Climate Engagement – 2022 – COP 26 vs. Fugitive Methane

28 May 2022

Before the Oregon Public Utilities Commission

TO: Chair Decker, Commissioner Tawney, and Commissioner Thompson
CC: JP Batmale, Kim Herb

SUBJECT: Docket UM 1278, The Future of Gas

The Case for Ending Energy Emissions and Waste Heat

Ed Averill, and Tracy Farwell, from the Sustainability Desk, Better Energy LLC

28 May 2022

The Case for Ending Energy Emissions and Waste Heat

For climate activists all GHGs are an essential issue. All fossil fuels have a dual problem with this. **When burned, they emit CO2** that hurts the planet with excess heating. **When extracted or when the well/mine is left untended, they emit CH4 (methane)** so there is a serious GHG consequence with direct dependency on ordering a fossil fuel, with CH4 becoming "fugitive methane" and however much the end vendor claims that is not his problem, the earth's ecosystems are being damaged, and … we WILL ALL CARE.

Simply switching from fossil fuels to green non-emitting energy completely solves this problem. Nobody is in a better position to influence the strategies of our energy utilities than the PUC. Thus we want you to see the logic and the opportunity to help save our ecosystems.

The Fossil Industry will claim that the EPA is directing rules to fix this. For decades this argument has co-existed with emissions increasing dramatically. There's no reasonable hope for using these fuels without driving increased risk. So, the opportunity is to achieve an early switch away from fossil fuels.

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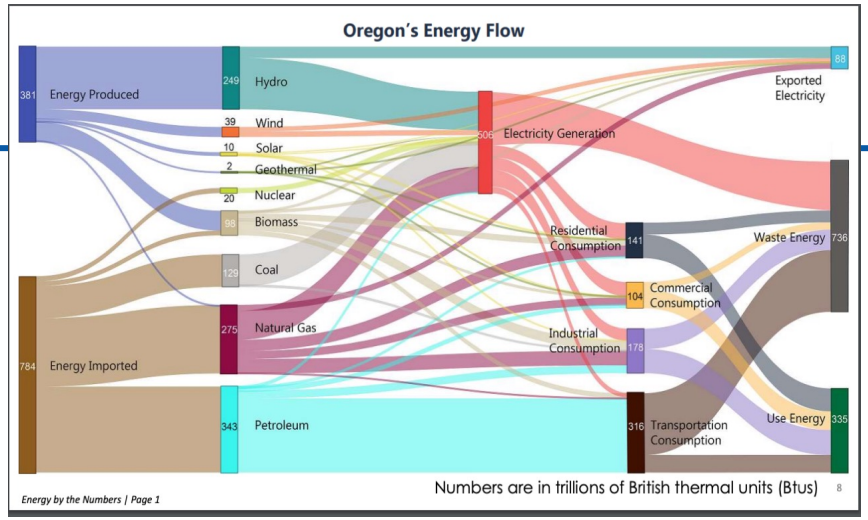
Climate Engagement – 2022 – COP 26 vs. Fugitive Methane



In August of 2021 the UN issued a 'Code red for humanity' - a challenge to not pass 1.5 deg C. We must

1. stop emitting Fugitive Methane
2. transition to non-emitting energy

Fugitive Methane is emitted during "fracking" for Natural Gas (methane, aka CH4) and for Petroleum, and newly we learn coal is worse than thought.

Removing about three years-worth of human-caused emissions of the potent greenhouse gas would reduce global surface temperatures by approximately 0.21 degrees Celsius while reducing ozone levels enough to prevent roughly 50,000 premature deaths annually.

A good reference from Stanford University is https://news.stanford.edu/press/view/41196

Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.

Peter Carter, an IPCC expert reviewer has recently released an 80-minute video on the state of the Climate Crisis as the result of bad responses to good science at the Glascow COP 26 in December 2021.
We have excerpted points from Peter Carter's video for our slides:
https://youtu.be/nvZaleYmqIE

Motivation – Global Climate is in deep trouble. We think few people have paid adequate attention to COP 26, and its follow-on. The emergency exists, and it is here and now.

The requirement is to Eliminate Emissions Quickly.

The Scientists at COP 26 knew major commitments to Decarbonization were needed.

Governments kept scientists out of the policy discussions which ignored a science narrative, **and the governments' policy agreements failed to target "A Livable Future"**

Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.

28 Feb 2022, IPCC WG2, Press release

Climate change: a threat to human wellbeing and health of the planet. Taking action now can secure our future

4 April 2022, IPCC WG3, Press release

The evidence is clear: the time for action is now. We can halve emissions by 2030

We are at a crossroads. The decisions we make now can secure a liveable future. We have the tools and know-how required to limit warming

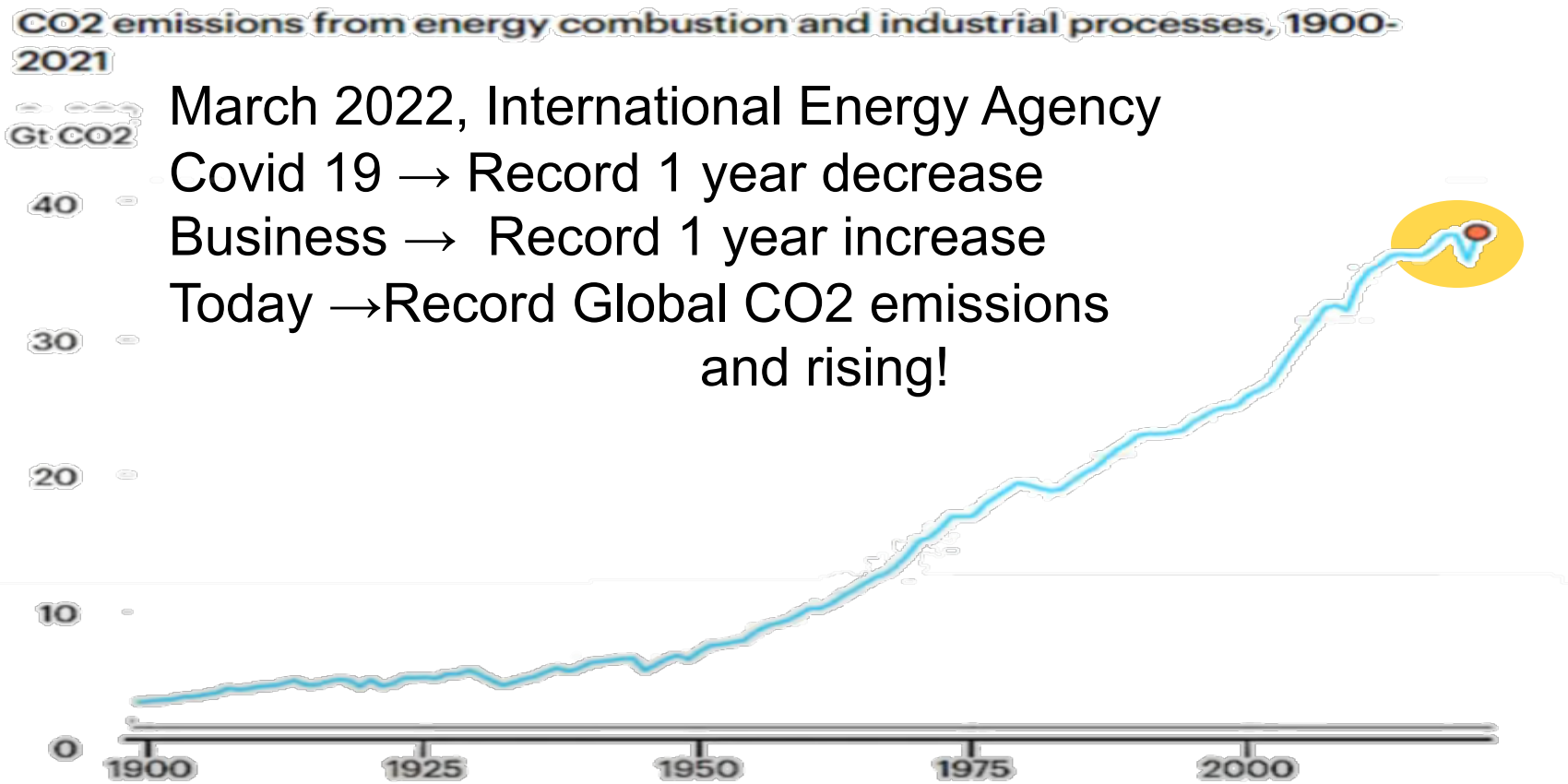
Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.

Peter Carter puts it this way;

We either choose to achieve rapid and large-scale reductions of emissions to keep the goal of limiting global warming to 1.5°C— or we accept that humanity faces a bleak future on this planet.

We either choose to recognize that business as usual isn't worth the devastating price we're paying and make the necessary transition to a more sustainable future — or we accept that we're investing in our own extinction.

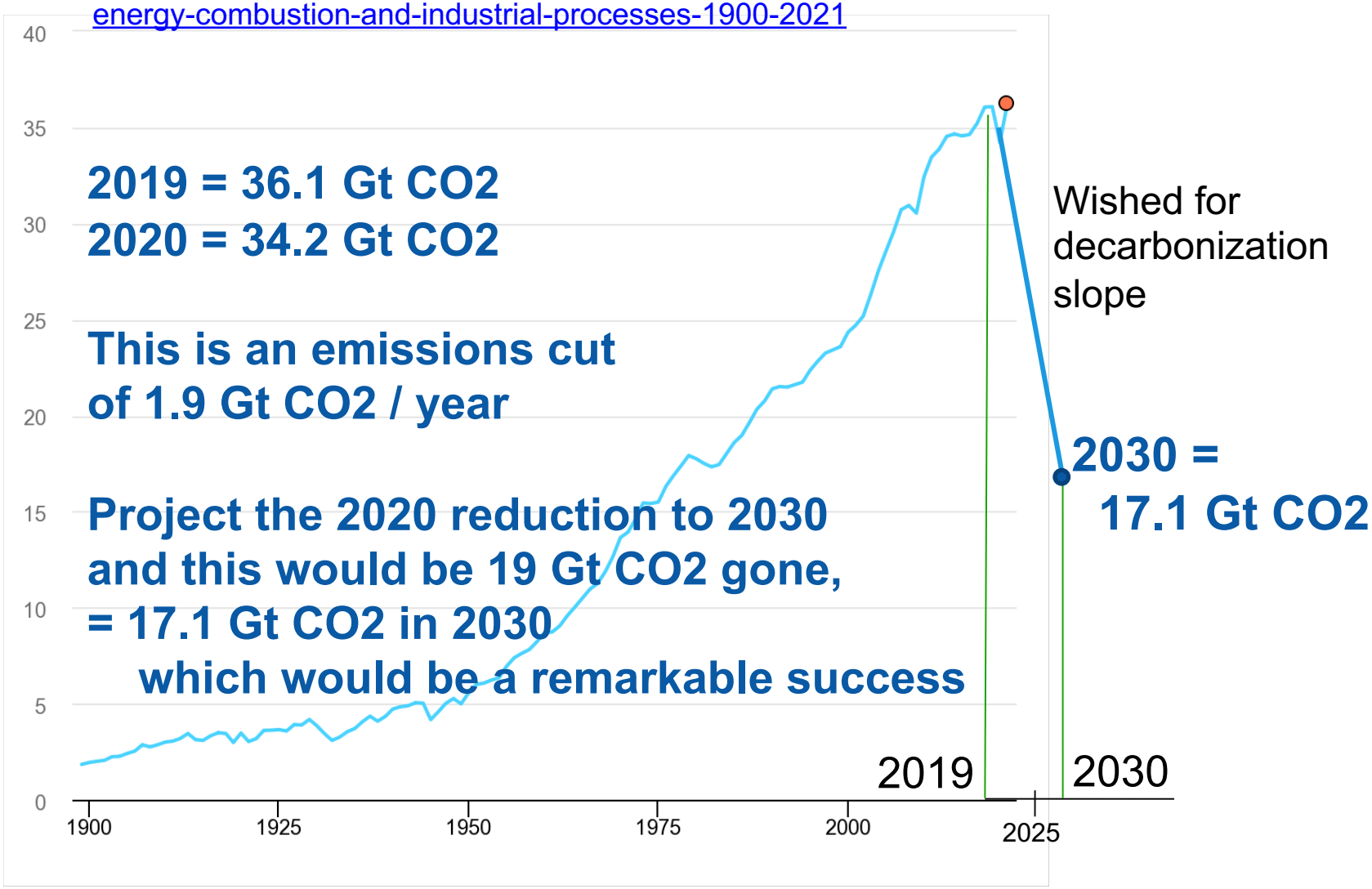
Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.



March 2022, International Energy Agency
Covid 19 → Record 1 year decrease
Business → Record 1 year increase
Today →Record Global CO2 emissions and rising!

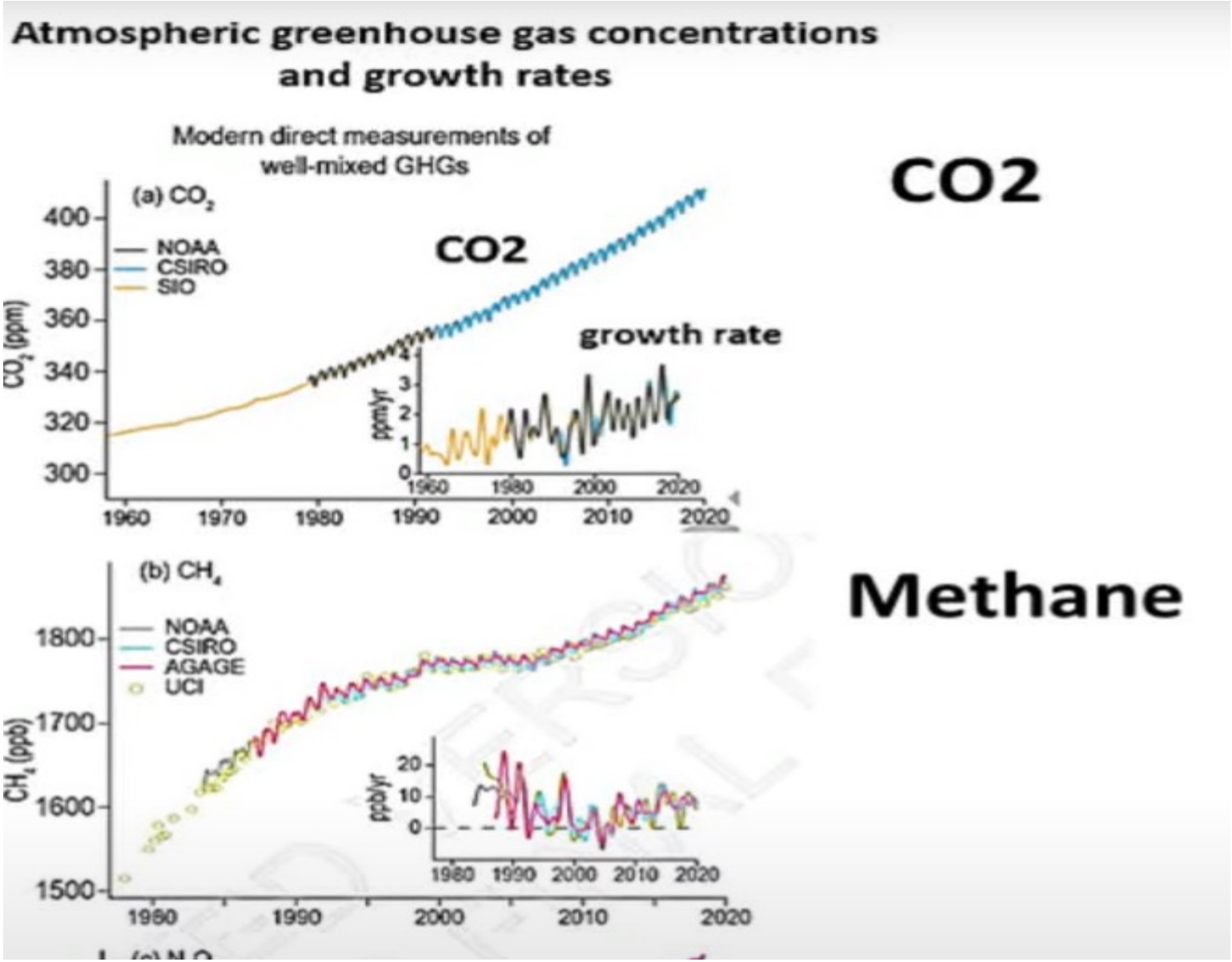
COVID Teaches the Difference Between Could and Would

Gt CO2 https://www.iea.org/data-and-statistics/charts/co2-emissions-from-energy-combustion-and-industrial-processes-1900-2021



Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.

US EIA data – no relief, no intervention



Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.

But Emissions are worse than ever, and the state of a variety of ecosystems is showing they are weaker than expected.

Ecosystems are not in any condition to deal with more GHG emissions

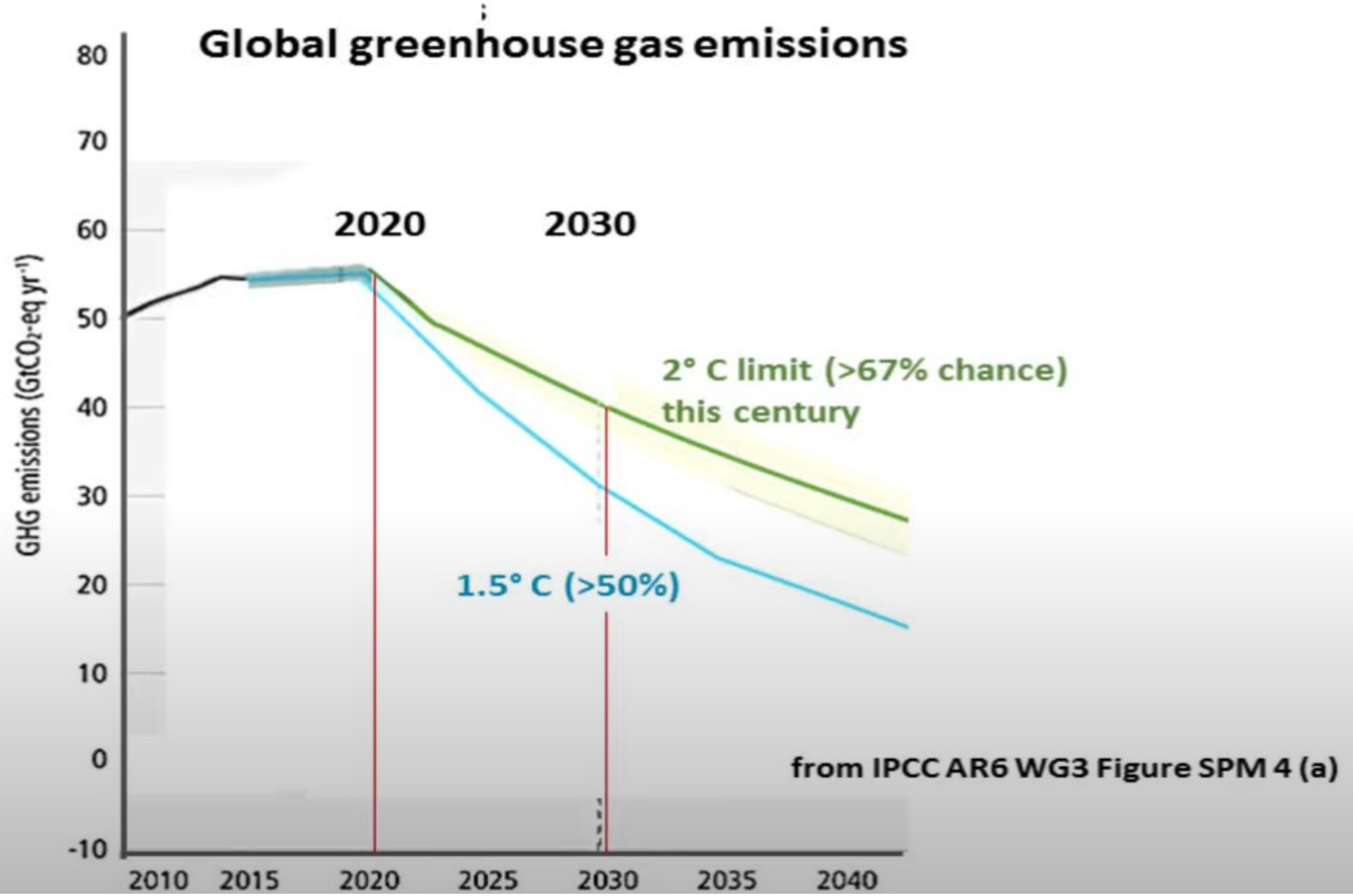
Looking for A Solution to Natural Gas when the requirement is Eliminating Emissions Quickly.

What if the Natural Gas companies quit selling buggy whips and instead sold what's needed in new economy?

Consider what's happening in Massachusetts with 3 gas utilities: https://www.canarymedia.com/articles/utilities/a-net-zero-future-for-gas-utilities-switching-to-underground-thermal-networks

Gas Utilities in Massachusetts are planning infrastructure to provide regional geo-grids supplying **Pumped Water** for heat exchange that supports ground-sourced **Electric Heat Pumps**

Emissions must decline rapidly to obtain Livable Future

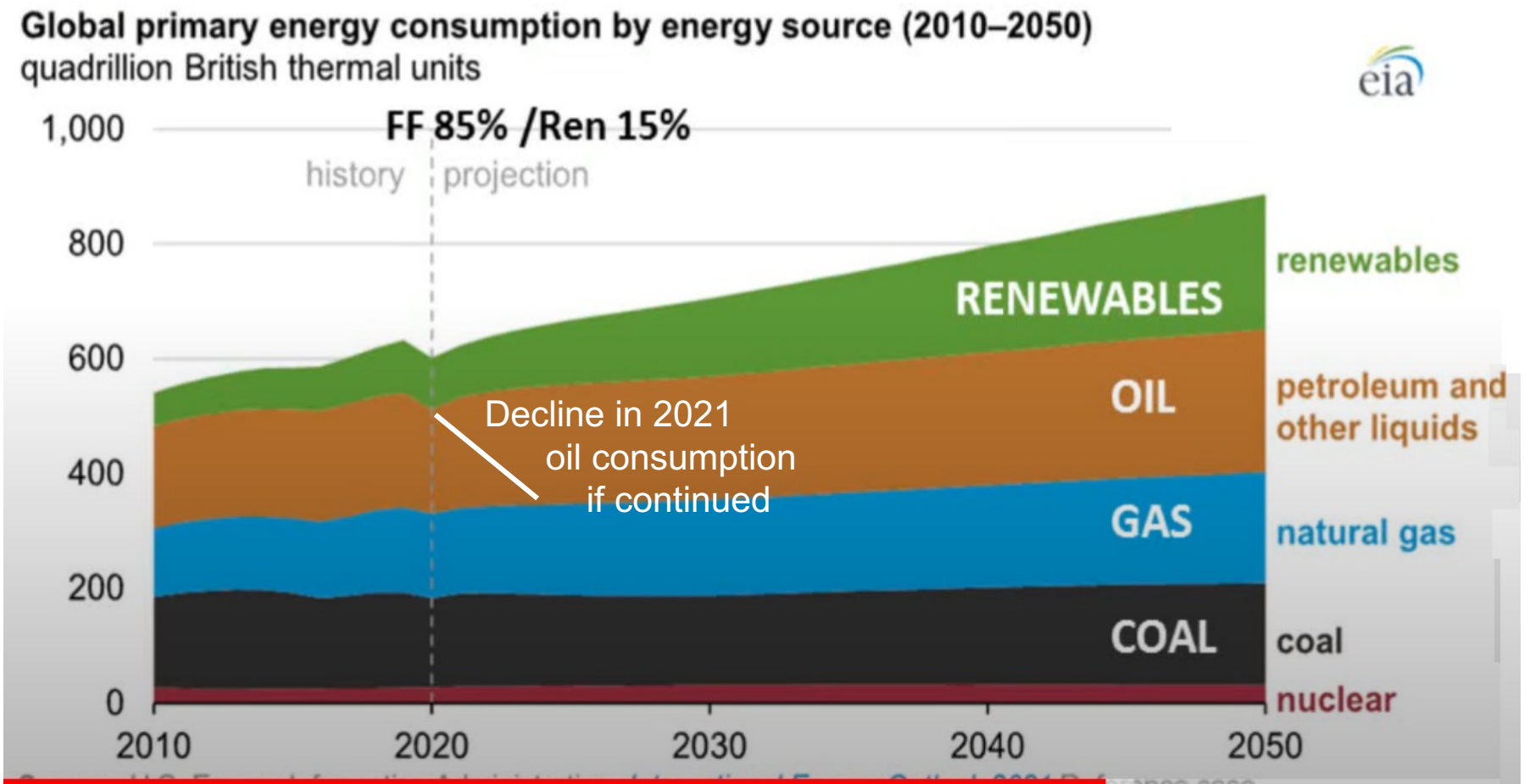


from IPCC AR6 WG3 Figure SPM 4 (a)

US Energy Information Agency World energy outlook to 2050

October 2021

Note decline in 2021 oil consumption from COVID illustrates feasibility of changing demand



The US Energy Information Agency, which is good at predicting, paints a dire future that **fails to keep anywhere near 2 degrees C.**

- **Remember that 90% of all coral is expected to be dead when we reach 1.5 degrees just after 2030.**
- *99 to 100% will die at 2 degrees C in about 2040.*
- The US EIA predictions put us well into serious extinctions in the food chain.

We need to plan for better than that !

Upcoming slides will show that when we buy fossil fuels we get an immense amount of energy – however, it's **not all available for use in creating useful work – only about 1/3 is.**

Much of the energy (about 2/3) is wasted as unusable heat.

<u>For winter heating</u> fossil fuels can deliver near **100% of available energy as heat.**

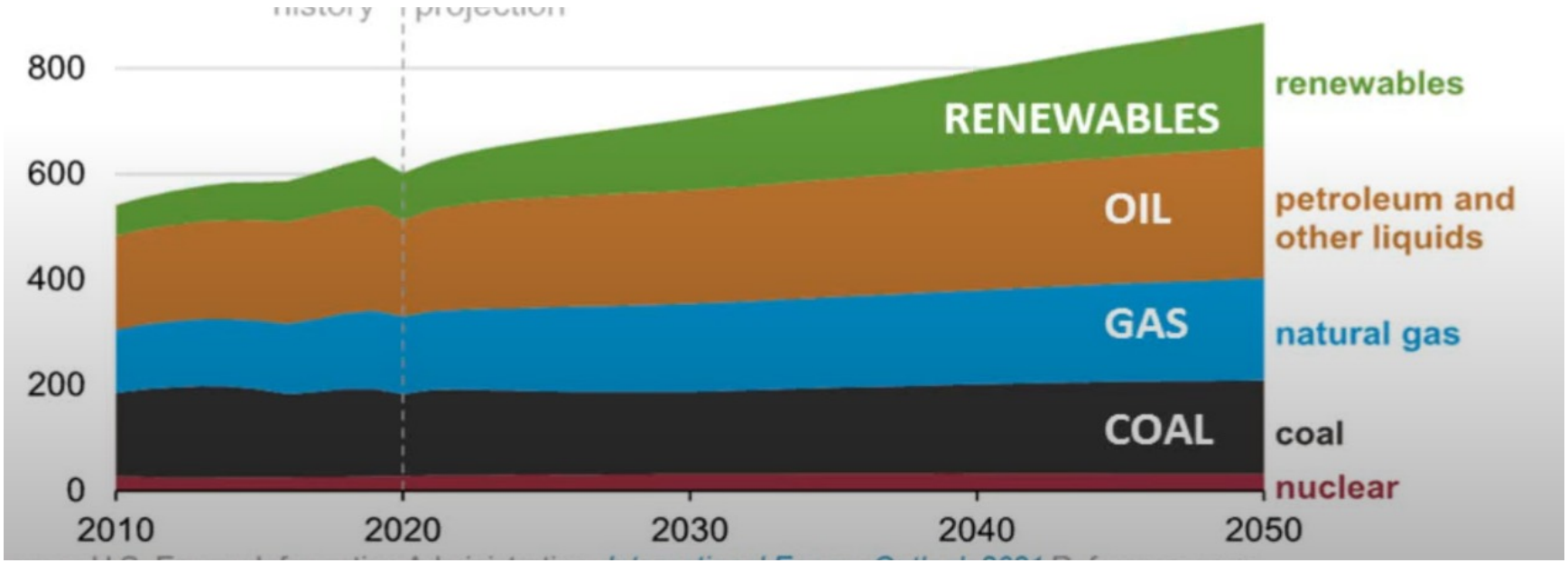
However, electricity with **heat pumps** can double to quadruple the heat gain. And give summer benefits. So we **get 3x benefit when going high efficiency electric heating.**

This EIA prediction depicting Fossil plus Renewables ***suggests*** two things:

1) Growth of Fossil Fuels might be very significant

2) While growth of Renewable might be large, it would not displace Fossil energy sources.

This is misleading because Renewables as electricity are about 3x more effective vs. fossil, and cost of Renewables is in decline.



We need to take on a new perspective.
Everywhere we now buy fossil fuels, and use them in typical ways, we could use 1/3 as much renewable energy and get the same results.

We noticed that the ODOE created an interesting Sankey Chart to show one of the efficiency issues that burdens carbon fuels. We decided to take that idea and expand upon it on the upcoming slides.

A Sankey Flow charts Story -- going from dirty to clean energy

Our Sankey Flow Charts show Incoming Energy getting transformed into good uses and to various wastes and pollutions.

They will show how little new clean energy it takes to replace the carbon-based energy system.

A Sankey Flow charts Story -- going from dirty to clean energy

The idea of expressing efficiency with Sankey Flow Charts came from seeing the ODOE Energy overview for 2021.

The following slides will enlarge on their starting point to show how a transition to renewable energy can work.

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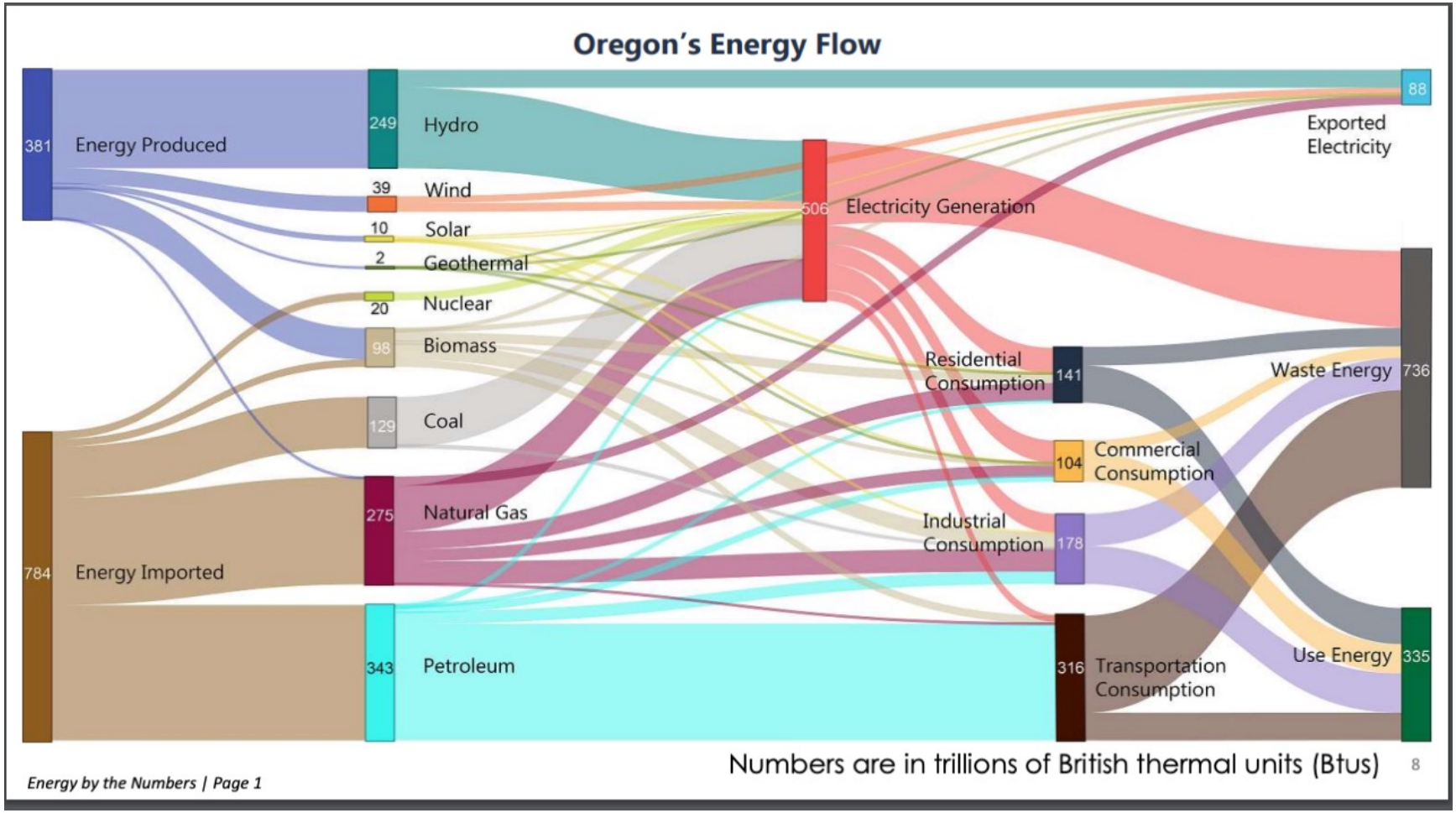
We want to explore energy scenarios and understand them in a larger context than we have had visualization tools for before.

ODOE created their view of Oregon Energy, like this:



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ODOE's Energy Diagram shows energy outputs *instead* of emissions. It shows **used energy** and **waste energy** and **exported energy** shared with Los Angeles

One chart can show Energy Use, Inefficiency, and Emissions

We would like to show you this way to visualize the

1) **inefficiency** of carbon-based fuels vs green energy

2) the associated **emissions**

so that we can address opportunities for decarbonization.

3) the **benefical energy** use

Climate Engagement – 2022 – A Target

It is essential that we contribute to <u>not reaching 1.5 degrees</u>. So, all excess GHG-trapped-heat is BAD, **really BAD**.

All ***delayed reduction*** of GHG emissions is just as BAD. Climate consequences are ***hard to reverse.***

Eliminating excess GHG would return us to a better situation. The result would not yet be a decreasing temperature but rising more slowly..

There are more complications than that. Ask questions if you want to discuss them.

Allowing emissions is bad because they accumulate. The earlier we slow or stop, the better.

The point addressed when our Legislature mandates **deadline times** for terminating use of COAL or Petroleum or Natural Gas is to do our best for reducing emissions and climate heating. Which avoids tipping points.

We will use Sankey Diagrams to help visualize scenarios that apply.

Methane is as frightening as ever

Here is a reference to our need to care about Blue Arctic and its consequences. Watch it when you have a chance. This is one place tipping points lurk.
Methane Hydrates - Extended Interview Extracts With Natalia Shakhova

During an interview with Dr Shakhova, a Russian environmental leader in Fairbanks, we became worried when she showed 2 charts - one with small insignificant plumes of methane from about 2001, contrasted with a chart from 2011 where the plumes of escaping gas from the permafrost were over a kilometer wide.
http://arctic-news.blogspot.com/2013/07/co2-let-me-introduce-you-to-my-little-friend-ch4-methane.html

Dr Shakhova and others talked about what might be coming in 2001. Much of that is happening now. Can we reverse it? We must set the stage by eliminating GHG quickly.

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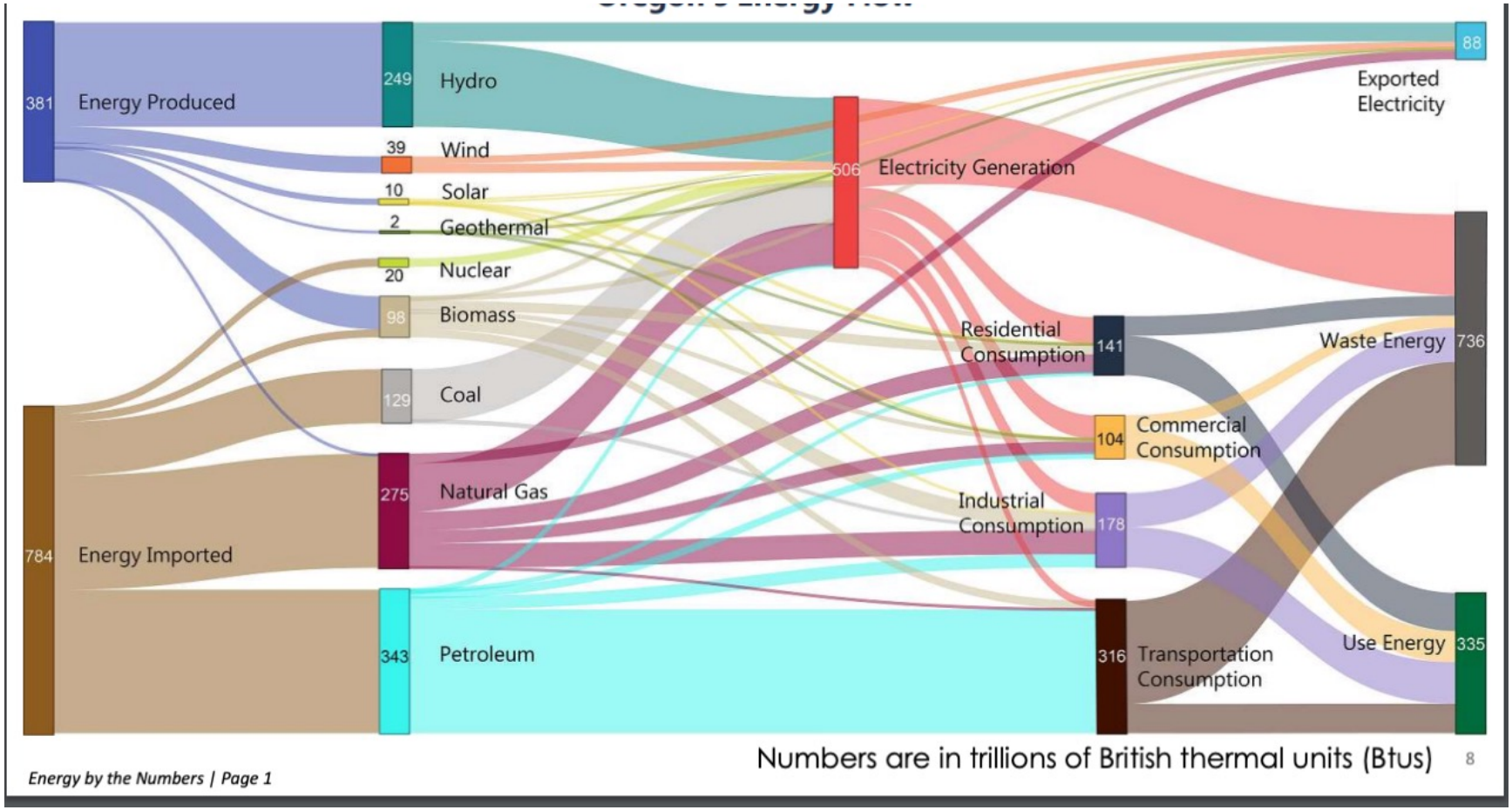
As ODOE created their view of Oregon Energy using the Sankey Chart, below: they chose to use annual energy units of **Trillions of BTU (Tera British Thermal Units)**. It's one arbitrary unit of energy. We have stayed with their units and associated numbers.



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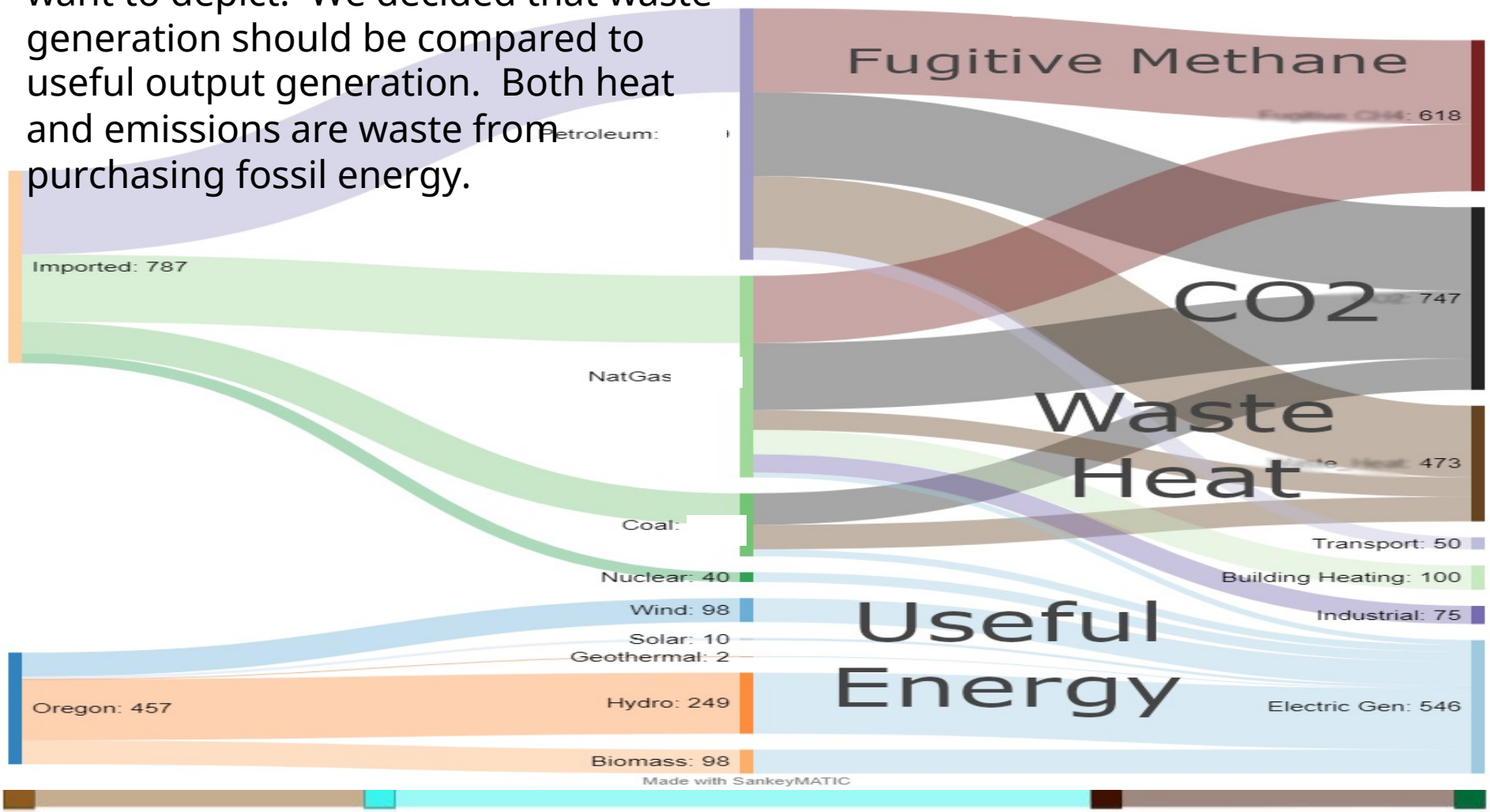
We used an online-available SankeyGen to create our charts, which is somewhat awkward, but with sufficient effort we achieved most of what we want to depict. We decided that waste generation should be compared to useful output generation. Both heat and emissions are waste from purchasing fossil energy.



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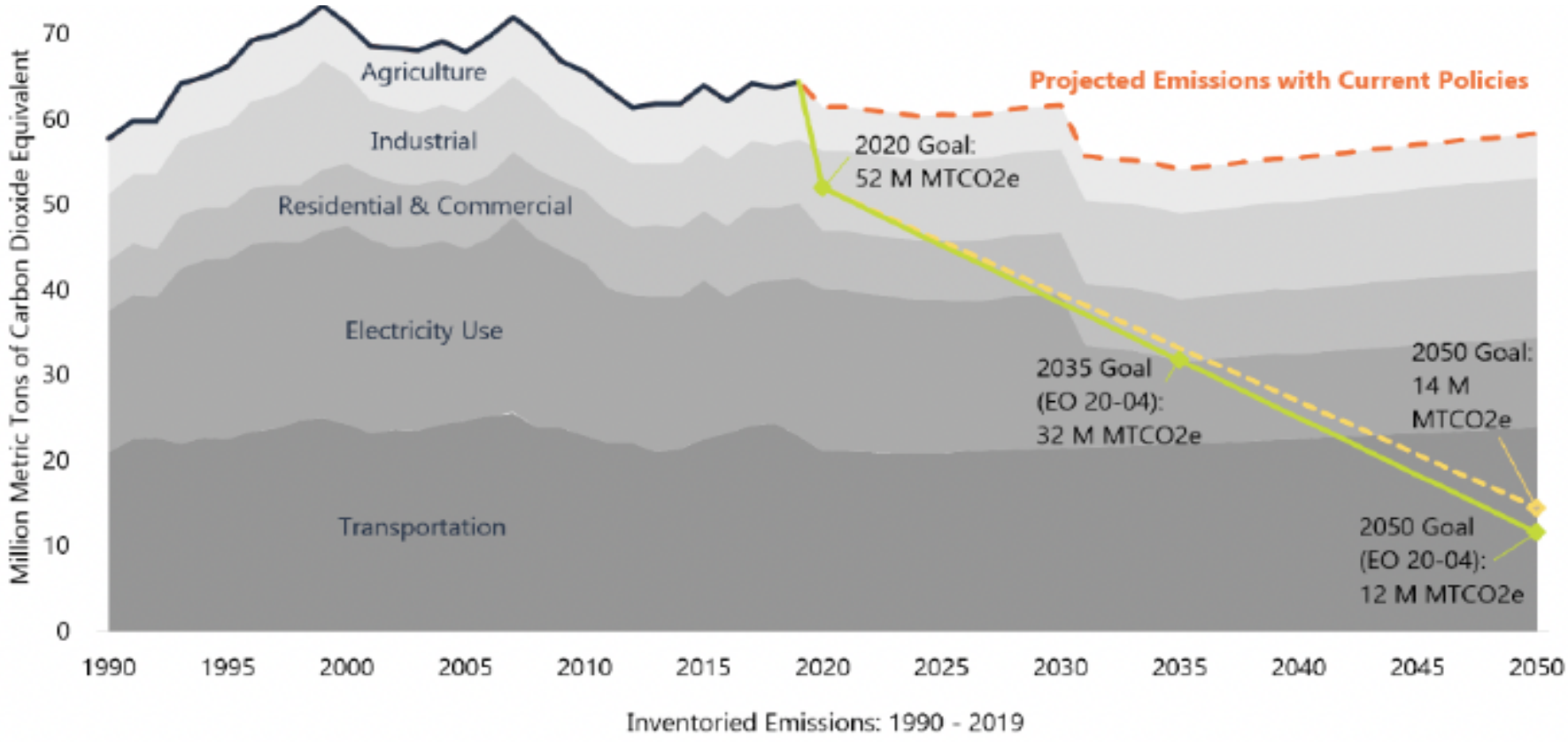
The first distinction between this emissions diagram we are accustomed to looking at and the Sankey Diagram is that we are no longer limited to looking only at GHG Emissions as the interesting story.

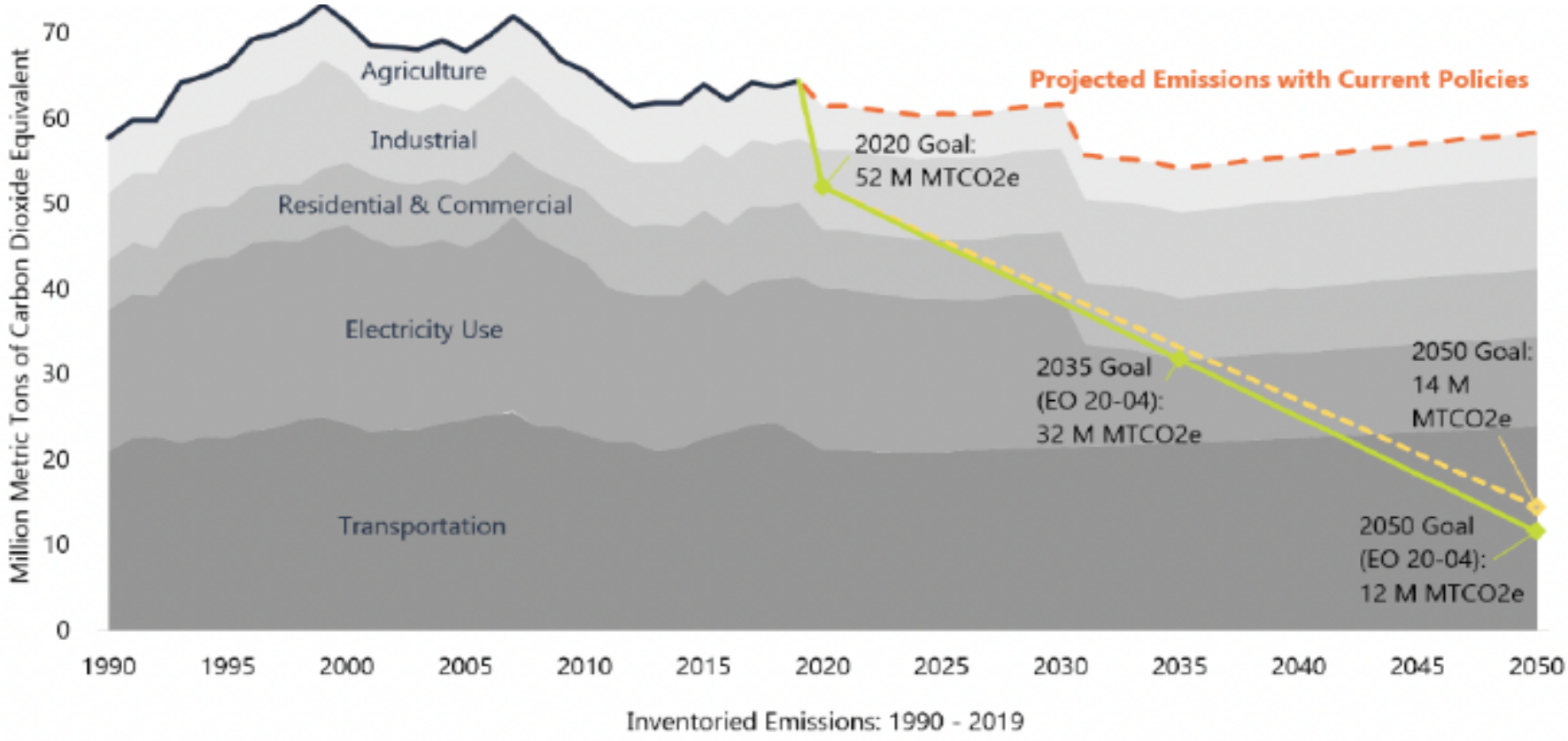
It is an interesting story, as below, but it is better when Sankey shows more outputs.



Climate Engagement – 2022 Special

What is missing in this analysis? UN credits Methane with up to 1/3 of our excess global heating, but it **doesn't even show up here because it is treated as an externality,** one with a huge cost to the ecosystem for our using it!

We include that demand-driven emission in our Sankey charts.

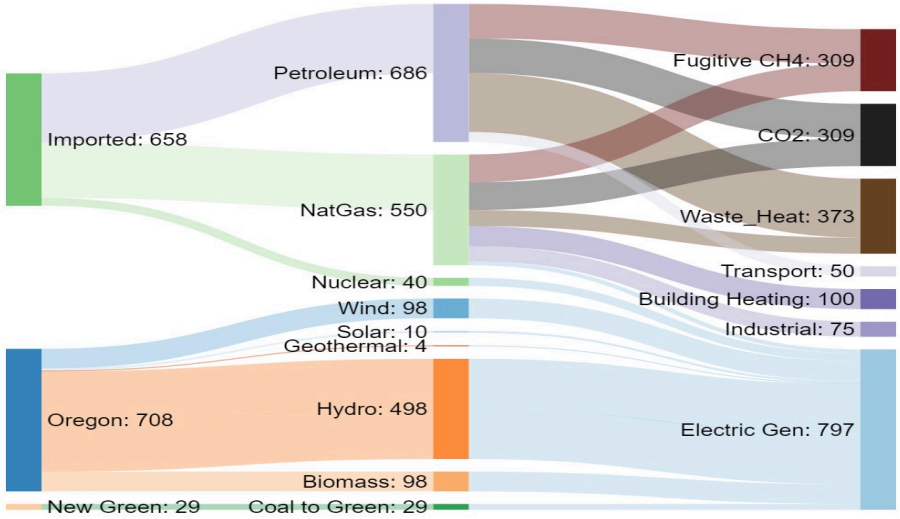


Climate Engagement – 2022 Special – Transitions

There are interesting utility targets to reach. They become the basis of interesting scenarios.

Using our Sankey Flow Charts, I think you will be able to better visualize how we can shift from our dirty present to a clean future with less energy growth than you would expect.

For each case we will replace the current fossil fuel with the equivalent amount of “New Green” energy that is required, taking advantage of the better efficiency.



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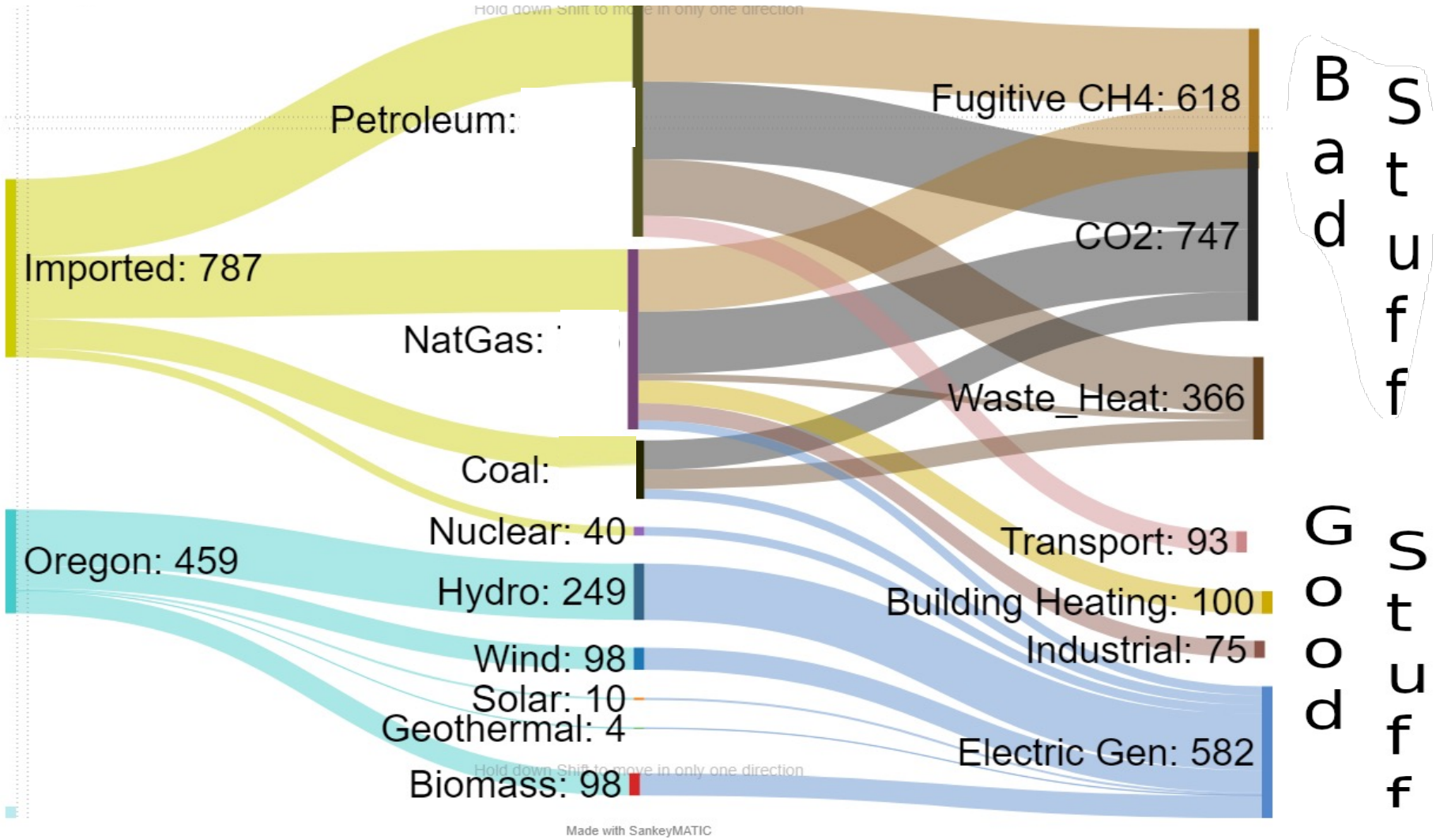
Starting scenario same as ODOE scenario.

Case 1 Current Energy Usage



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Each Case is a step away from carbon emitting fuels

Case 1 Current Oregon Energy Usage

Case 2 No Coal after 2025

Case 3 No Coal, Half Methane

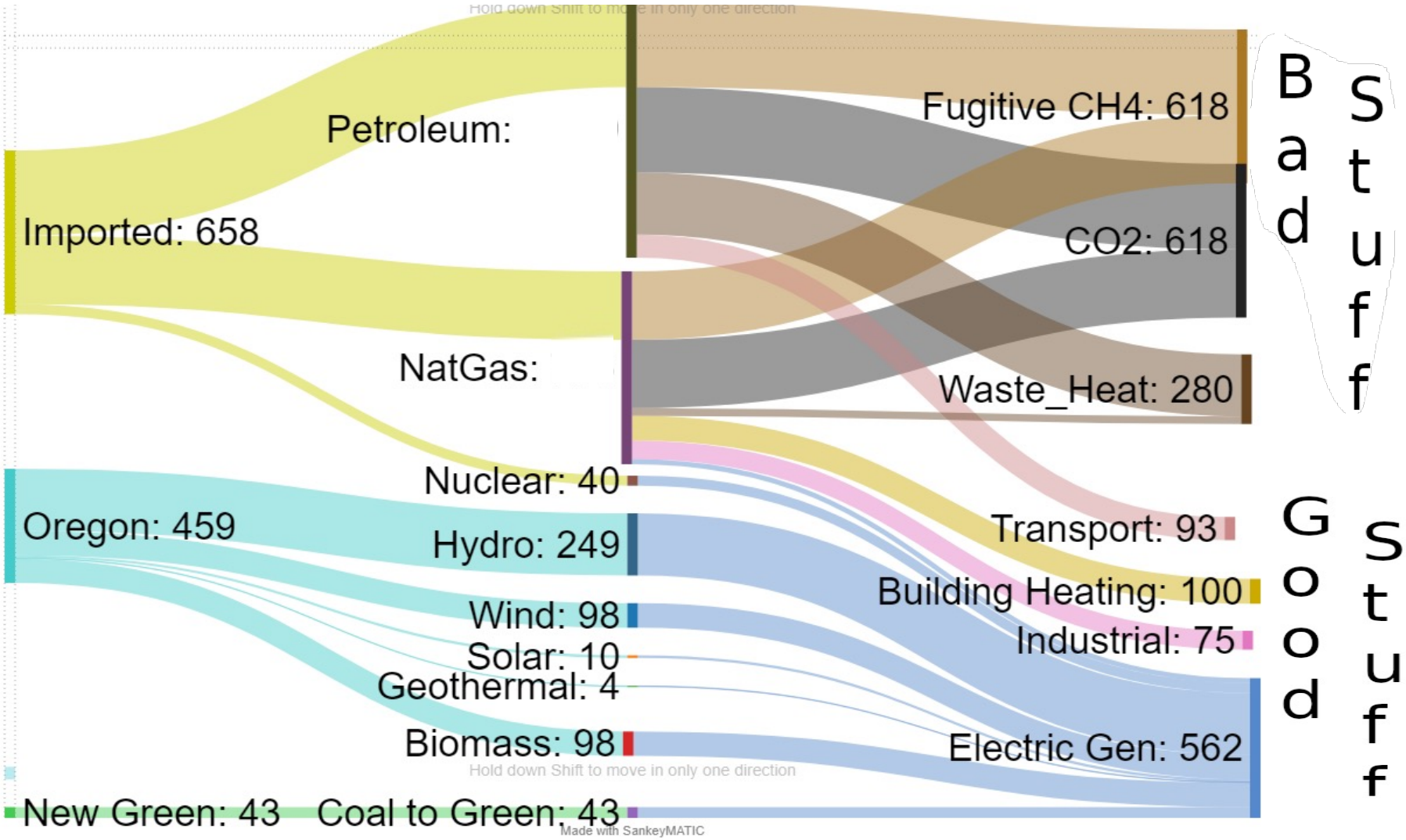
Case 4 No Coal, Half Methane, Half Petroleum

Case 5 No Coal, No Methane, No Petroleum

Climate Engagement – 2022

Case 2: Do **"Coal to Clean"** ASAP (say 2025) early from 2030
The 43 TBTU renewable is replacement energy for 129 TBTU of coal.

Case 2 No Coal after 2025



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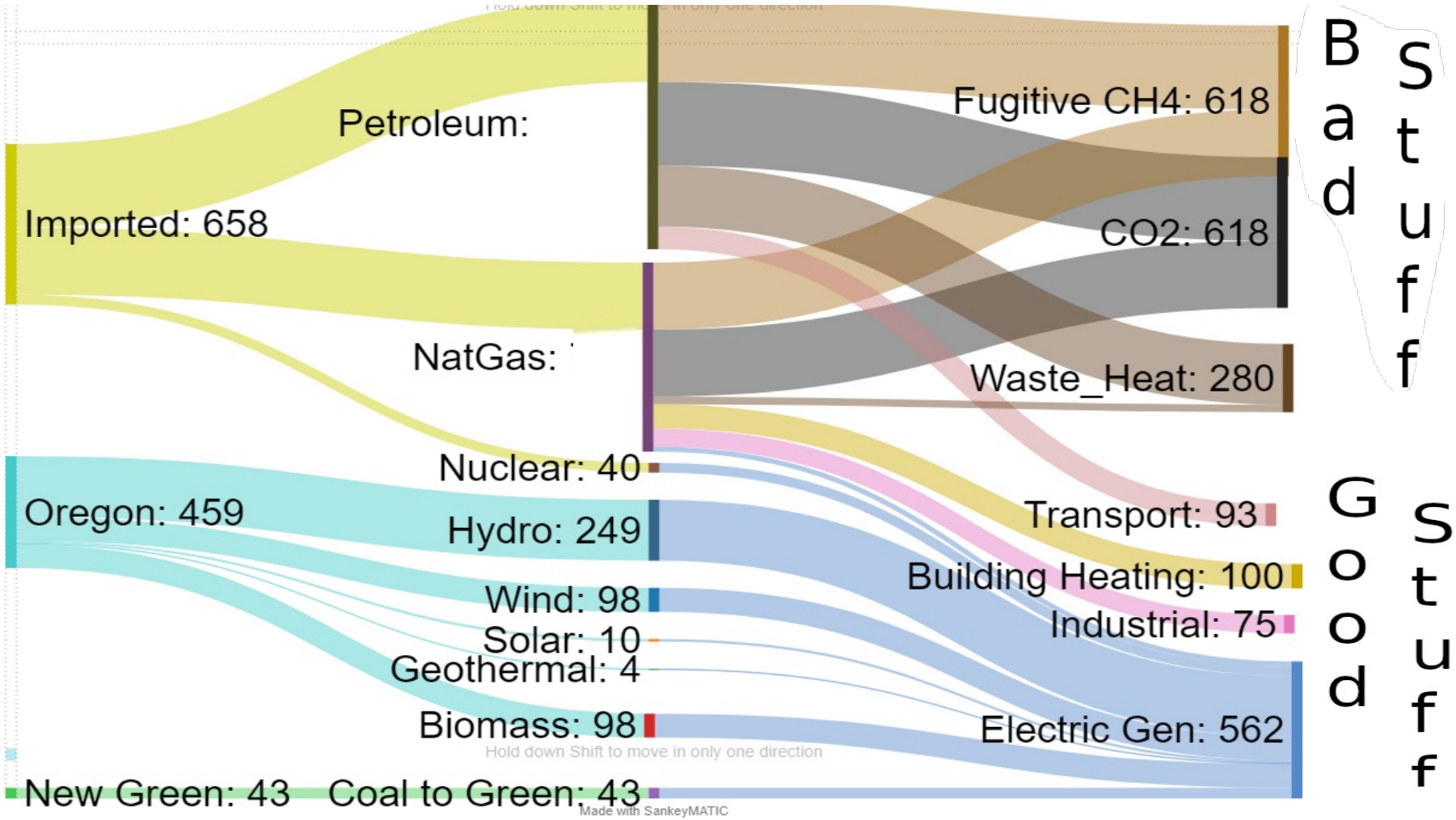
(repeated coal scenario with different comments)

"New Green" (Bottom flow below) compensates for eliminating coal use. Steam turbines driven by coal power have similar inefficiencies as other rotating machines.



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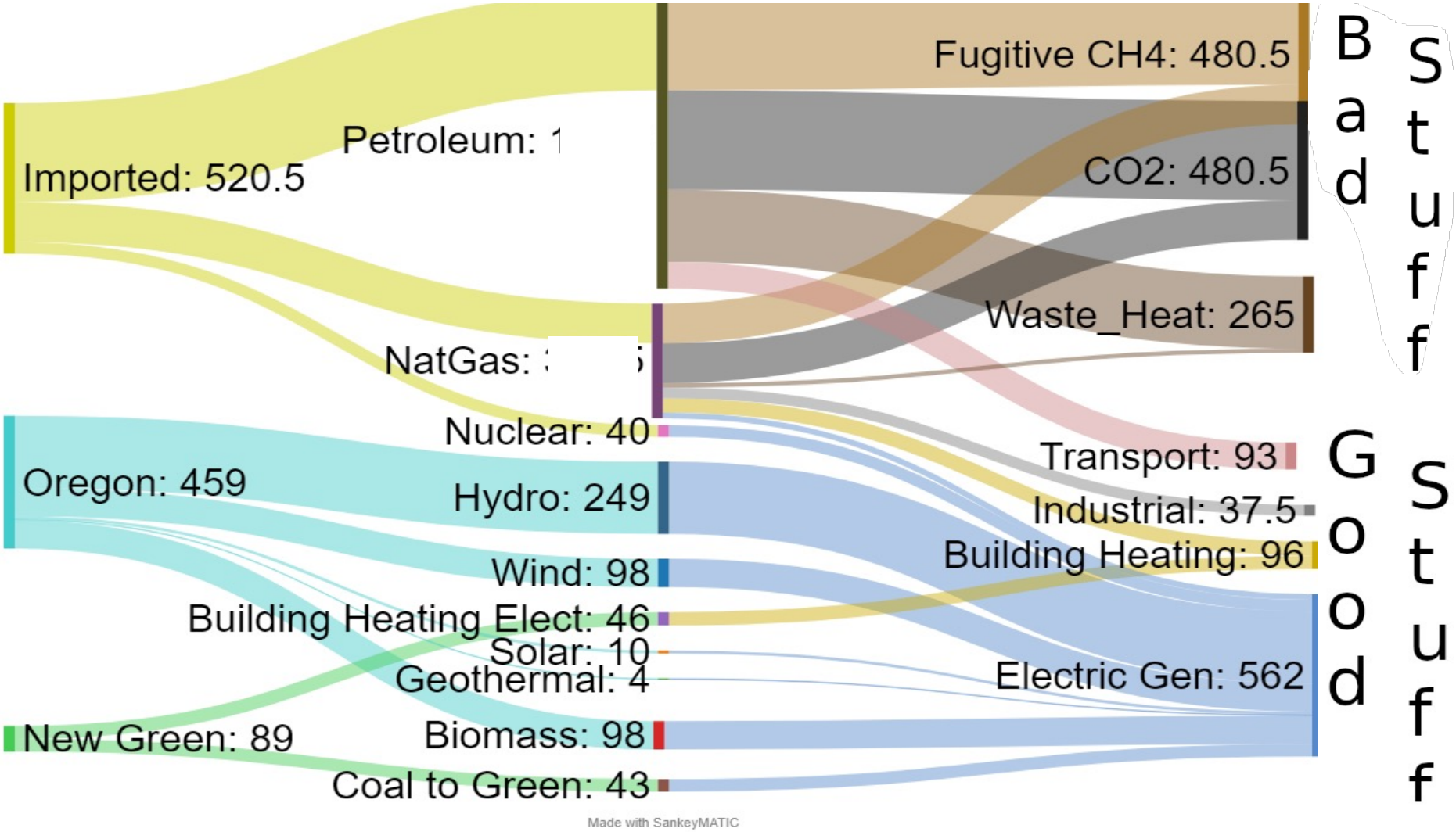
Case 3: Methane is ½ gone because Heat Pump electrification is half installed. New Green Energy increased by 46 TBTU to balance newly electrified load.

Case 3 Half methane, no coal



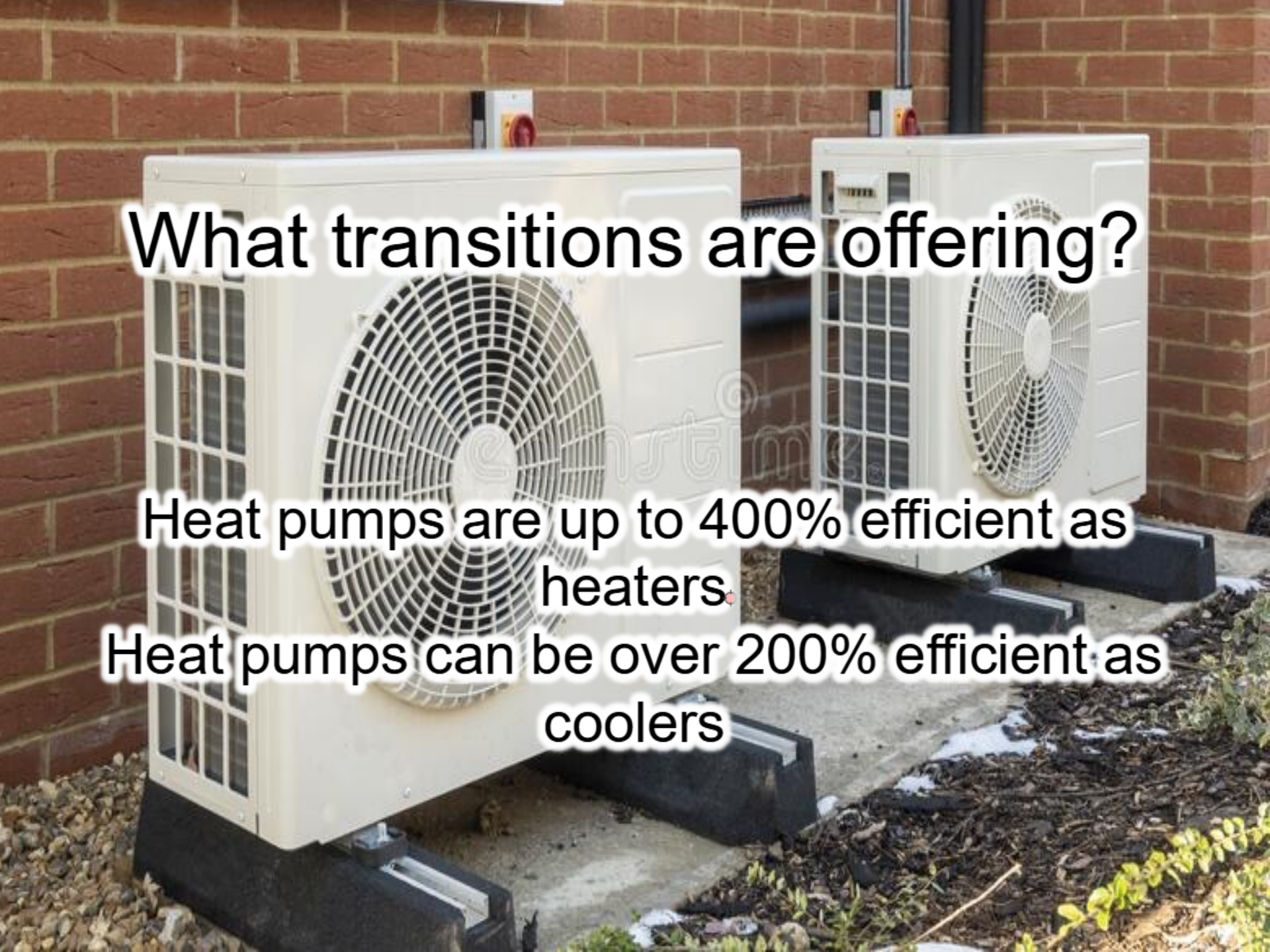
Climate Engagement – 2022 – A Target

Natural Gas Inefficiencies:

1. Rotating Gas Machinery has similar energy inefficiencies as Petroleum rotating machinery

2. Building Heat: 100% efficiency is no longer good enough. Heat pumps can double or quadruple that.
2x for Air Sourced heat pump
4x for Ground Sourced heat pump

3. Heat Pumps address Summer as well as Winter.



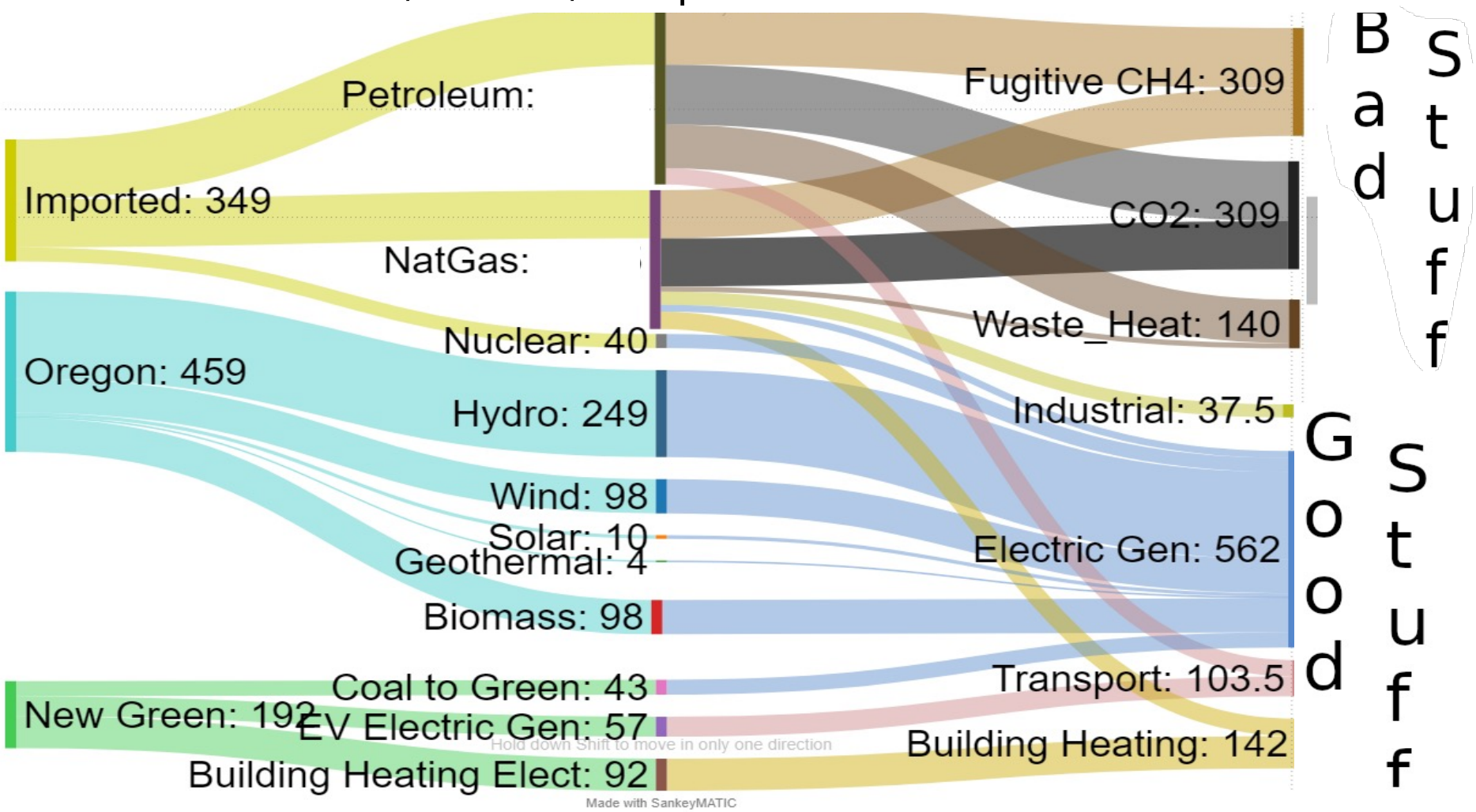
What transitions are offering?

Heat pumps are up to 400% efficient as heaters

Heat pumps can be over 200% efficient as coolers

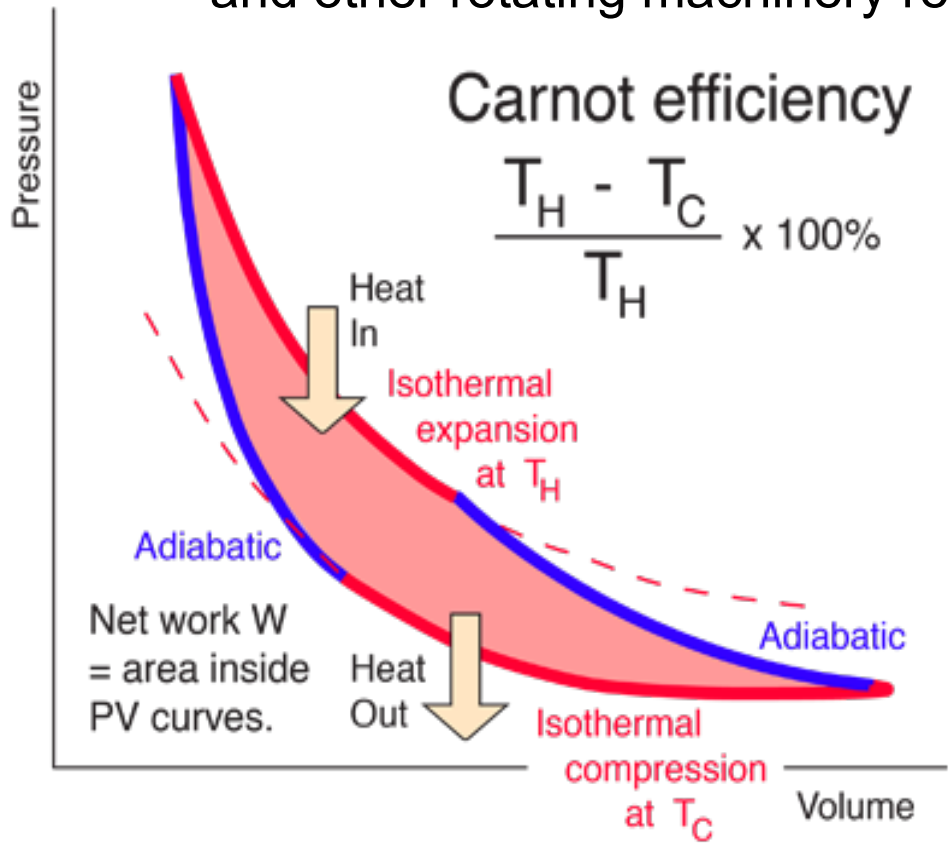
Case 4: Half of Petroleum is gone when ½ EV replacement achieved.
43 TBTU New Green energy added to replace 171 TBTU Petroleum.

Case 4 Half methane, no coal, half petroleum



Inefficiency: Meet the Carnot Cycle

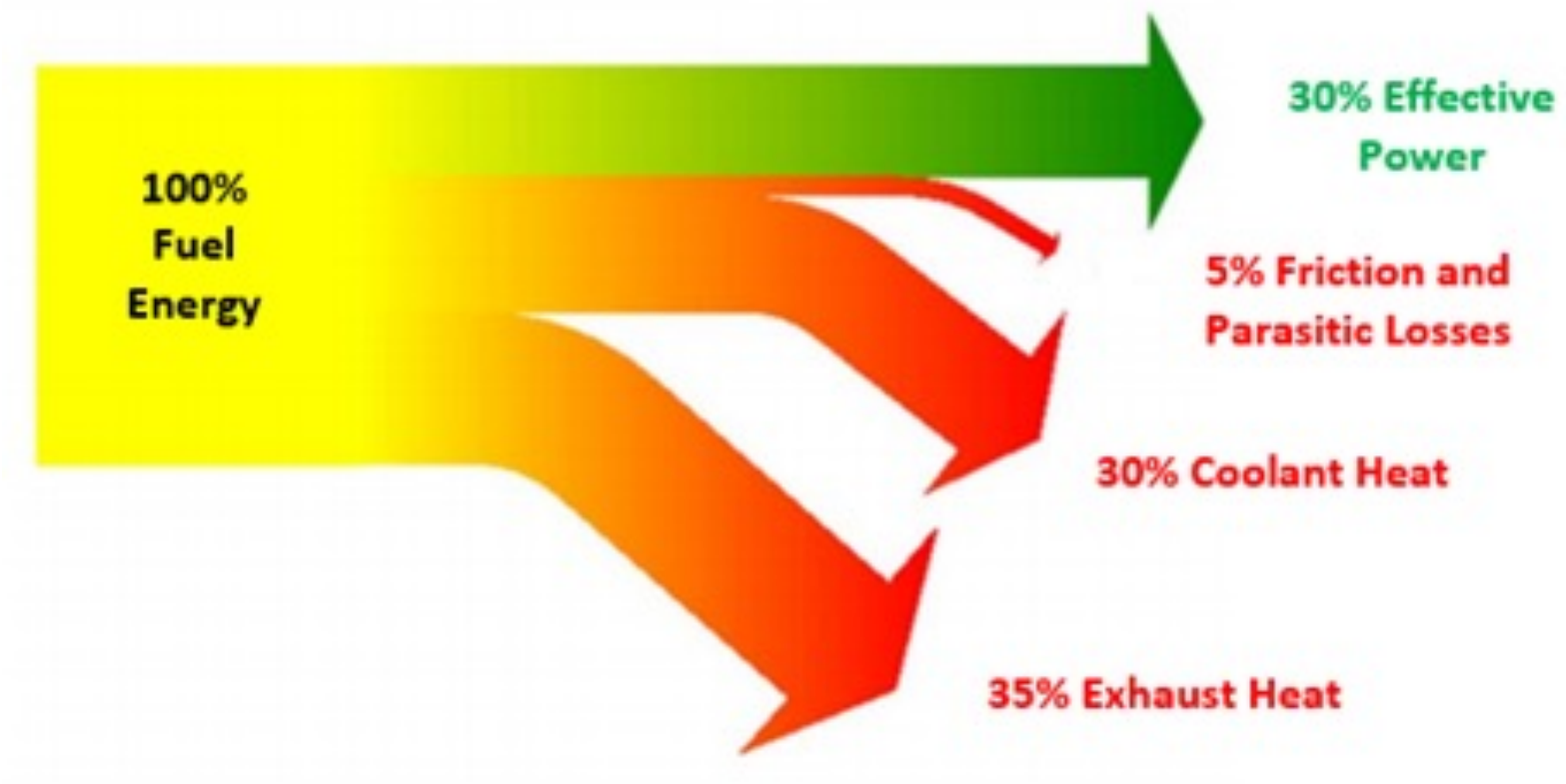
This is important because Green Energy doesn't rely on Carnot cycle engines and so doesn't need the overage of energy that automobiles and other rotating machinery require.



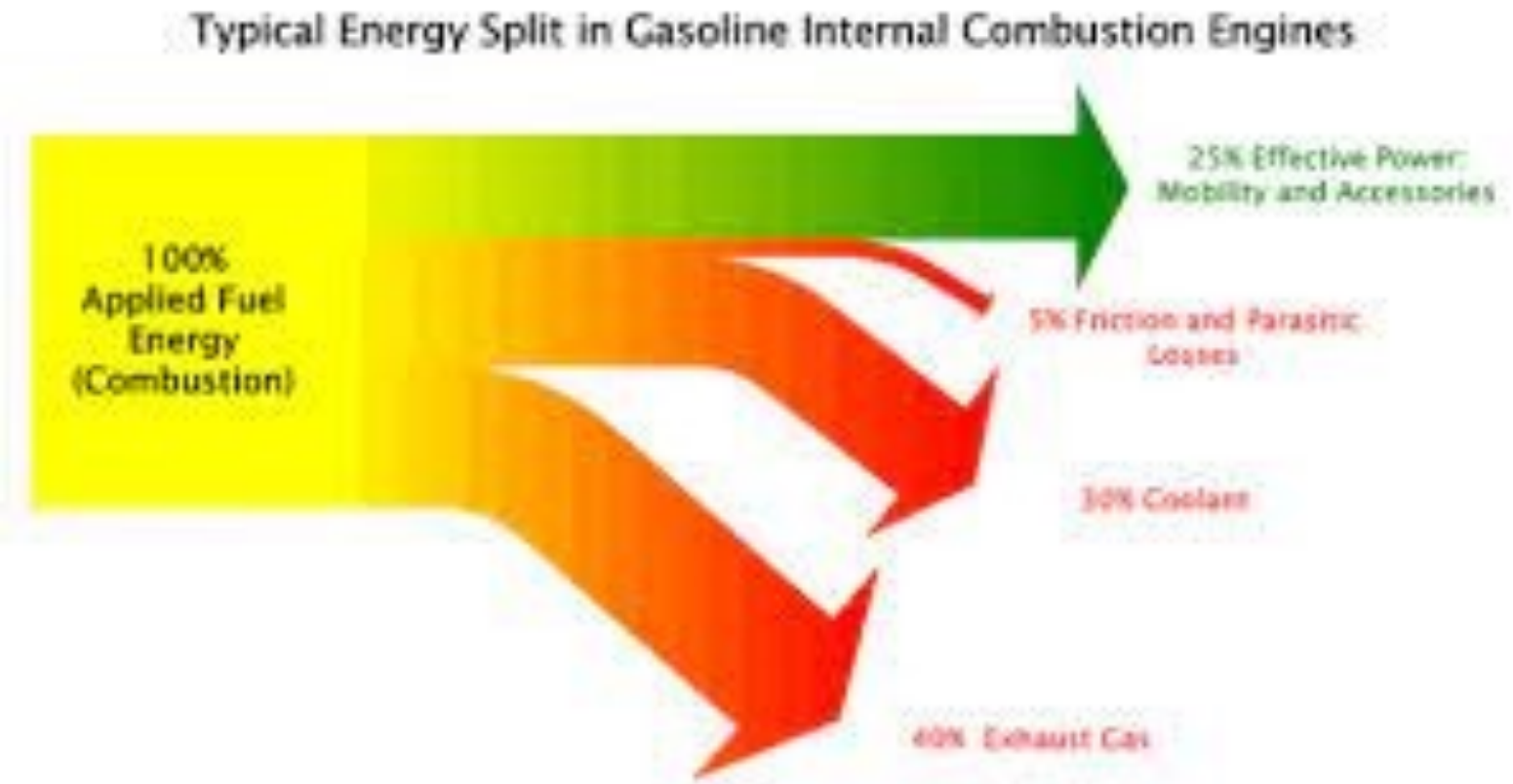
- The extent to which the gas cools during the expansion determines the heat converted to motion.

- Engines that rely on hot gases have efficiency limits. Fossil fuels require them.

Efficiencies of Diesel Transportation



Efficiencies of Petrol Transportation

- 

- Engines that contained hot gases have efficiency limits. Fossil fuels use them.

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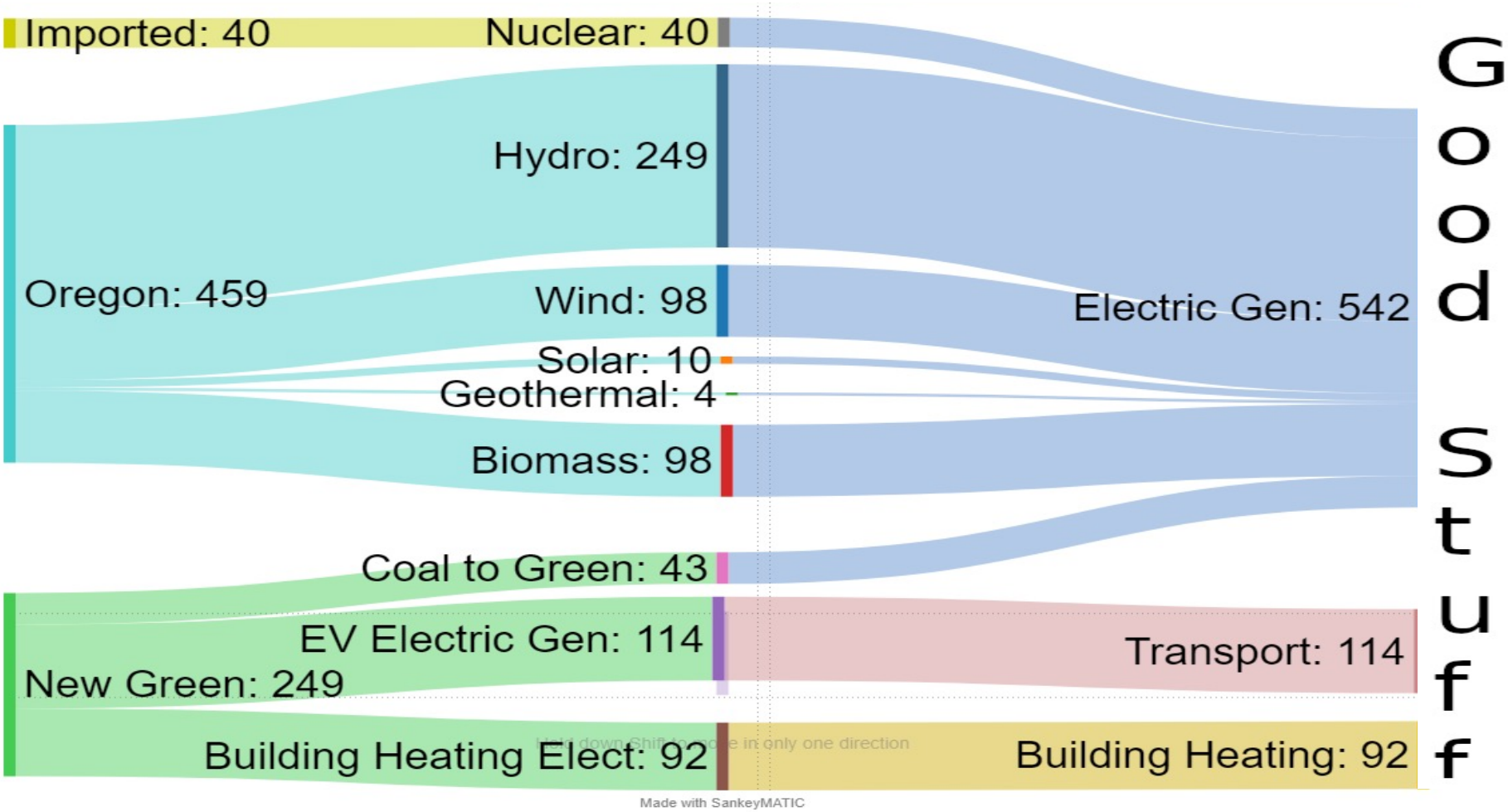
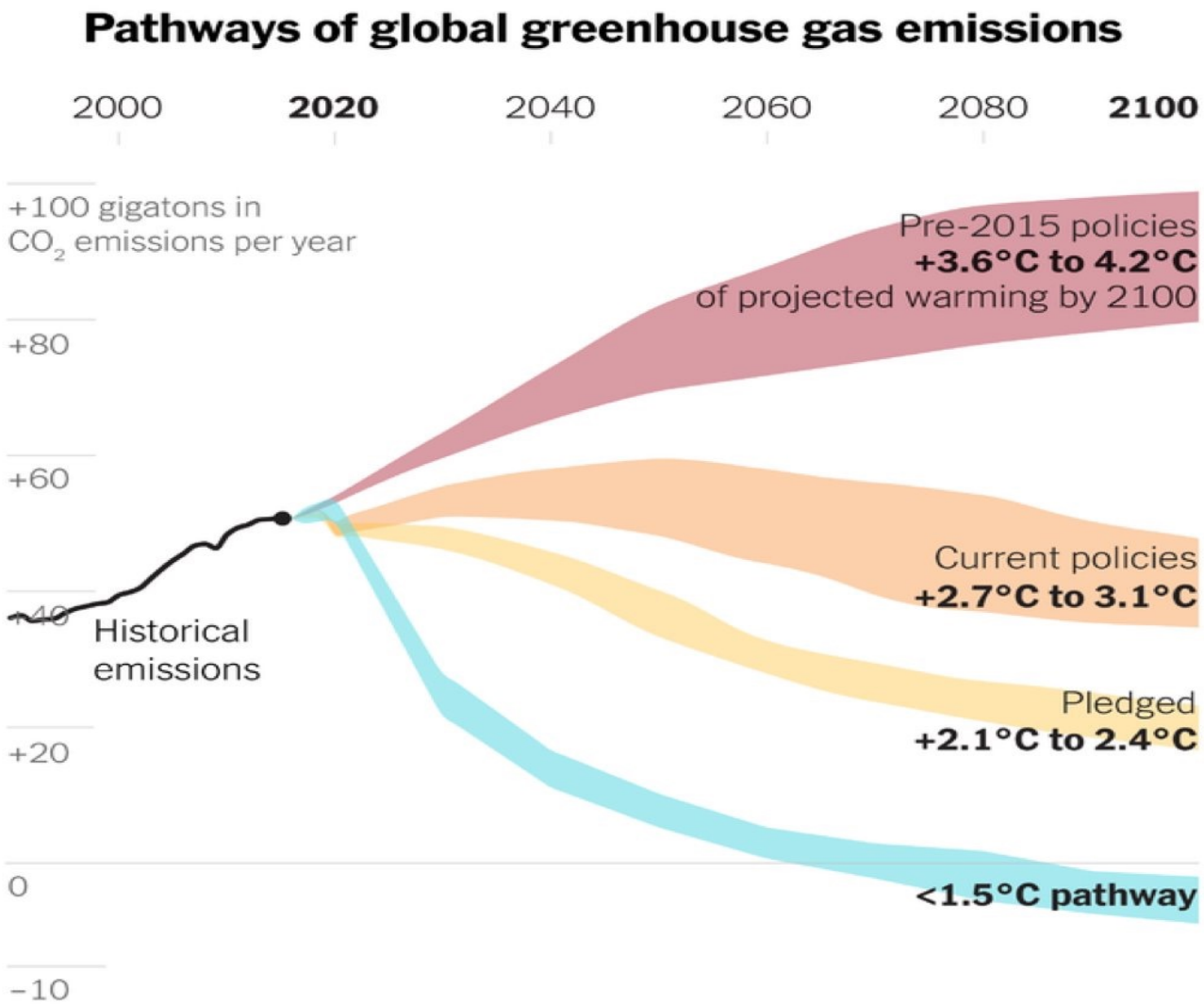
Case 5: All fossil is gone, and New Green increased to balance.
So, 249 TBTU of New Green replaced 747 TBTU of imported fossil fuel.
No bad stuff left.

Case 5 No coal, no methane, no petroleum



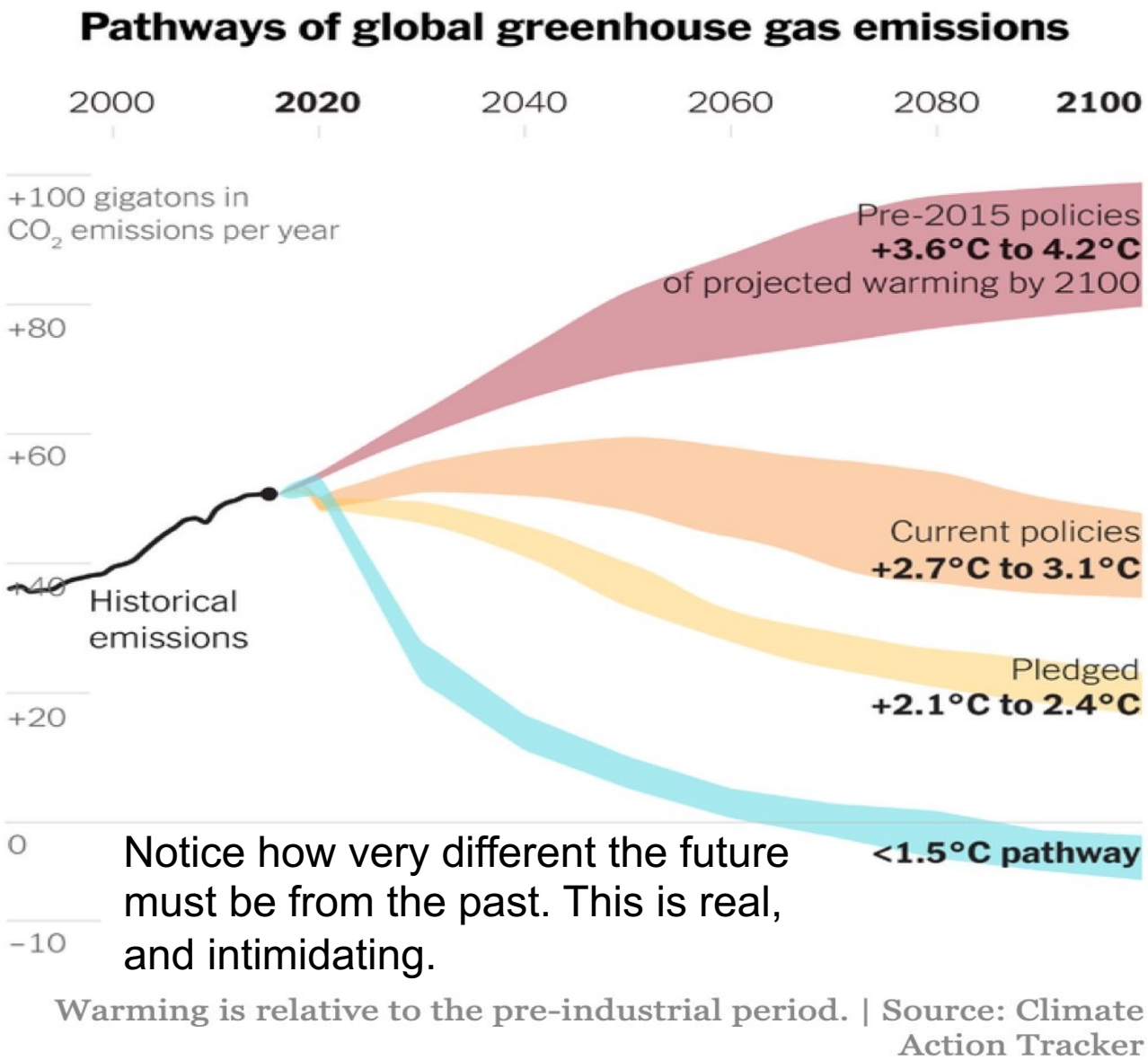
What's the End Goal?

On 9/9/2021 the UN announced the desperation of the IPCC for stopping at 1.5 degrees C temperature increase as peak – or even just hold it off for the foreseeable future.



What's the End Goal?

We need to **follow the lowest path on this chart.** Many are declaring it impossible already, but to miss it is a disaster. Let's not give up early.



Notice how very different the future must be from the past. This is real, and intimidating.

The efficiency path

Rows are scenario examples (prev charts) showing energy sources in use and their emissions. The New Energy required to replace fossil is shown. Units are in TeraBtus for Oregon energy profile

	Total Fossil Energy		Coal Energy		Gas Energy		Oil Energy			
Scenario Step	Total CO2	Total CH4	Burn CO2	Extract CH4	Burn CO2	Extract CH4	Burn CO2	Extract CH4	Energy Req'd NewGreenGen	Scenario Step
Starting Now	747	747	129	129	275	275	343	343	' Baseline = 0	Starting
No Coal > 2025	618	618	0	0	275	275	343	343	' 33% of 129 = 43	Eliminate 33% eff coal
& ½ Gas	480.5	480.5	0	0	137.5	137.5	343	343	' 43 + 275/2/3=89	Eliminate half of 33% eff gas
& ½ Oil	309	309	0	0	137.5	137.5	171.5	171.5	' 89+343/2/3 =146	Eliminate half of 33% eff oil
No fossil	0	0	0	0	0	0	0		' 146 + 343/2/3 = 249	Eliminate the rest
New Green Energy req'd to go green			43		92		114		249	

This is intended to work through the math for "New Green Energy" needed for each scenario step
It is based on:
0) Baseline is full imported fossil.
1) Coal Turbines are about 33% efficient.
2) Gas engines are 27% efficient and diesel 35%. I called that 33%
3) Heat Pumps are x2 efficient for Air and x4 efficient for Ground. I called that 33%
4) Yellow shows where a scenario step made a change for an energy type switching to ":New Gre

What transitions are offering?

Energy efficiency provides huge benefits

New Green Energy of 249 TBTU would bring us near zero emission based on electrification – replacing 747 TBTU fossil

It only takes about 1 of green to replace 3 fossil.
Energy Utilities must plan to provide zero emissions with high efficiency.

Gas utilities can be part of the clean energy transition by supporting geo-grids.

Where could we get that much green energy?
(We could, you know!)

Can we do it?

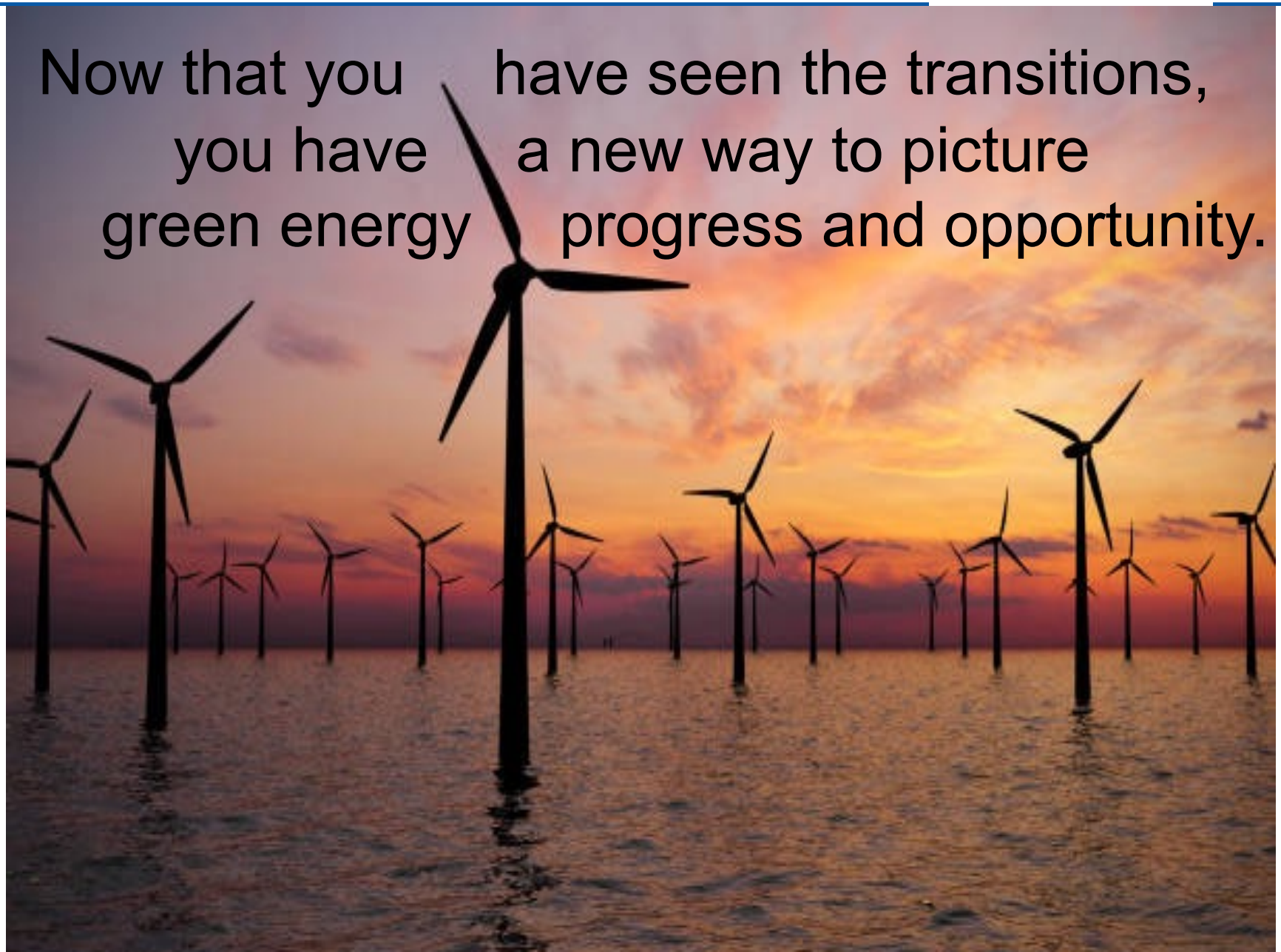
I think we can do it by recognizing

1) Efficiencies make goal attainable

2) Available offshore wind is capable of providing one path

We need broader resilience from more local energy plus storage, too.

Let's do it, and do it early.


Now that you have seen the transitions,
you have a new way to picture
green energy progress and opportunity.