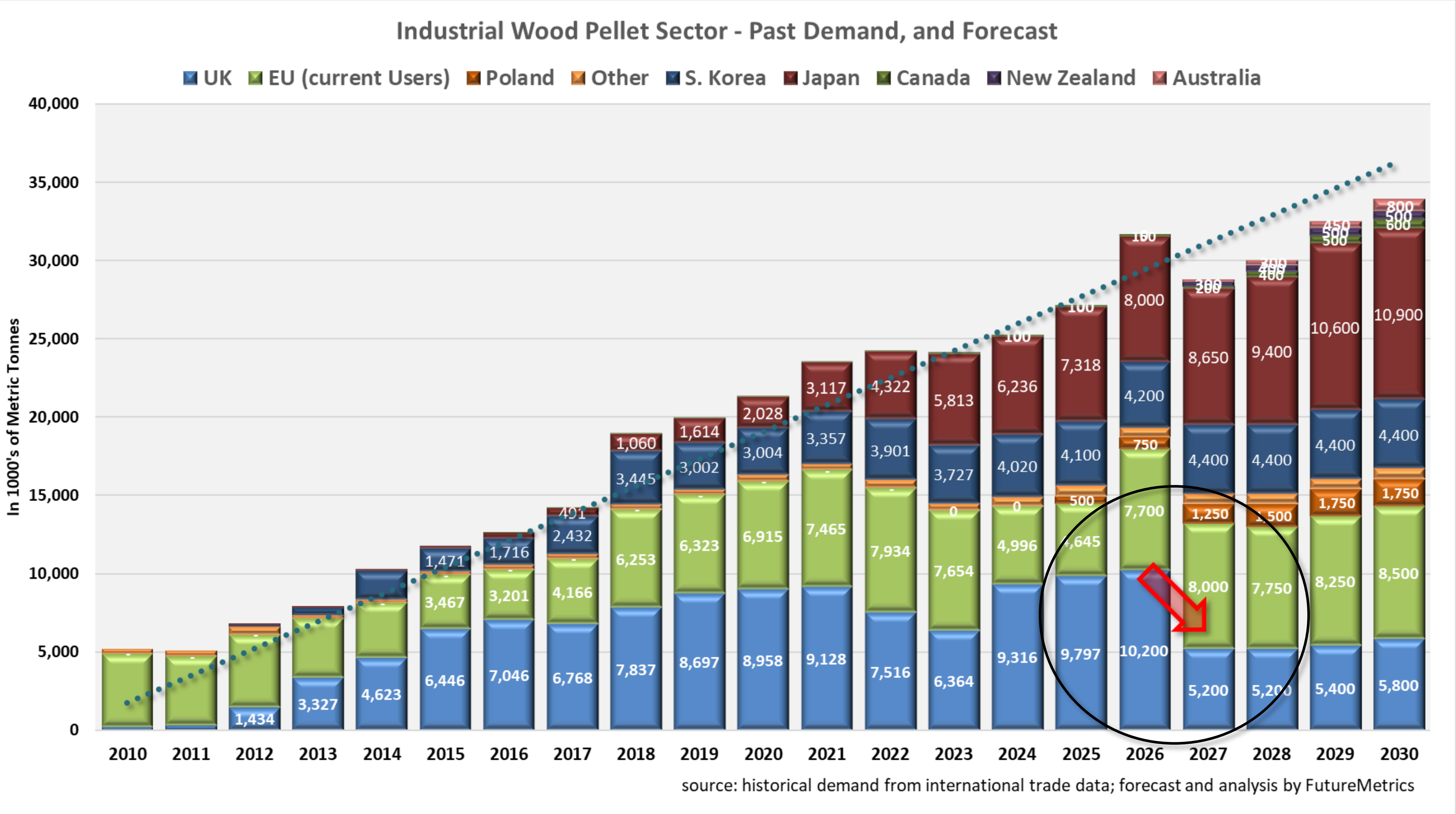
Georgia (and other US southeast states) already export millions of tonnes per year of coal replacement pellet fuel to the UK.

BUT



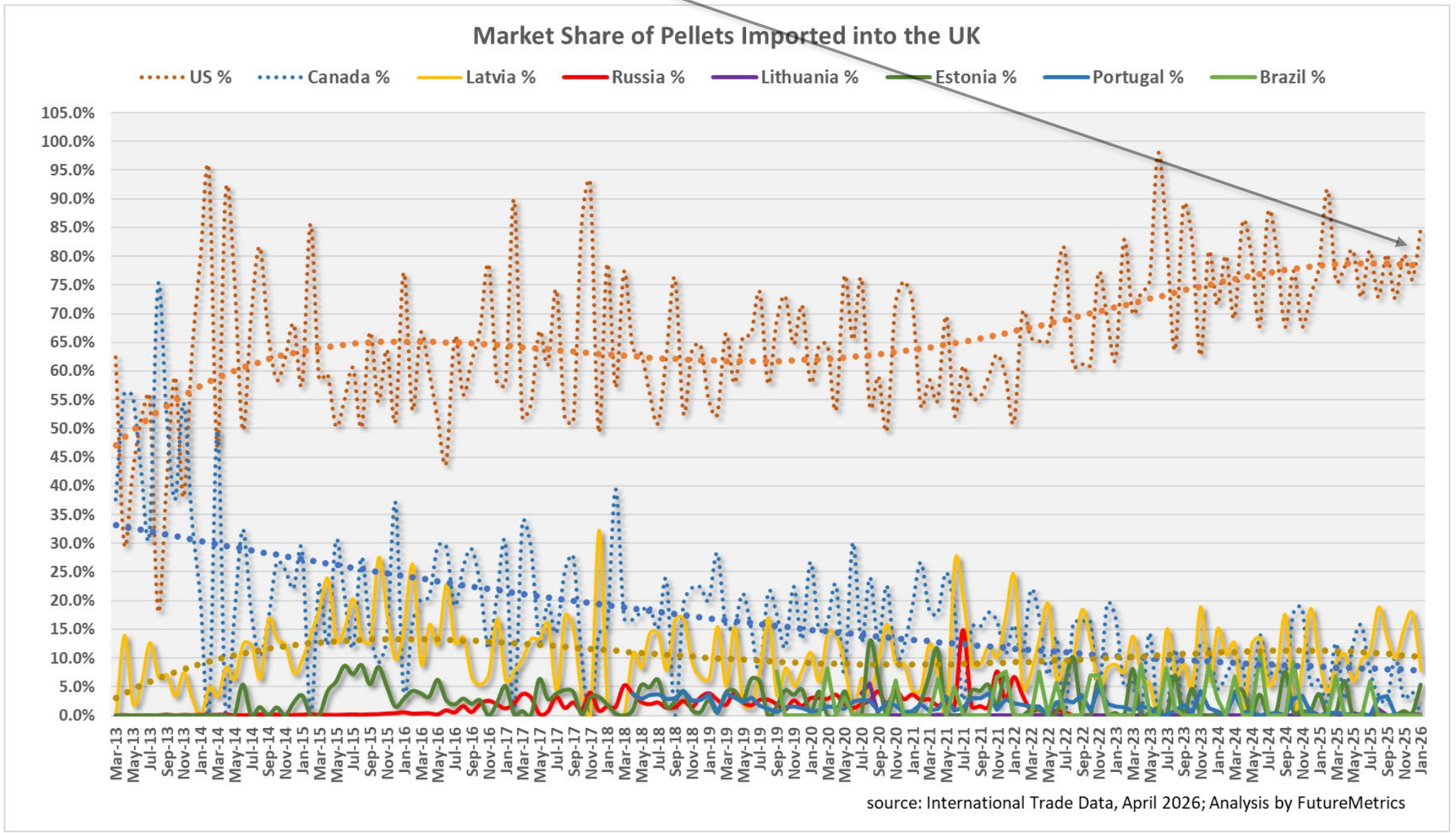
On March 31, 2027 (less than one year from now) UK policy will dramatically change!!

There will be a drop in annual demand of about 5 million tonnes per year!



About 80% of pellet fuel imported into the UK is from the US.

Starting next year, there will be *significant overcapacity* in the pellet fuel export sector in the US.



Conclusion

The use of coal-replacement fuel produced from upgraded woody biomass garners a lot of misguided criticism around the idea that forests are being destroyed in the process of producing the fuel – and thus that the CO_2 emitted in combustion is net positive to the atmosphere.

Yet those same critics do not fret about how lumber or cabinets or Amazon boxes or toilet paper is produced even though

they all come from the same source: continuously renewing forests

But clearly there are limits to the application of this coal-replacement strategy.

Solar energy captured by forests that is available for sustainable power generation is limited to the size and growth rates of the managed forest resource.

Respecting the growth/removal ratio boundaries and nurturing the resource are essential.

But within those constraints, there are significant opportunities.

Especially given the loss of a significant portion of the policy supported UK market next year!

Hyperscalers Take Notice!

(Microsoft, Meta, AWS, Google, Oracle, etc.)

Government Take Notice!

By expanding our perspective of energy storage to include the biomass that is produced every day by the solar energy that is powering the chemistry of plant life,

we can expand our perspective

on **reliable low carbon baseload**

power generation for datacenters.

In countries outside the UK, modifying existing coal fueled stations to use sustainably sourced carbon beneficial coal replacement biomass derived solid fuel is a solution to the need for reliable baseload green electrons for datacenters.

In the UK, the Drax and Lynemouth stations are already converted to pellet fuel. Co-located datacenters are a strategy that leverages the existing infrastructure that Drax and Lynemouth have built with the potential to supply up mort than 20 TWh's per year of green baseload power.

Thank you!

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FutureMetrics LLC ™

Bill Strauss enjoying some British Columbia powder…