Adaptations & Opportunities

--OR--

HOW I LEARNED TO STOP WORRYING AND LOVE CLIMATE CHANGE

Don't worry. It's not that bad.

Fast Facts about Carbon Emissions (1)

- Alaska, Canada, Norway, Sweden, Finland, Greenland, and Iceland emit around **2.44%** of the global carbon emissions total.
- USA & Canada together emit about **15.61%** of global total.
- Europe emits about **13.8%** of the global total.
- Asia emits about **58.6%** of the global total.
- **MORAL: "Sinners are going to sin—some more than others!"**

Fast Facts about Carbon Emissions (2)

- Anthropogenic emissions are around **10%** of what the earth absorbs and emits via natural processes each year.
- Natural processes absorb and sequester about half of all anthropogenic CO_2 emissions each year.
  - This translates to a rate problem—not necessarily a quantity problem.
  - Slow down the rate, and nature will eventually catch up.

Perception vs. Reality (1)

Perception

- We need to decarbonize energy use in the Arctic to mitigate climate change.
- We need to stop climate change to save the fragile Arctic environment.

Reality

- At 2.4% of the global emissions total, energy use in the Arctic is a very small piece of the overall contribution.
- What we do in the Arctic has little to do with the effects and consequences of what the rest of the world does.

Perception vs. Reality (2)

Perception

- Climate change is going to be a disaster for the Arctic.
- We need to stop drilling for oil in the Arctic. The cost to the planet is too high.

Reality

- If true, we need to prepare accordingly.
  - Do we actually know this?
- If people in the Arctic are going to adapt, they need money to adapt.
  - Economic development is a necessary pre-requisite to that.

To Decarbonize or not to Decarbonize? (1)

Why We Should Not

- Expensive
- Pointless
- Leftist Pipe Dream

Why We Should

- Cost depends on technology and approach.
- Decarbonization will future-proof essential parts of the Arctic economy.
- Thinking we can keep using oil and gas forever is the real pipe dream!

To Decarbonize or not to Decarbonize? (2)

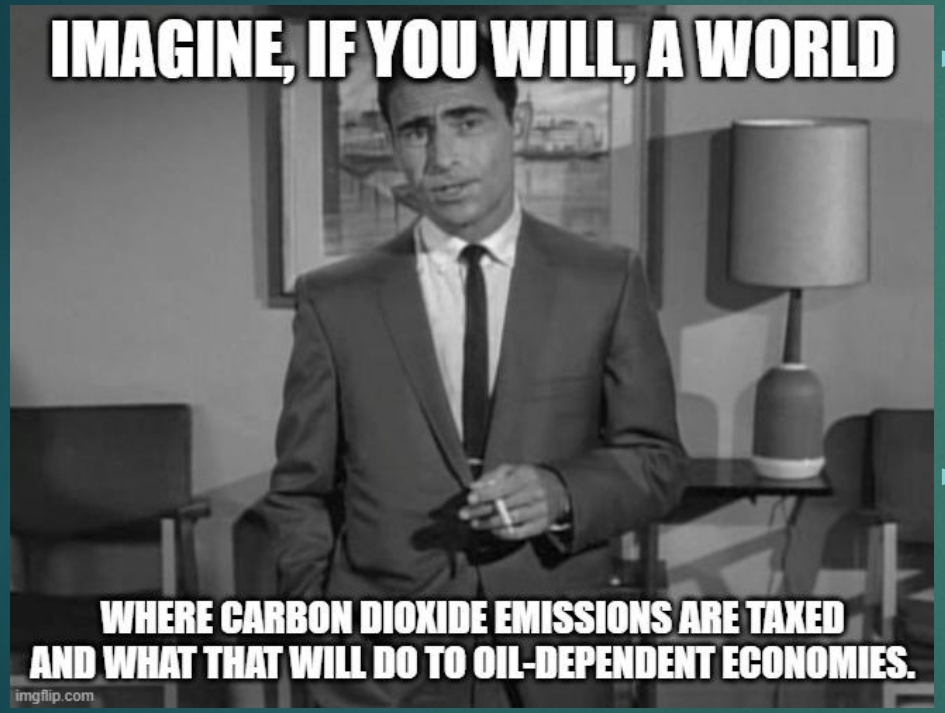
Why We Should Not

- Doesn't Work
- Resistance to Change

Why We Should

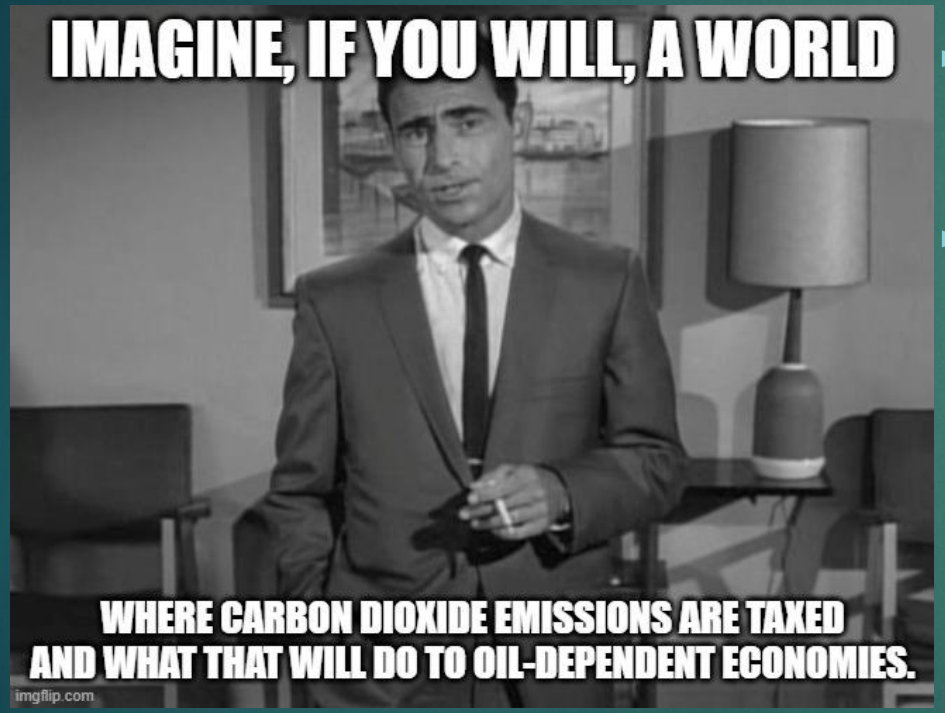
- Success depends on having a good plan and strategy.
- Change is hard, but it's often needed.

Carbon Taxes are Coming… (1)



- Will reduce demand for petroleum products.
  - This may adversely affect Arctic economies that are oil-dependent for revenue.
- A carbon price will put a price floor on any fossil-fuel based energy resource, no matter how cheap or abundant the fuel source is.

Carbon Taxes are Coming… (2)



- Energy costs are already very high in many rural Arctic areas.
- Reliance on renewables will encourage energy-dependent industries to move toward "sun belt" climates and away from the Arctic.

How to Two-Block Ourselves (1)

- Ignore climate change.
- Refuse to adapt because “it’s not real” or “not worth it.”
- Keep relying on oil and gas for electricity, heat, and transportation because we have plenty of it in our own back yard.
- Keep hoping for another “oil boom” to give us what we need for sustenance and economic development.

How to Two-Block Ourselves (2)

- Wait until the oil industry is in a permanent state of decline and we have a bunch of carbon taxes to pay for the energy that we are using.
- Blame our politicians for taxing carbon and not letting us drill.
- Beg and plead for relief as our economies shrivel up and die.
- Remember the "glory days" and cry about them because there's no hope.

A Better Way (1)

- Get qualified engineers involved early.
- Come up with a plan.
- Figure out what is realistically going to work and what is not going to work.
- Put ideologies aside.
  - Be pragmatic about the situation.
  - Philosophical ideals do not keep the lights and heat on!

A Better Way (2)

- Understand that energy cost is going to be a major factor in the acceptance and execution of any plan.
- Prepare for the inevitable decline of oil and gas industries.
  - We will need other industries to sustain our economies.
  - All industries need abundant energy supplies.

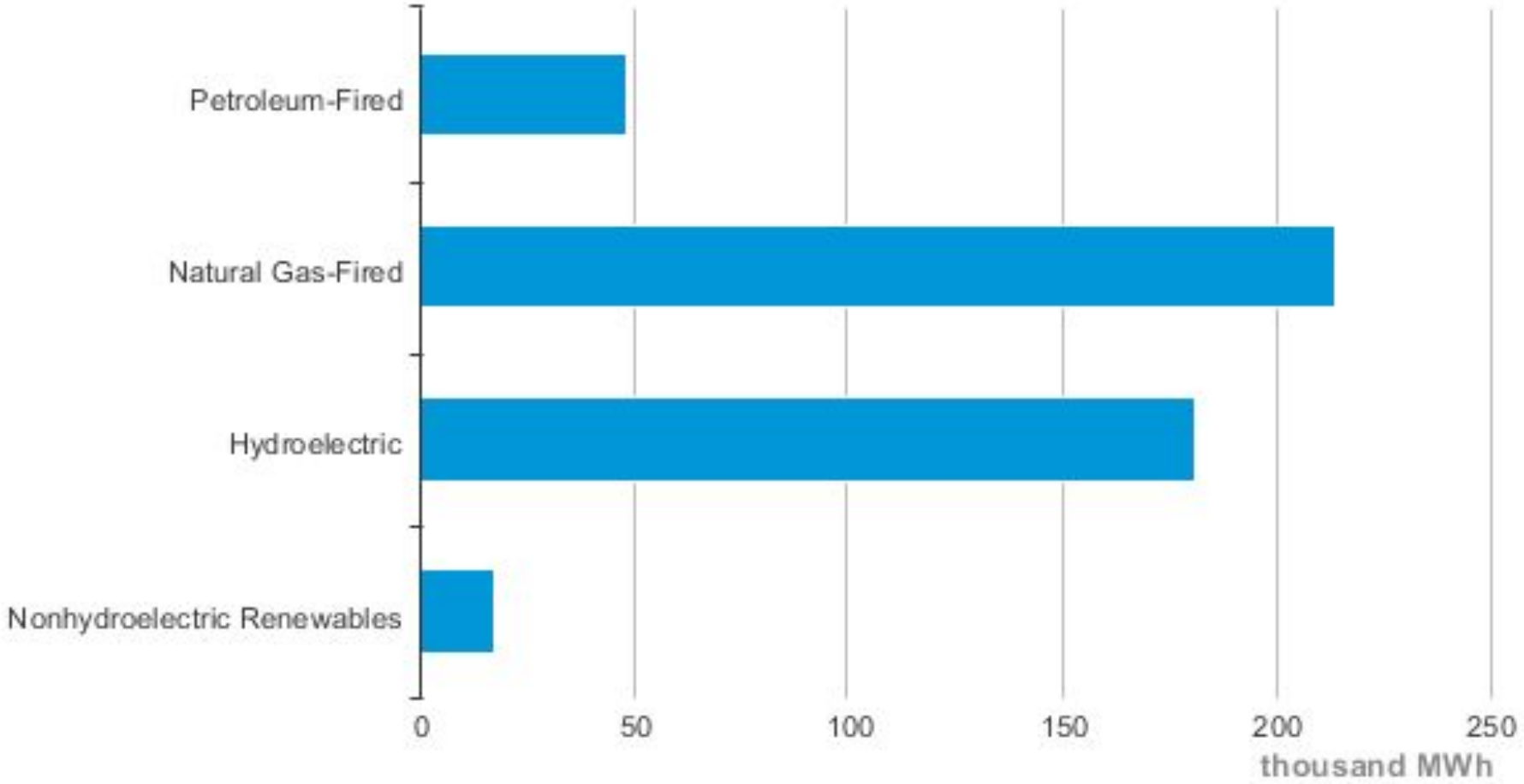
Arctic Challenges (1)

- Sparsely Populated
  - Particularly true in Alaska and Canada.
  - Makes connecting communities difficult.
  - Reduces economies of scale and increases cost.
- Extreme Winters
  - Short daylight hours reduce solar output.
  - Cold Temperatures make everything more difficult.
  - Snow accumulation hinders solar output.
  - Intermittent wind makes wind turbines unreliable.

Arctic Challenges (2)

- Access Challenges
  - Many places are only accessible by sea or air.
  - Qualified personnel to service equipment are expensive.
- Climate Complications
  - Melting permafrost makes constructing anything more difficult.
  - Uncertainties associated with climate change increases project risk.
  - What is our design basis anyway?

Alaska Net Electricity Generation by Source, Jun. 2018



eia Source: Energy Information Administration, Electric Power Monthly

Urban Alaska Challenges (1)

- Multiple entities involved.
  - They have their own interests.
- Conflicting planning goals.
- Lack of funding.
  - Initial funding came from oil revenue.
- Lack of ownership.

Urban Alaska Challenges (2)

- Studies, studies, studies.
  - Where ideas go to die.
- Resistance to power pooling.
- NIMBY is a problem in some places.
  - In addition to the high cost, the Susitna-Watana Hydro Project was a victim of this.
  - Too easy for non-stakeholders to obstruct any large-scale project.

Rural Alaska Energy Challenges (1)

Diesel generator at Nushagak Electric's power plant in Dillingham, AK.

- Alaska has more microgrids than any other state.
- Most microgrids are located in rural towns or villages.
- All the Arctic-specific challenges are often exacerbated in the bush.
- Funding projects is a challenge.

Rural Alaska Energy Challenges (2)

Diesel generator at Nushagak Electric's power plant in Dillingham, AK.

- Diesel is the fuel of choice.
  - Very costly—several dollars per gallon translates to tens of cents per kWh.
  - Environmentally risky—involves storing millions of gallons of fuel in tank farms.
  - Carbon intensive, particularly when transportation is factored in.
  - Prime target for future carbon taxation.

Everyone's Challenges (1)

- In the bush, the move toward renewables is driven by a desire to save on diesel costs.
- In urban areas, people are resistant to large-scale energy transitions because of cost.

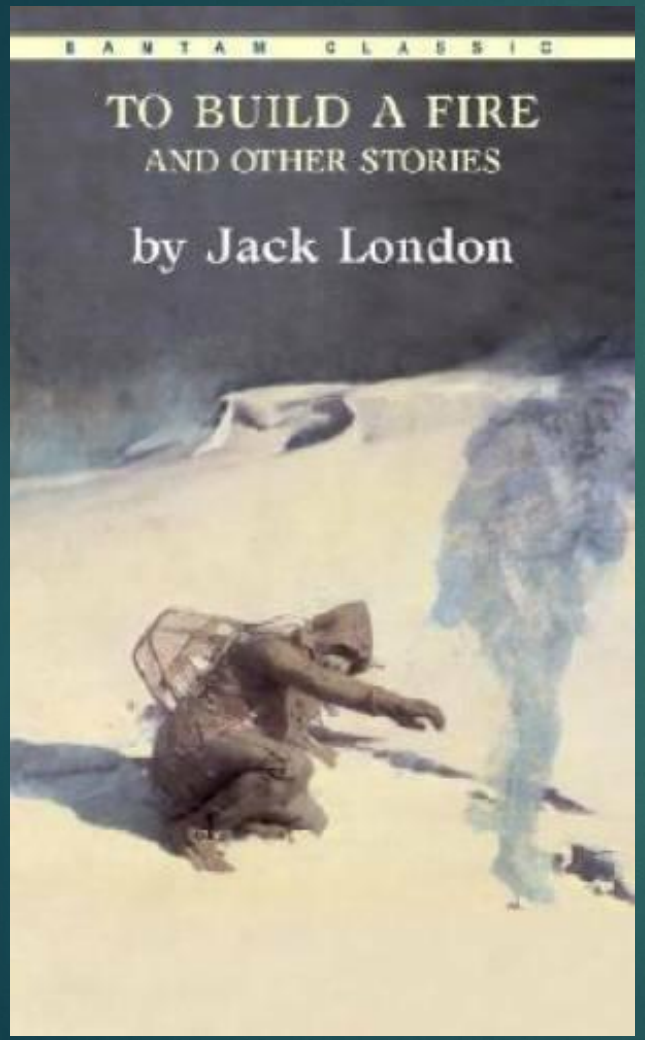
Everyone's Challenges (1)

- Everyone's a "greenie," meaning that they want to keep the "green" in their pocket.
- Again, what benefit do we Alaskans gain by decarbonizing when our contribution to the total is practically insignificant?

Goals

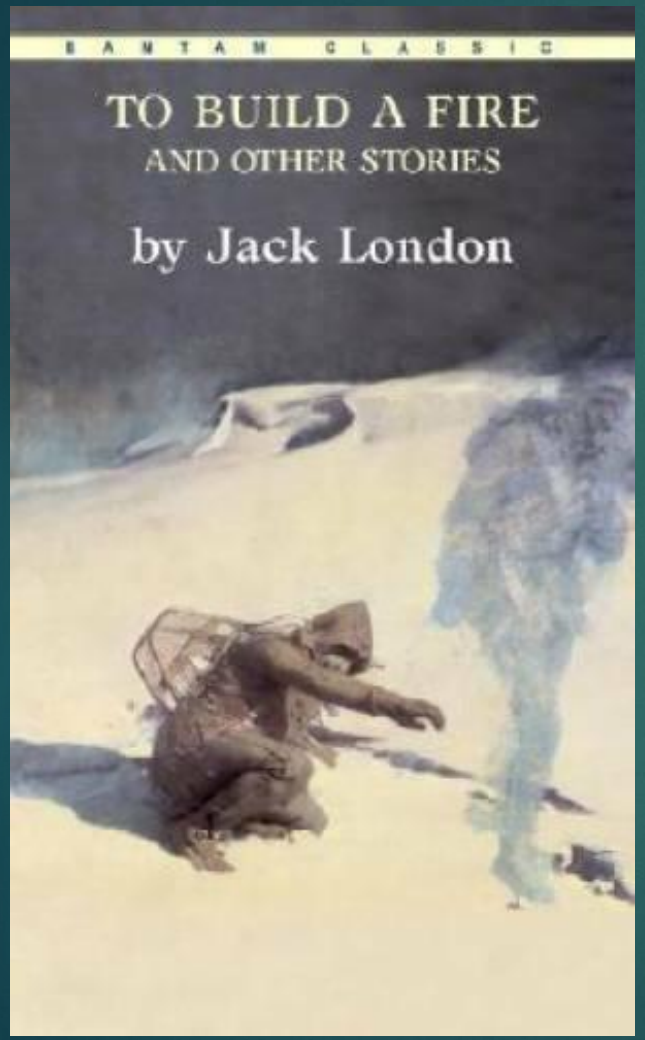
What	Why
Future proof our energy supplies.	Because we don't want to be crippled by future taxes and mandates.
Ensure reliability.	Because people will die if energy is not reliable.
Provide low cost energy.	Because low cost energy is necessary for modern economies to prosper.
Make the Arctic attractive to businesses and new industries.	Because being poor sucks and contributes to pollution.
Reduce carbon emissions.	Because that is the goal on a global scale.

Get it Right!



- The Arctic is unforgiving.
- As illustrated in Jack London's short story "To Build a Fire," the consequences of ignoring wisdom combined with poor planning can be catastrophic.
- Don't forget about heating needs. Electricity is just a part of the picture.

Get it Right!



- Focus should be on adaptation to changes in geopolitics and climate changes.
  - Mitigation should be a byproduct of this.
- Stop trying to kill the oil and gas industries before we have viable alternatives working.
- The only thing worse than “dirty” energy is energy poverty.

Ideally Speaking…

- Solutions should produce heat and power.
- Solutions should be dispatchable.
- Solutions should not be tied to geography.
  - Do we want to build hundreds of miles of transmission lines or have resources at each site where energy is needed?
- Solutions should not depend on the environment to make energy.
  - Energy needs are usually highest when the frigid air is calm and the sky is dark.

What Might Work?

Resource	Produces Electricity?	Produces Heat?	Is Dispatchable?	Capacity Factor?	Geographically Constrained
Wind	Yes	No	No	30-40%	No
Solar	Yes	No	No	10%	No
Hydroelectric	Yes	No	Yes	40-60%	Yes
Geothermal	Yes	Yes	Yes	>90%	Yes GOOD
Nuclear	Yes	Yes	Yes	>90%	No BETTER

Geothermal vs. Nuclear (1)

Geothermal

- Produces heat and power.
- Zero carbon.
- Dispatchable.
- Reliable.

Nuclear (SMR)

- Produces heat and power.
- Zero carbon.
- Dispatchable.
- Reliable.

Geothermal vs. Nuclear (1)

Geothermal

- Scalable.
- Proven.
- Geographically constrained.
- May work in the Railbelt.

Nuclear (SMR)

- Scalable.
- Proven.
  - US Navy.
  - EBR II & other Test Reactors.
- Not geographically constrained.
- Can work just about anywhere.

Eielson AFB SMR

- Defense Logistics Agency chose Eielson AFB as the location for an SMR pilot program.
  - 5 MWe of electric power plus steam from a single small modular reactor.
- If this works out well at Eielson, this could be the first of many opportunities for SMRs in Alaska.

Concluding Remarks (1)

- Alaska needs to decarbonize, but it needs to do it the smart way.
- Decarbonization should be viewed as a means of future-proofing our economy.
- The oil and gas industries are not our enemies, but their days are numbered.
- We need to prioritize economic development so that we can afford to make changes to our energy economy.

Concluding Remarks (2)

- People are going to be concerned about the cost and disruption to their ways of life more than anything else.
- Get engineers involved up-front; make a plan, and execute the plan intelligently.
- Stop viewing this is a Left or Right issue. View it as a challenge that requires real-world problem solving.