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On June 12, 2025, Trump signed an Executive Order that includes language that encourages federal efforts to find innovative uses for woody biomass.

This Paper Describes a Strategy that Supports that Order

By William Strauss, PhD

June 23, 2025

The executive order[1] focuses on wildfire mitigation. If implemented, there will be millions of tonnes per year of woody biomass produced. The order says that, "*The Secretary of Agriculture, in consultation with the Secretary of the Interior, shall consider promoting, assisting, and facilitating, as consistent with applicable law, innovative uses of woody biomass and forest products*." If well executed and properly supported, the quantity and the cost of the woody biomass produced will support a number of innovative uses. It will also support some well-proven uses.

This white paper focuses on a well-proven use of woody biomass. The plan that this white paper discusses is a strong compliment to Trump's executive order.

Forest fire risk reduction via selective thinning will result if very large quantities of low-grade biomass needing a destination. The massive influx of thinnings from wildfire mitigation efforts will overwhelm a sector that is already oversupplied.

The strategy outlined below will strongly support the otherwise fading markets for residual forest products (more on residual forest products below).

The strategy this paper describes for using the wildfire mitigation thinnings is based on a well-proven use of existing coal-fueled power stations that are modified to use upgraded coal replacement fuel produced from woody biomass.

This strategy will stimulate billions of dollars of new capital investment for the production of upgraded coal-replacement solid fuel derived from the by-products of the forest fire mitigation efforts.

There is no need to build new power generating stations that would use raw biomass for fuel[2]. In most locations, it is optimal in terms of the total cost of generating power to build wood pellet manufacturing plants that convert woody biomass to fuel that is compatible with the existing coal-fueled power plants so that those already grid connected stations can continue to efficiently produce baseload grid-stabilizing power.

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[1] See HERE

[2] Hog fuel burning power stations typically have efficiencies in the range of 20% to 30%. Modern utility scale coal-fueled power stations typically have efficiencies in the range of 38% to 43%. Efficiency measures how much of the energy in the fuel turns into MWh's of electricity.

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Not only can this strategy be used to supply utility power grids with steady non-intermittent, on-demand, and frequency stabilizing power, but in some cases datacenters that are sensitive to the carbon impacts of their power consumption can be built near to the power station and can be supplied direct "inside-the-fence" steady and reliable power produced from renewable fuel[3].

For utility co-firing, the cost of generating a megawatt-hour of electricity at a 15% co-firing ratio (15% is used as an example later in the paper) is only marginally higher than the cost of generating with 100% coal. Diluted across the overall power supply, the impact on ratepayers is imperceptible. For an inside-the-fence application in which minimizing CO_2 emissions is a primary objective, the power station could use 100% US produced pellet fuel[4].

The strategy this paper proposes as a policy is based on proven low-cost and easy to implement minor modifications of coal fired power stations to allow them to blend upgraded bioresource derived solid fuel with coal.

These modifications are widely deployed in England, western Europe, South Korea, and Japan. For example, on average, about 9% of England's electricity is produced from pellet fuel; of which about 80% is currently imported from the US.

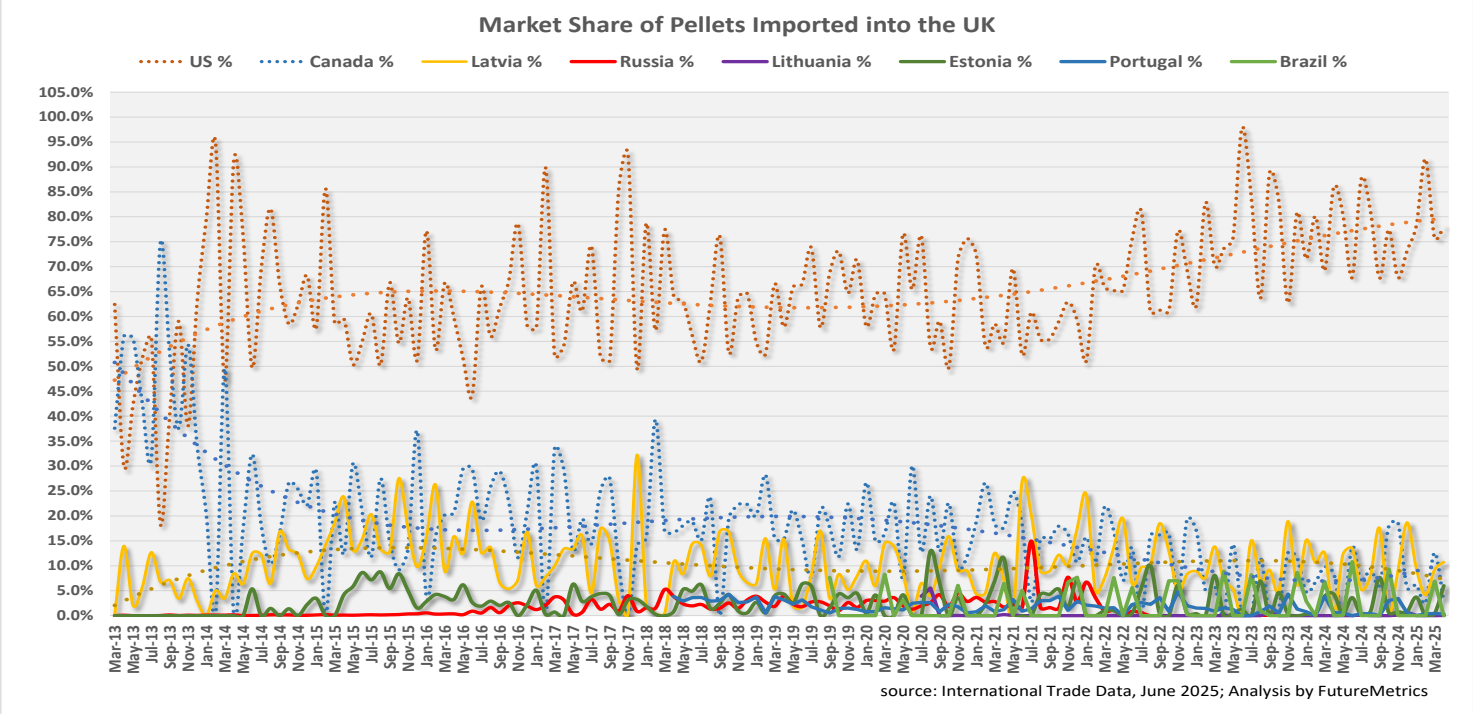

Figure 1 - England's Imports of Pellet Fuel by Market Share of Exporters

[3] See FutureMetrics white papers on how properly procured biomass derived fuel is renewable and carbon beneficial. "Inside-the -Fence" means that the power from the generating station does not enter into a distribution and/or transmission system. It is a direct connection with only one customer. There are no addition costs for transmission and distribution.
[4] FutureMetrics has an interactive dashboard that allows the user the calculate the fuel costs per MWh from 0% to 100% co-firing ratios. That dashboard and many other are free to use on the FutureMetrics website.

It is remarkable that England, western Europe, and Japan import a significant proportion of that coal replacement fuel from the US while the US does not use any of that fuel in its power stations!

All current US production of wood pellet fuel used to replace coal in utility power stations is exported.

The US exported about 10 million metric tonnes[5] of pellet fuel in 2024 (see Figure 2). That is the equivalent of a shipload every day of the year[6].

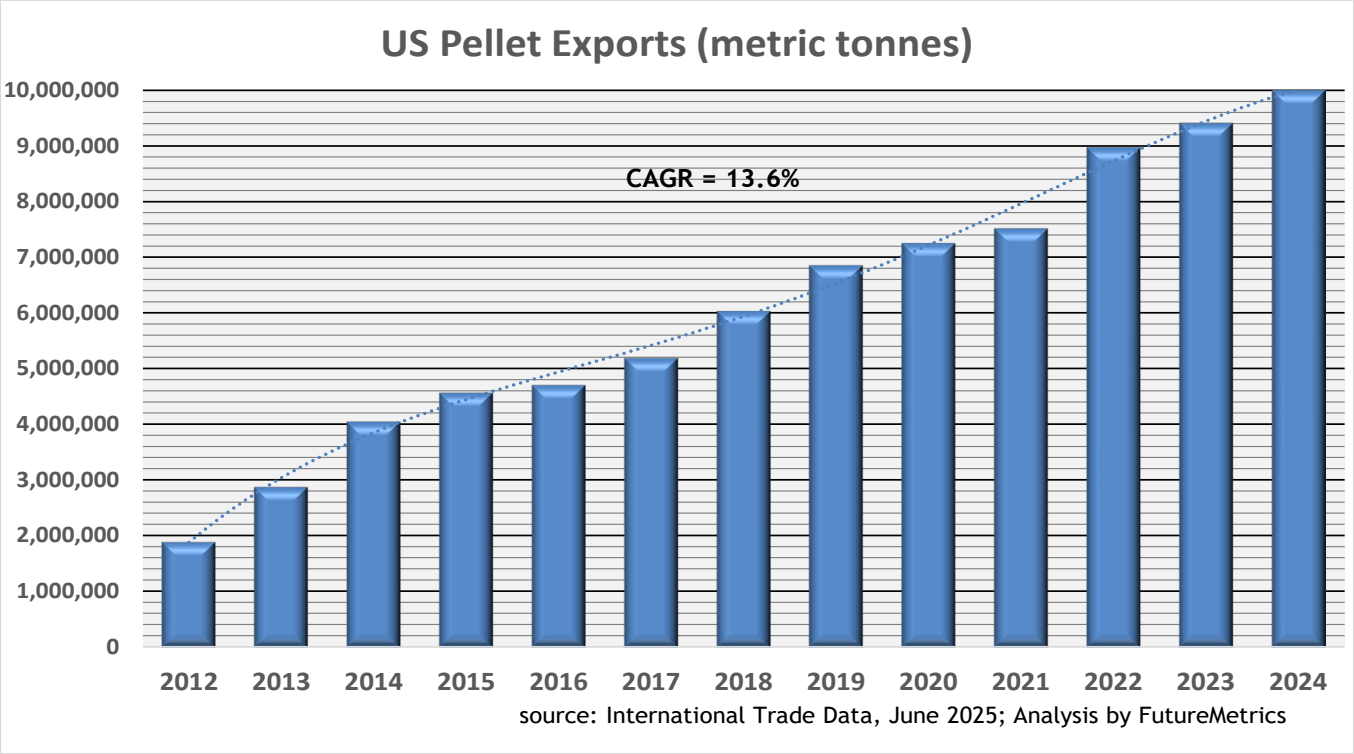

Figure 2 - US Wood Pellet Fuel Exports

The global market for bioresource derived solid fuel is a large and growing market. Total global trade of wood pellet fuel used to replace coal was nearly 25 million metric tonnes in 2024 with the US being the largest producer and exporter (41.1% of the global market share).

This is not a bleeding edge solution. It does not rely on conversion pathways to end products that are not proven at large scale. This solution does not need demonstration projects and does not have scaling up risks. It is already proven on a large scale.

And US pellet fuel producers would welcome a domestic coal replacement market!

[5] All references to tonnes in this report are to metric tonnes. 1000 kilograms (a metric tonne) equals approximately 2,200 pounds.
[6] Assumes a "handysize" vessel holding about 30,000 tonnes of dry bulk cargo.

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A Plan that Supports Efforts to Expand the Demand for "Low-Grade" Woody Biomass

The plan outlined herein leverages existing US coal-fueled power plants with the US's strength in producing competitively priced coal replacement fuel that is derived from the "low-grade" by-products of the forest products industry. (More on what "low-grade" refers to below.)

Thinnings from forest fire mitigation are a perfect feedstock for the production of upgraded biomass derived solid fuel that is compatible with existing coal-fueled power stations.

First, we take a look at the US coal-fueled power generation sector. It is the foundation of this plan.

The Coal-Fueled Power Plants in the US

The map below shows the locations of the 352 still operating coal-fueled power plant units[7] in the US that are larger than 150 megawatts (MW's)[8]. To interactively browse the generating units, open the Google Map HERE or click on the map below. Once open in your browser, click on any station to see details and a link to an online description of that station.

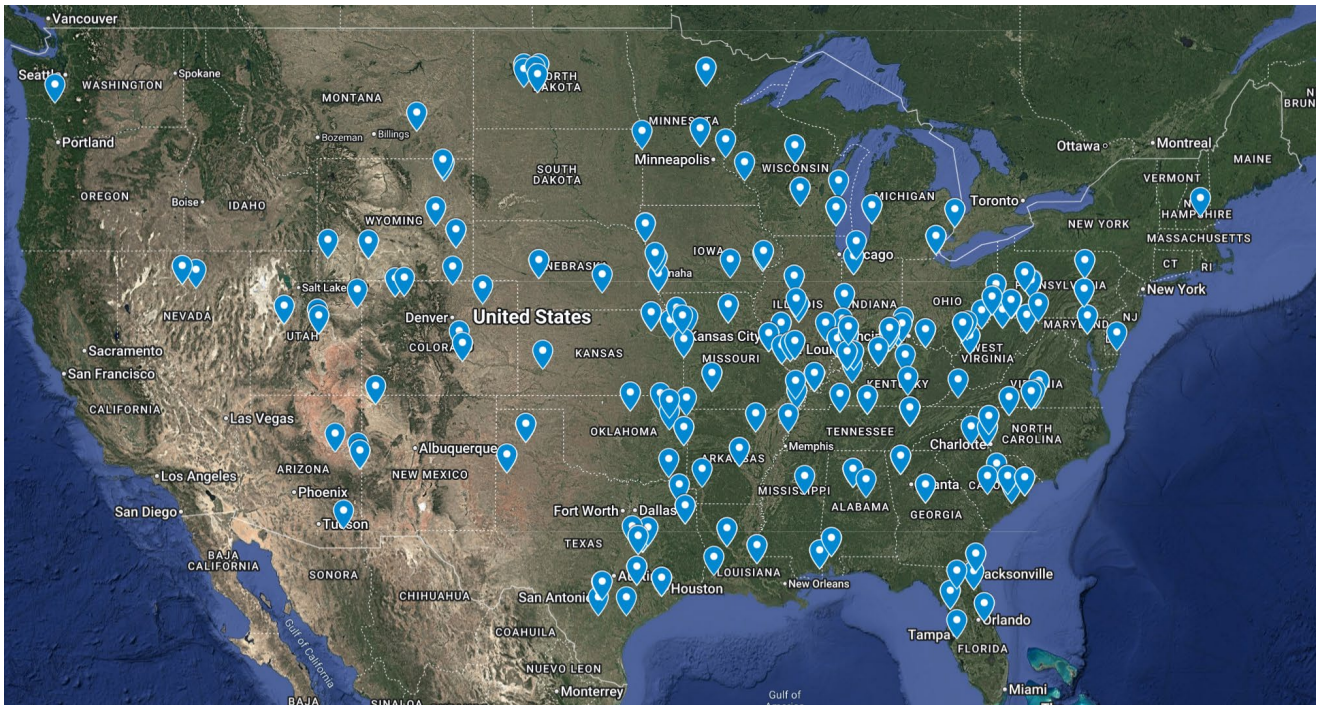

Figure 3 - US Operating Coal Fueled Generation Units greater than 150 MWs

[7] Many power stations have more than one generating unit.
[8] Data from Global Energy Monitor, Global Coal Plant Tracker, January 2025.

All of the 352 operating units shown in the map use pulverized coal (PC) technology. PC power plants are easily modified to use a blend of coal and solid fuel derived from bioresources. With proper low-cost easy to implement modifications, there is no diminution to the maximum power output, and no loss of reliability. These stations can almost seamlessly transition from 100% coal to co-firing wood pellet fuel with coal.

This is a Timely Strategy

The US power generation sector has changed significantly over the last several decades.

Hydraulic fracturing (fracking) in shale formations has opened up massive reserves and a flood of natural gas (NG) resulting in NG prices well below coal in fuel cost per megawatt-hour (MWh) generated. As a result of current and expected future low-cost NG, the power sector has been shifting from coal to NG by building new NG fueled power plants and retiring older coal fueled units.

As the Figure 4 shows, the shift has been dramatic.

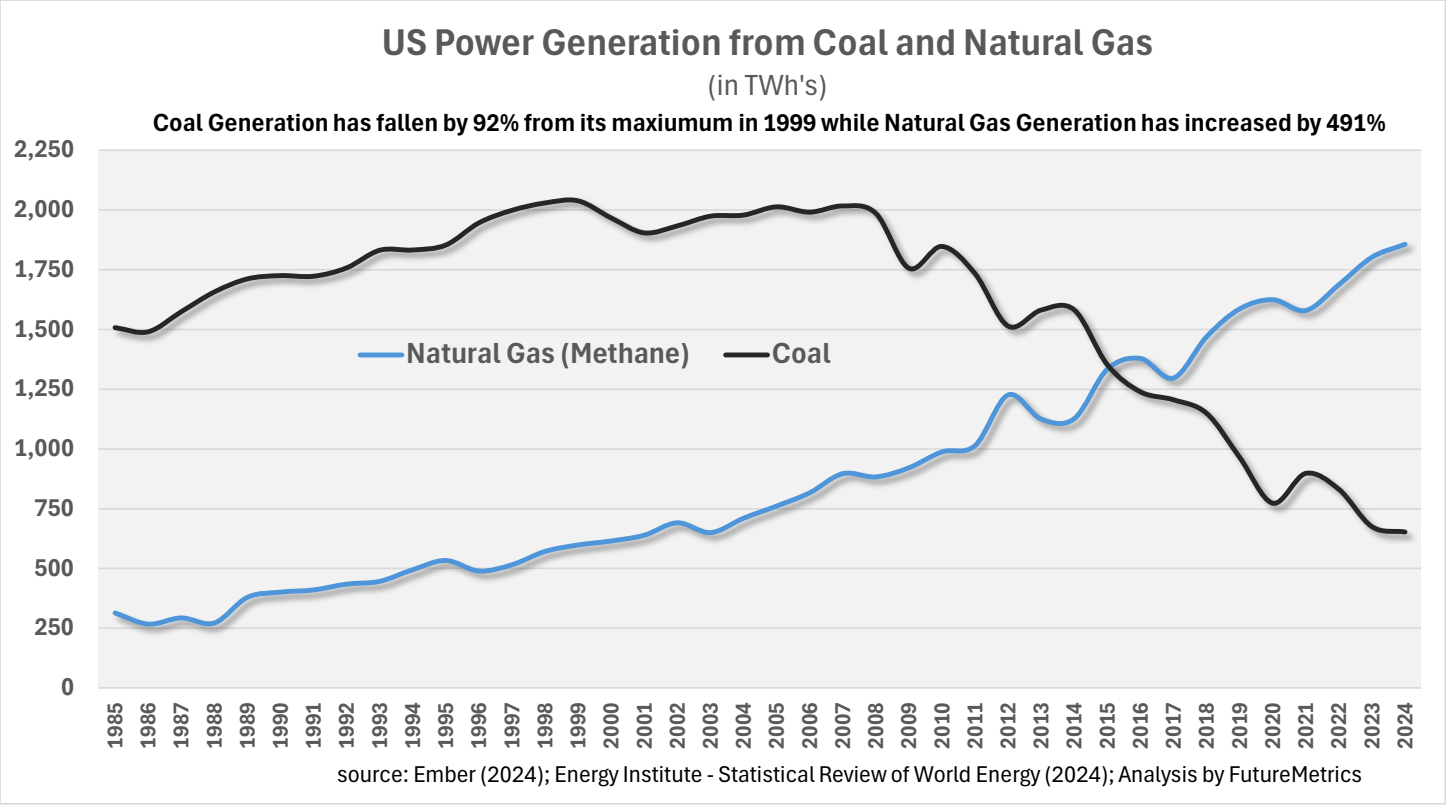

Figure 4 - US Power Generation from Coal and Natural Gas 1985 through 2024

The shift from coal to NG has created very challenging conditions in the coal mining sector.

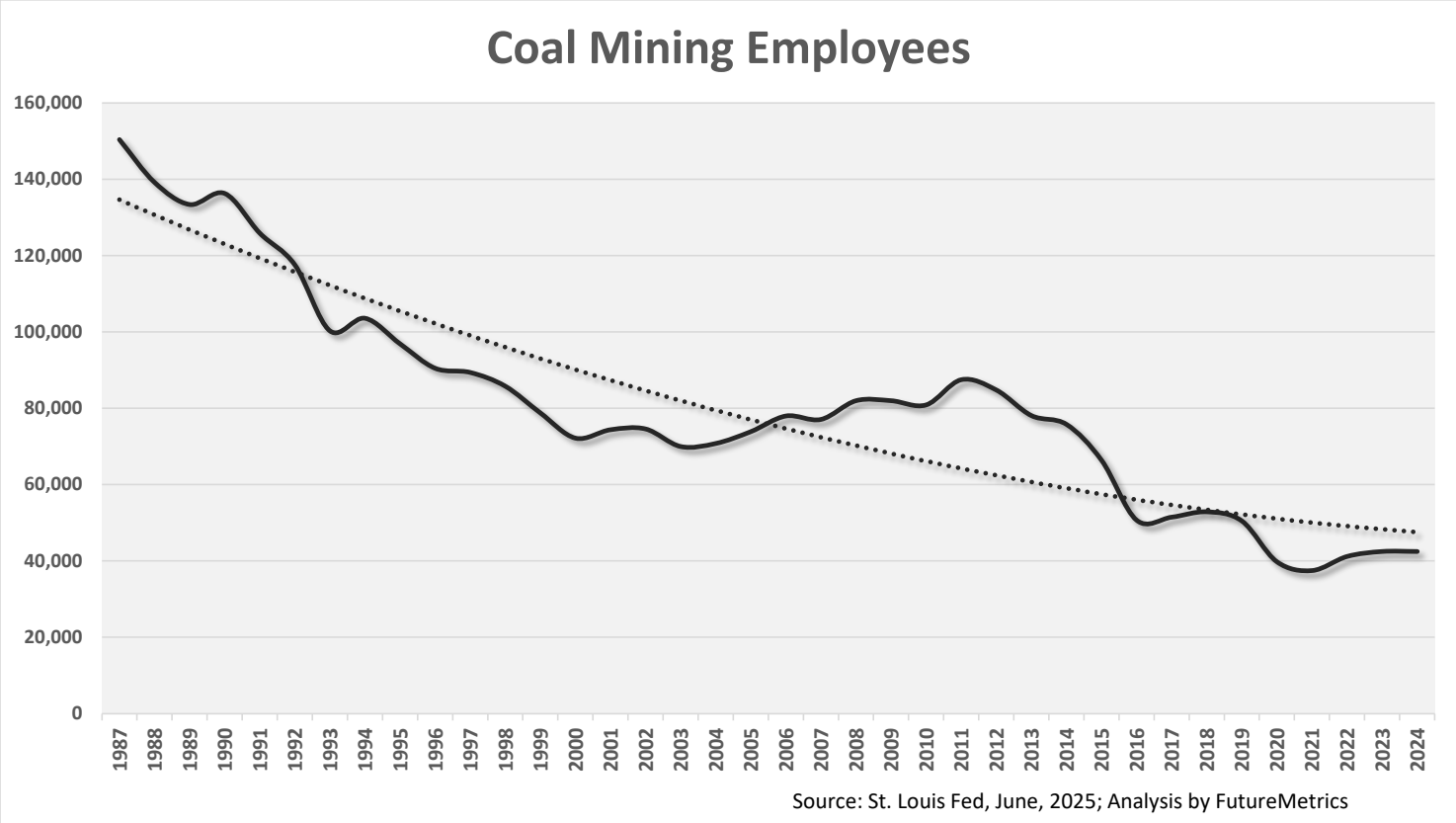

Figure 5 - Coal Mining Employees

Given current conditions, there is no reason to think that the downward trends will not continue.

Furthermore, the US coal-fired power plant fleet is aging. The median age of utility scale pulverized coal-fueled power plants larger than 150 MW's is 45 years. As the chart below shows, nearly 70% of larger PC plants are 40 years old or older, and many are nearing or past 50 years old. 50 years is often the defined useful life of a coal unit.

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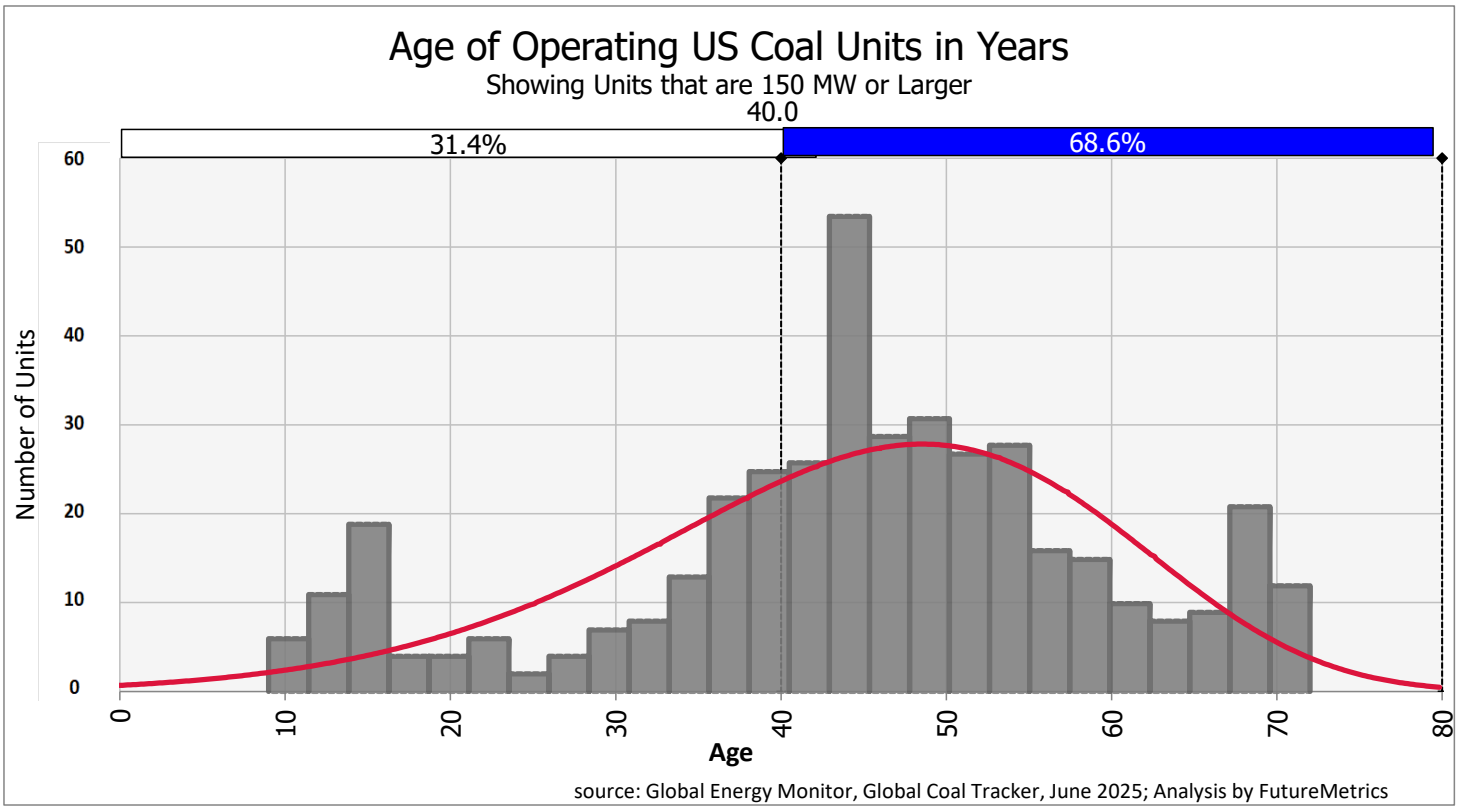

Figure 6 - Age of US Coal Fueled Generation

As the coal generation fleet ages, there is no incentive to build new coal plants.

The phasing out of coal in the US under current policy is not a result of environmental policies.

It is a function of low-cost NG and an aging fleet of coal fueled generating units.

The second part of this plan, and the part that is directly connected to the June 12, 2025 executive order, comes from the supply chain for wood pellet fuel.

The Executive Order Encourages Building Demand for Uses of Otherwise "Low-Value" Biomass

The primary forest products industry converts the "high-value" portion of trees (sawlogs) to lumber, flooring, cabinetry, and furniture. As logs are processed into those products, between 35% and 55% of the log becomes by-products (often called residuals) in the form of chips, shavings, and sawdust.

These sawmill residuals are part of the "low-value" biomass supply chain.

A significant portion of those sawmill residuals are used to produce other products. One of major end users of the low-value sawmill residuals are pulp and paper mills. But pulp and paper manufacturing is a declining sector (see Figure 8 below). Another user for sawmill residuals is in wood pellet fuel manufacturing plants. This is a growing sector.

Figure 7 shows the actual material flows from the primary harvests in the US and Canada to the producers of products made from wood. Note that the pulp and paper sector takes in about 26% of woody biomass that is not made into lumber, flooring, and other products made in sawmills.

Part of the input to pulp and paper mills are the low-value residuals produced from the initial harvest. When the trees grown in managed forests are harvested at maturity, there are portions of the tree that are not suitable for being sawn into lumber, flooring, furniture, etc. Those so-called forest residuals (tops, limbs, crooked stems, and stems that are rotted in the center) are usually made into chips and find their way to pulp and paper mills, engineered wood products factories (for example, oriented strand board or "OSB"), and to pellet factories.

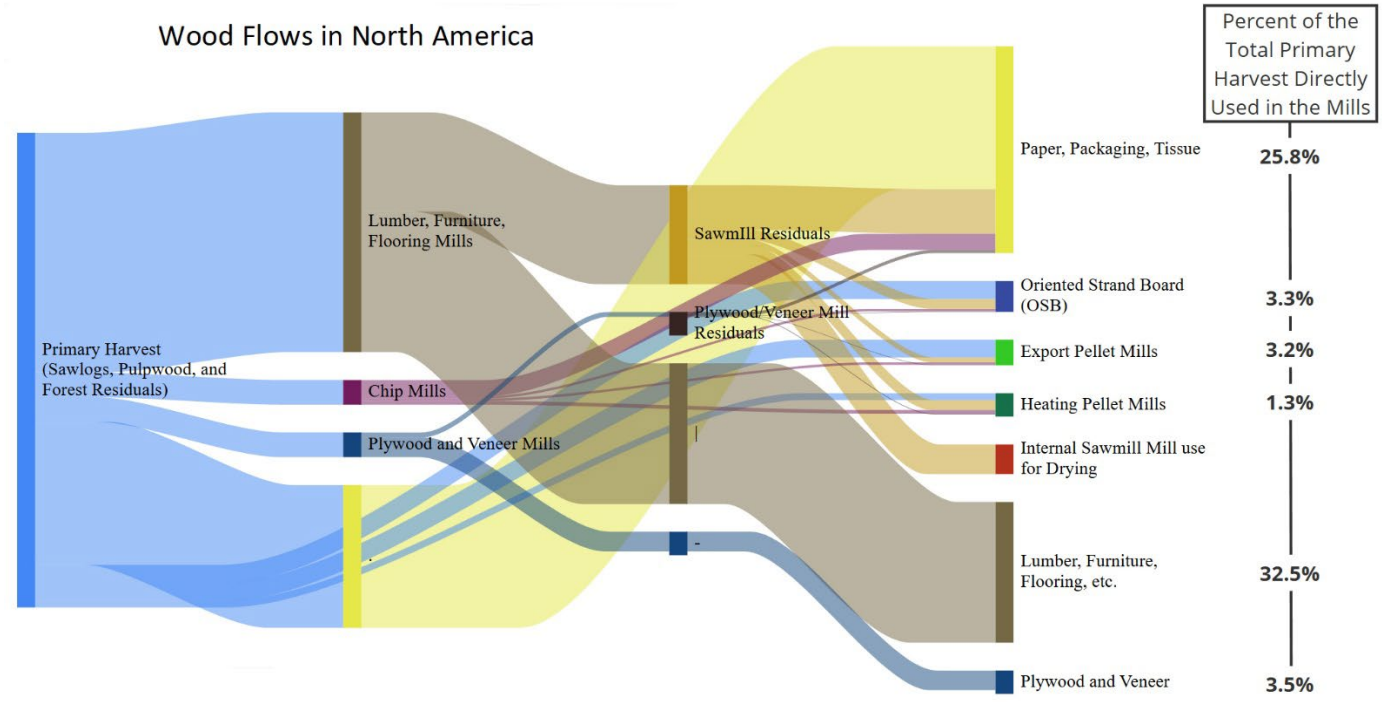

Figure 7 - Wood Flows in North America

The flow into the yellow-colored paper, packaging, and tissue group in the chart is challenged by the dramatic fall in demand for paper for printing. In some parts of the US, pulp and paper mill closures have destroyed not only those mill jobs but also all of the jobs in the supply chain that were delivering millions of tonnes per year of woody biomass to the pulp mills.

In some locations, because of pulp mill closures, sawmills have no feasible market for their residuals. In some locations, sawmill residuals accrue a disposal cost to the sawmill rather than revenue for the sawmills.

The impacts in many rural forested areas with generations of history sustainably supporting the forest products industries have been devastating.

Changes in demand for printed media and offshore competition have been extremely challenging for the US pulp and paper sector.

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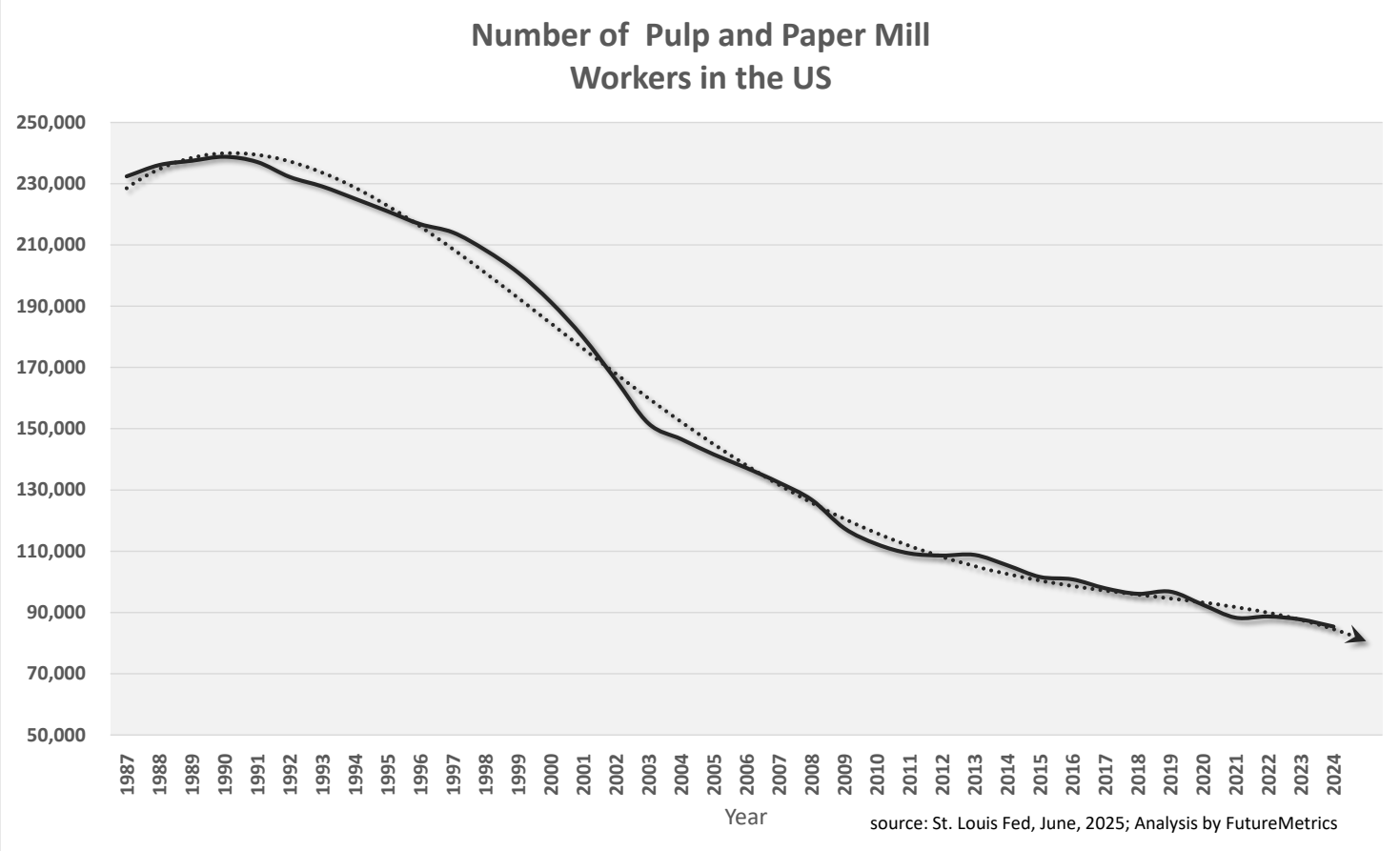

Figure 8 - Employment in the Pulp and Paper Sector

As Figure 8 shows, employment in that sector, which typically benefits workers in rural areas, has crashed. The number of people working in pulp and paper mills in 2024 is about one third of what it was in 1987. And the indirect and induced jobs that have been lost are many times greater.

It is unlikely that trends in the demand for paper will change as increasingly what most people read is on a screen. While the production of packaging (think online product purchase deliveries) and tissue (think toilet paper!) remains strong, the use of paper for printing is in steady decline. Newsprint has all but disappeared.

The June 12 executive order supports a strategy which can bring many of those jobs back.

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Policy that Supports a Significant Increase in the Use of US Biomass Resources

The June 12, 2025, executive order, when actualized, will result in a significant increase in forest thinnings; which will add significantly to already oversupplied low-grade biomass markets. The flood of low-grade biomass will not be soaked up by the current traditional end users of low-grade biomass. The steady decline in demand for paper is unlikely to change.

Thus the need to develop "innovative uses."

There is already a proven pathway for creating a use for an increased supply of woody biomass in the United States.

The production of upgraded solid pellet fuel that can be used to replace coal in power generation for use in US utility power generating units would use significant quantities of the fire mitigation thinnings.

With very modest investments, existing US coal generating stations can co-fire pellets with coal. Those stations would provide support to a pellet fuel manufacturing sector. The demand for feedstock by the pellet factories would soak up the flood of low-grade biomass produced as a result of the executive order.

A 556 MW unit (see below for more on why this size is used as an example) co-firing 15% pellets and rest coal would need about 325,000 metric tonnes (about 358,000 short tons) per year of pellet fuel. This would require about 750,000 metric tonnes per year of woody biomass.

Which of the currently operating coal fueled units should be selected?

Since many of the new pellet manufacturing plants will likely be in the west where wildfire mitigation will be concentrated[9], in most locations, access to relatively nearby rail to move the pellet fuel from the pellet mill to the power stations will be part of the decision making process on where to locate the pellet factories.

The analysis below looks at coal fueled units that are less than 15 years old. There may be other units that could be more optimal co-firing choices based on optimizing pellet fuel transportation logistics and cost.

The starting premise for this analysis is that selecting the newer plants not only focuses on the most modern and efficient designs, but also avoids the substantial costs associated with the early retirement of major assets.

The classic "stranded asset"[10] scenario for early retirement will shift the as yet unfunded capital cost liability of relatively new power stations onto ratepayers. For newer plants, the unfunded liability can be substantial.

This analysis assumes co-firing 85% coal and 15% pellet fuel. Each unit will likely benefit from different ratios.

[9] Pellet manufacturing plants are typically located near the center of the wood supply area to minimize the distance that so-called "green" wood must travel. Freshly harvested wood has a very high water content (50% on average). It is better to transport upgraded densified low water content (~5%) high energy density pellet fuel over long distance to optimize the net cost of delivering energy to the power station.

[10] See https://assets.lloyds.com/assets/pdf-stranded-assets/1/pdf_stranded-assets.pdf for a detailed analysis.

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In the US, of the 352 operating units greater than 150 MWs, there are 28 that are 15 years old or less. The average size of those units is 556 MWs. Click on the map below (or HERE) to open a Google Map in a browser. Clicking on the icons brings up a link to a more detailed discussion about the unit. Zoom in to any of them for a close view.

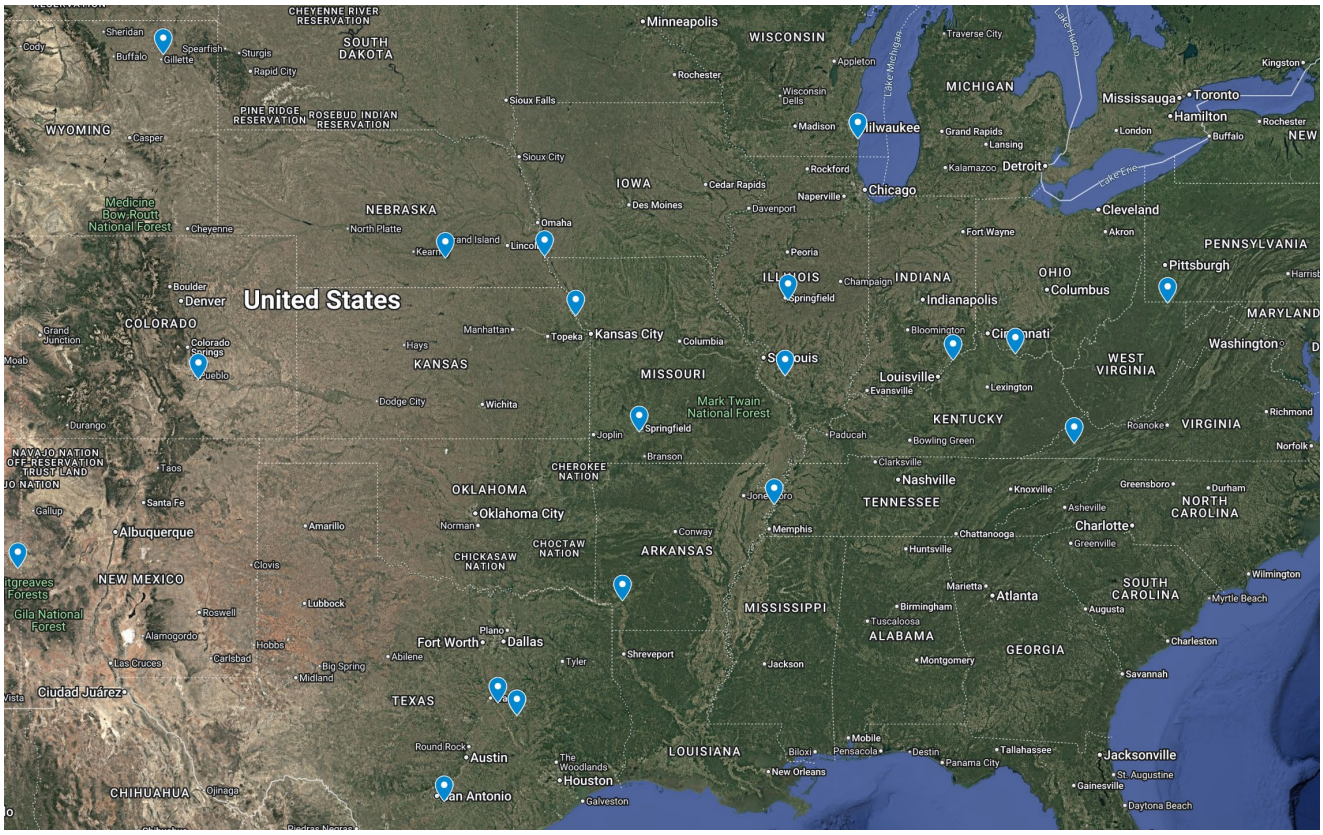

Figure 9 - Coal Fired Units that are Less than 15 Years Old

The total capacity of those units is 15,570 MWs.

Using the dashboard setting in the FutureMetrics dashboard referenced in footnote 4, blending 85% coal and 15% pellet fuel results in an increase in the cost of generating electricity over 100% coal of $3.90 per megawatt-hour. That is $0.00386 per kilowatt-hour. A fraction of a penny per kWh!

Suppose all 28 coal stations that are less than 15 years old co-fire at 15%. Total pellet fuel demand would be about 9,000,000 tonnes per year. Total low grade woody biomass demand would be close to 19,000,000 tonnes per year.

Increasing production from current levels to levels needed if the full 28 unit 15% co-firing scenario were implemented would require capital investments in new pellet manufacturing facilities of about 3 billion dollars.

The supply chain for delivering coal replacement pellet fuel is more labor intensive than the supply chain for delivering coal. Thus, at any co-firing ratio above zero pellets, the station will support a higher number of fuel supply jobs.

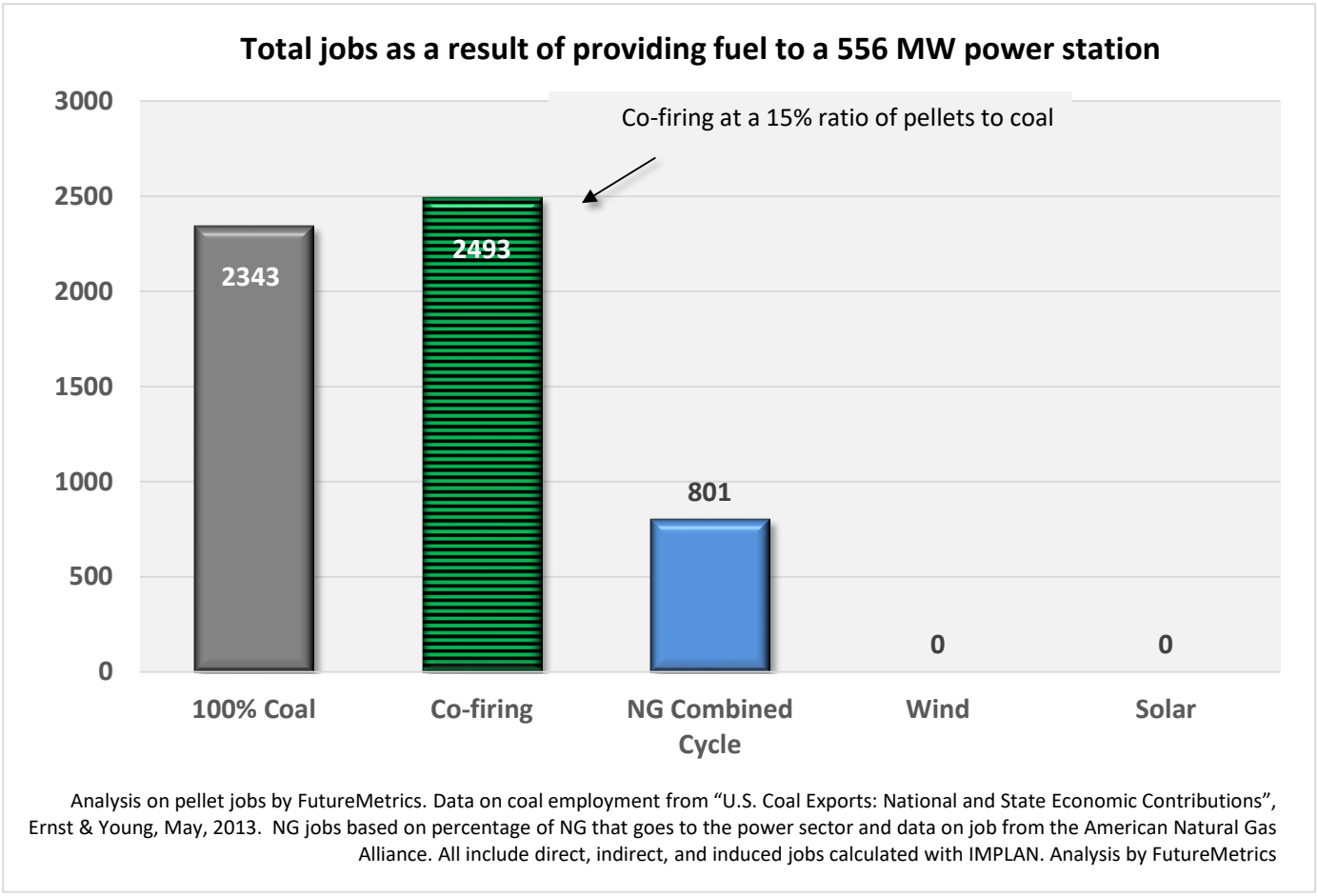

Figure 10 - Jobs Needed to Supply Fuel to a 556 MW Generating Station

Maybe some of the 23 of the newer coal fueled power stations will not co-fire. Maybe some of the others will co-fire at higher ratios. But under most scenarios, the demand for low-grade biomass will still very large.

Conclusion

The implementation of the executive order will create a flood of biomass that will have to quickly find markets. This white paper shows a way to do that. But it will require further action by policymakers.

To support wildfire risk reduction goals with the strategy outlined in this white paper, the administration will have to implement policy that influences the strategic decision making of utilities. There will have to be a reason that utilities will choose to keep selected coal plants running and co-firing coal with pellet fuel.

(1) First, the Secretaries of the Interior and of Agriculture can follow the guidance in the executive order and "consider promoting" the use of the thinnings by supporting the costs of harvesting and transportation. Any conversion pathway of low-grade woody biomass into useful products only makes economic sense if the cost of the feedstock is kept low. The executive order implicitly defines forest fire risk mitigation as a "public

good[11]". Therefore, the cost of harvesting and transporting the woody biomass in support of the goals of the executive order should be supported to keep the delivered cost of the biomass to the pellet factories economically viable.

(2) **Second**, policymakers need to mandate that selected currently operating coal-fueled generating units that participate in this strategic plan continue to operate for at least 10 more years and use a blend of domestically produced coal and domestically produced pellet fuel at a ratio that is fixed at the beginning of the 10-year term. The system operators that purchase power for transmission into the grid will need to be required to buy that power and pay the regulated price based on the cost of generation. That cost should remain low and stable as long as the woody biomass feedstock costs delivered to the pellet factories are low and stable (refer to item one above). Note that this will also bring certainty to the thermal coal suppliers.

While natural gas generation is lower cost, it is not possible, nor strategically wise, to have the entire on-demand non-intermittent supply of electricity for the grid fueled only by pipeline delivered natural gas.

This strategy supports a more robust system entirely based on US produced solid fuels and the diversification of the baseload supply of power to the grid.

The growth of a US co-firing market would spur billions of dollars of investment into new manufacturing plants in areas of the US that need industry and jobs.

Blending of pellet fuel with coal in a small proportion of our nation's coal fired generation fleet supports multiple stakeholders and improves the resilience of the US generation systems.

On-demand non-intermittent power from diversified sources using domestically produced fuel is the backbone of a stable, secure, and reliable power grid.

And perhaps most importantly from a pragmatic perspective, the strategy outlined in this white paper would solve some of the huge challenges created by the flood of wildfire mitigation forest thinnings.

[11] https://en.wikipedia.org/wiki/Public_good