

Can the Nordic countries become
CO₂ negative by 2040?

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Nordic Energy Research
Nordic Council of Ministers



Nordic Energy Research



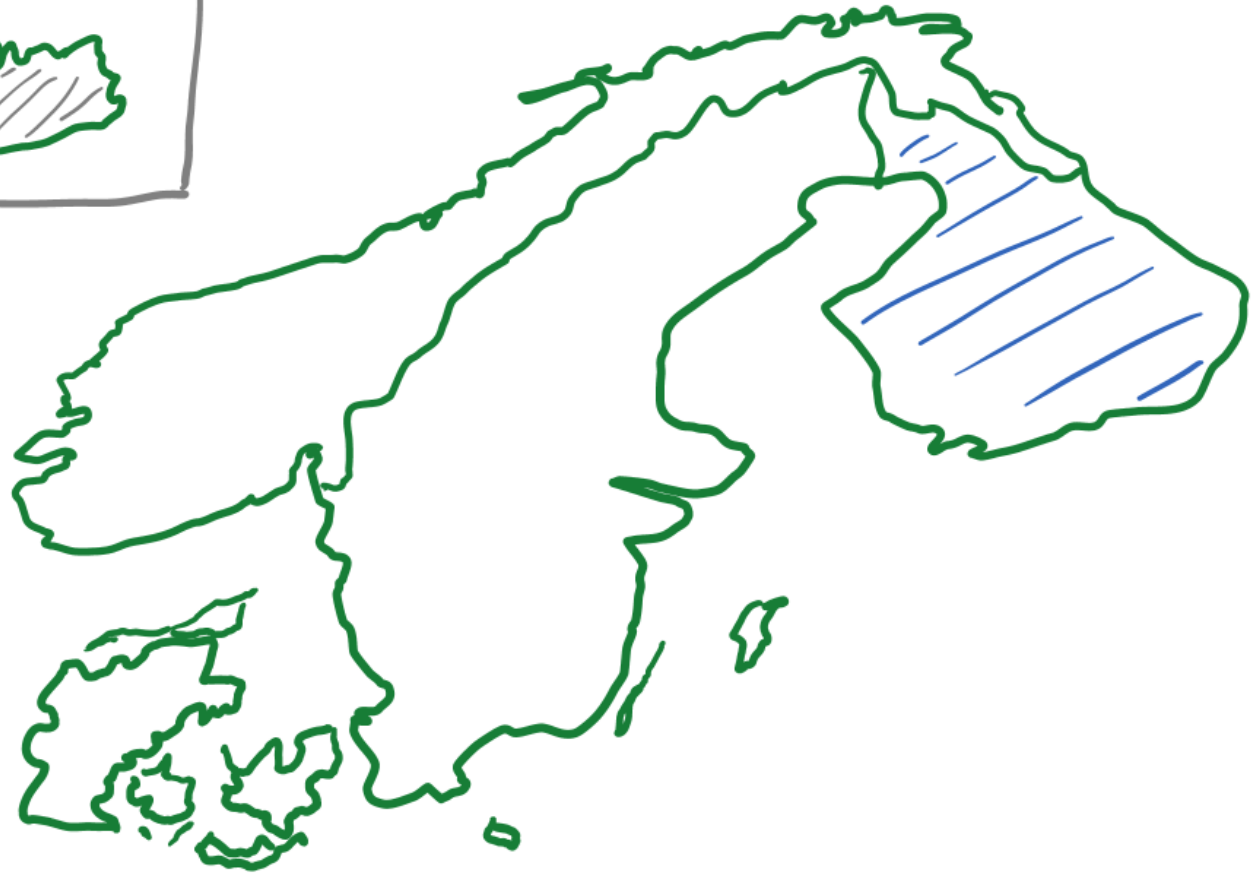
Negative CO₂



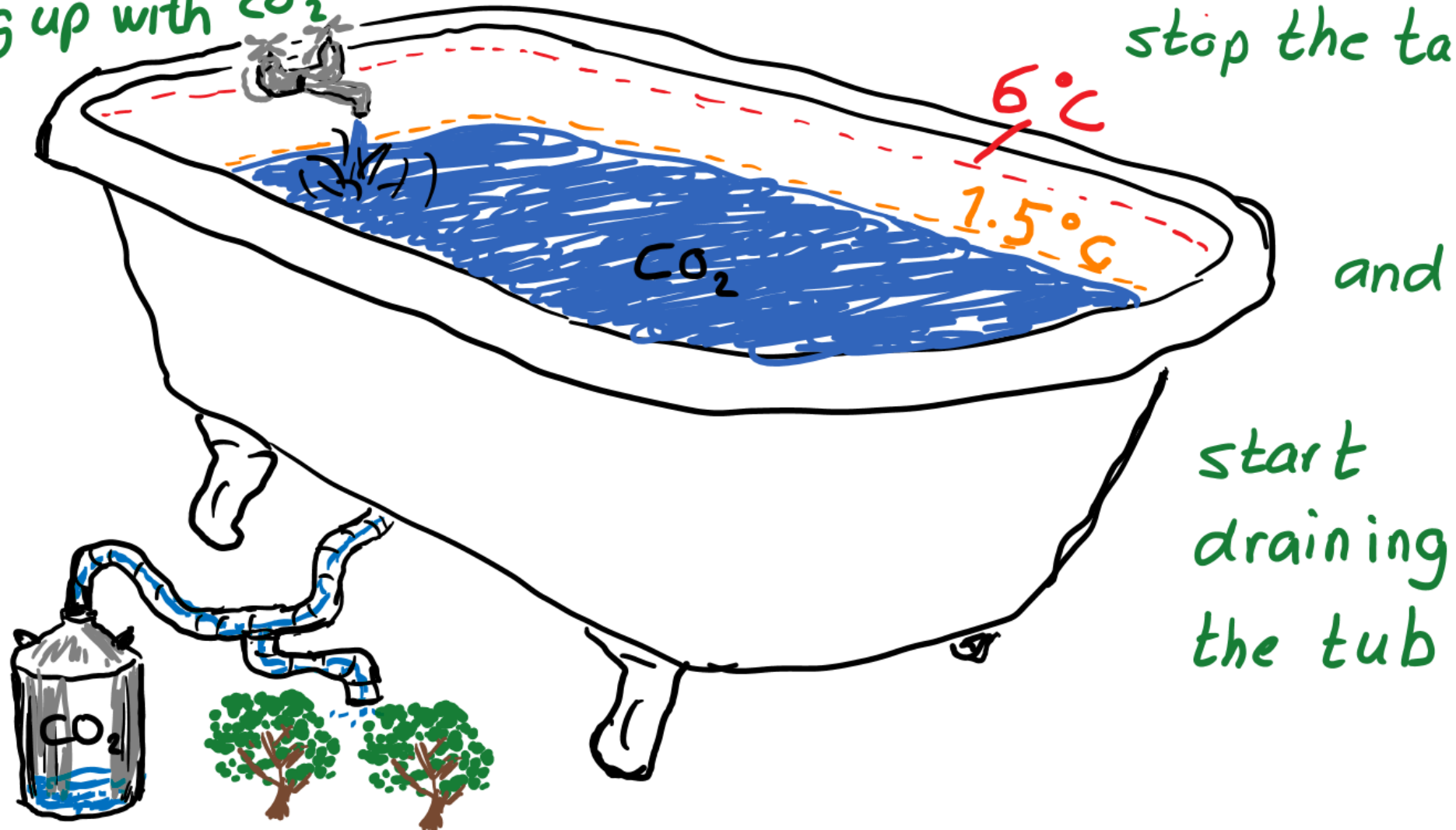
Project Shift



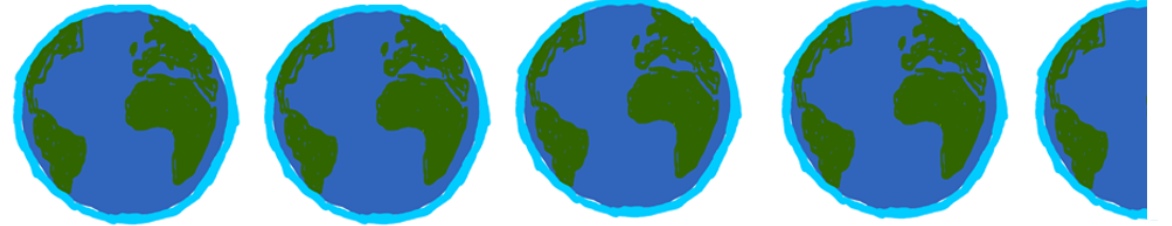
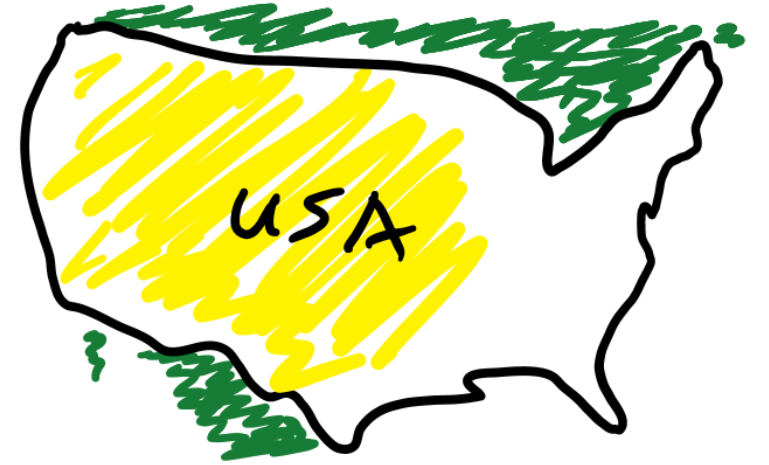
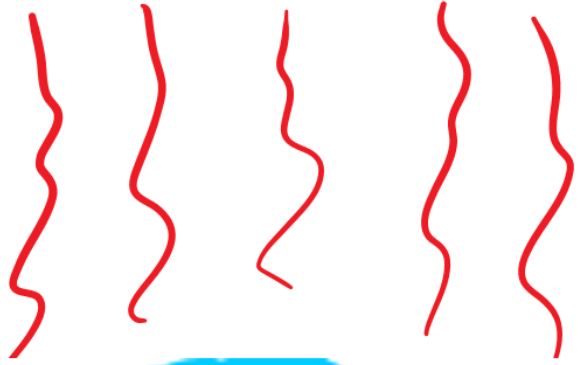
Flex4RES



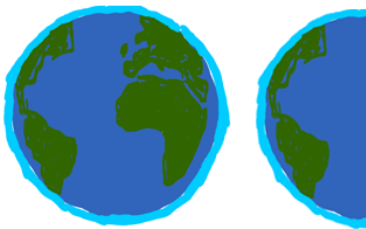
Our atmosphere is like a bathtub $\Rightarrow$ We need to
filling up with CO_2 stop the tap



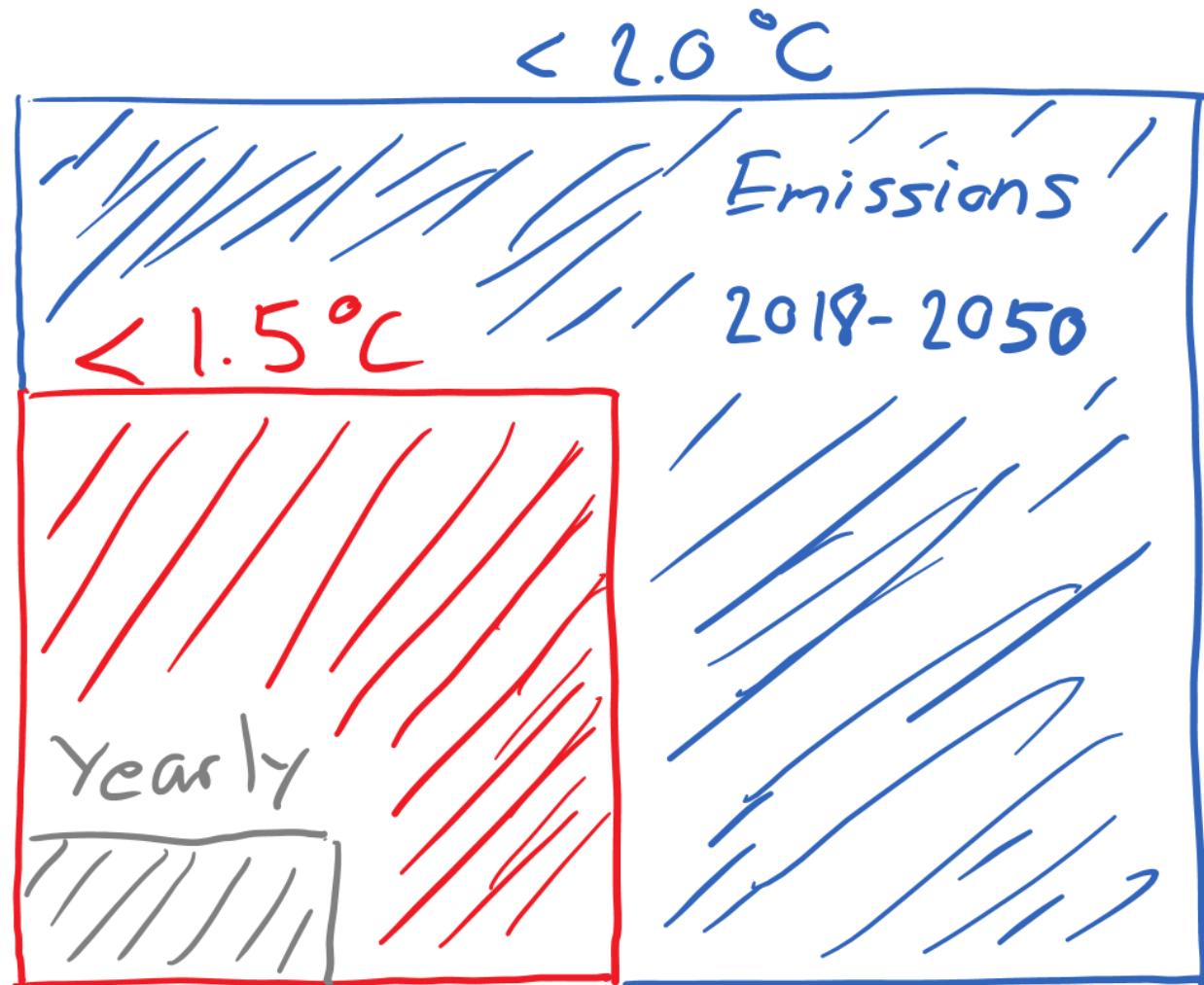
Global Footprint



World
today



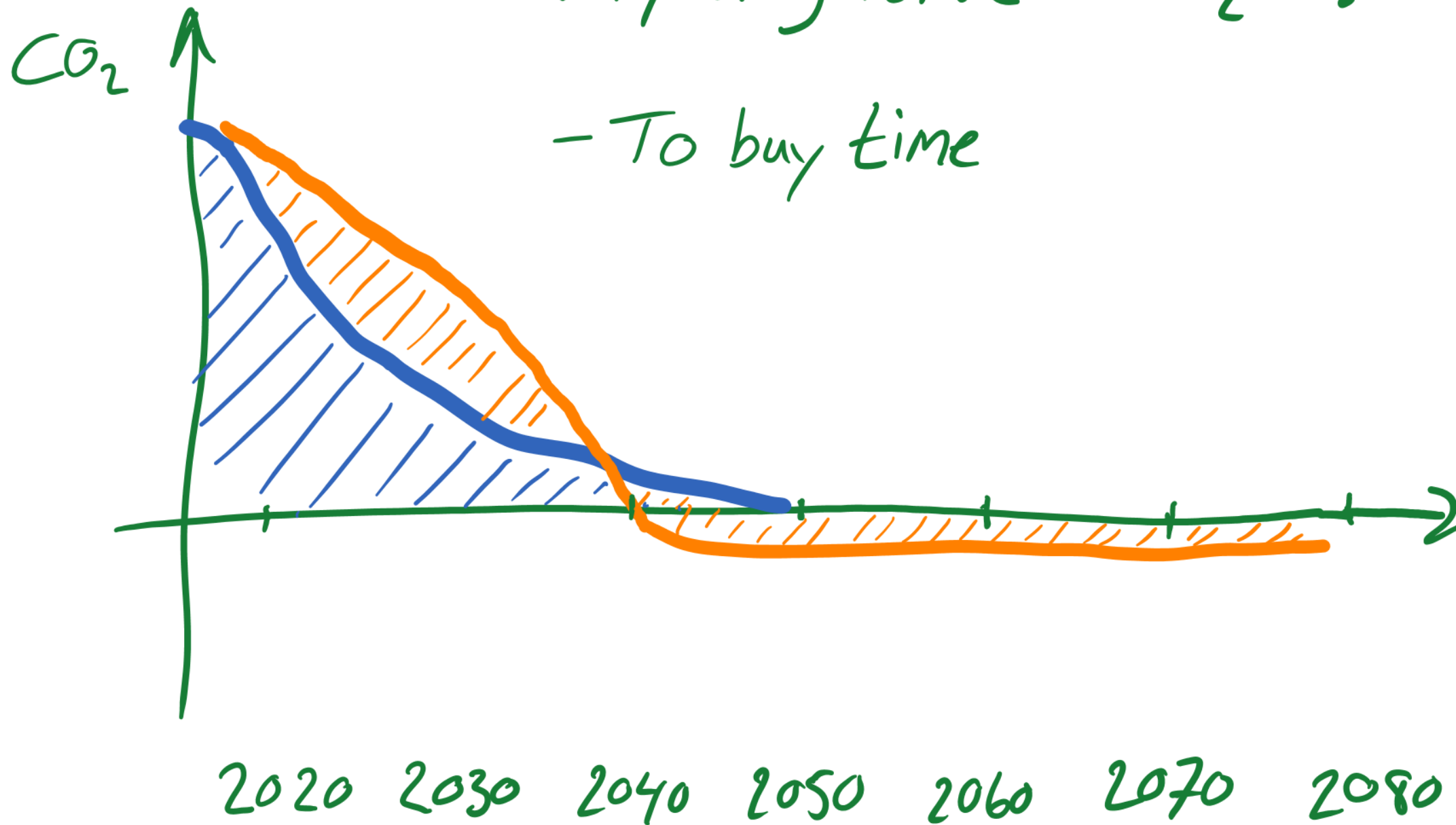
The Nordic Carbon Budget from 2018



~ 10 years
with same
emissions
as today

why negative CO_2 ?

- To buy time



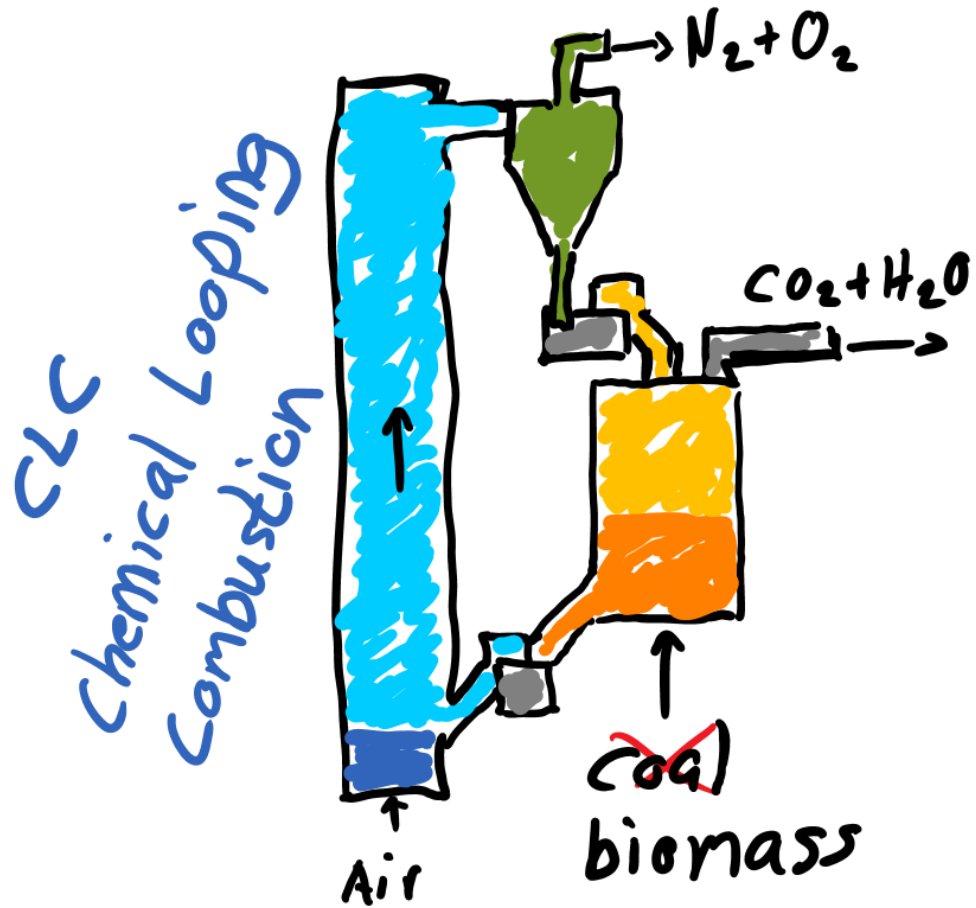
Take aways.....

- The Nordics can become front-runner in solving the climate challenge
- The CO₂ net negative target needs to be translated into realistic policies for each sector
- Without CCS we cannot fulfill the Paris Agr.
- without Nordic collaboration it does not make sense

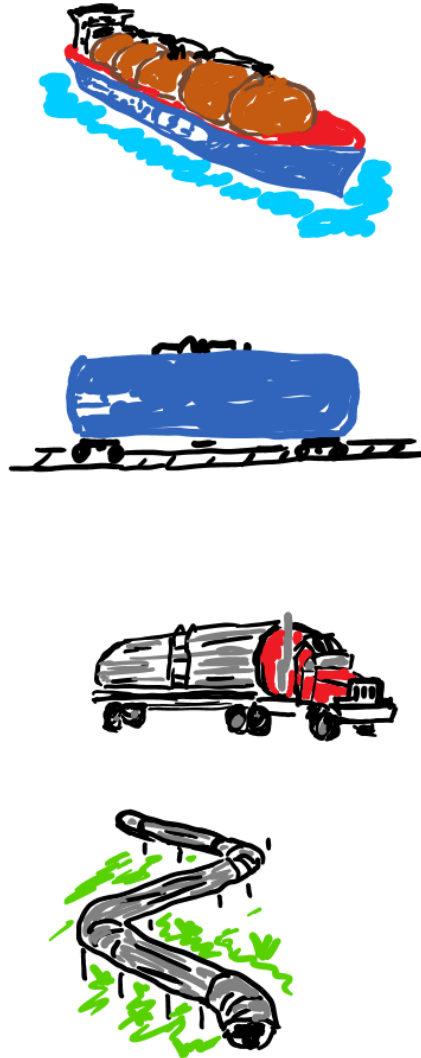
Critical Points

- Enough Sustainable Biomass ?
- Sector Coupling and Integration
- Carbon Capture and Storage
- Greening Transport
- Disruptive Technology Development

Capture



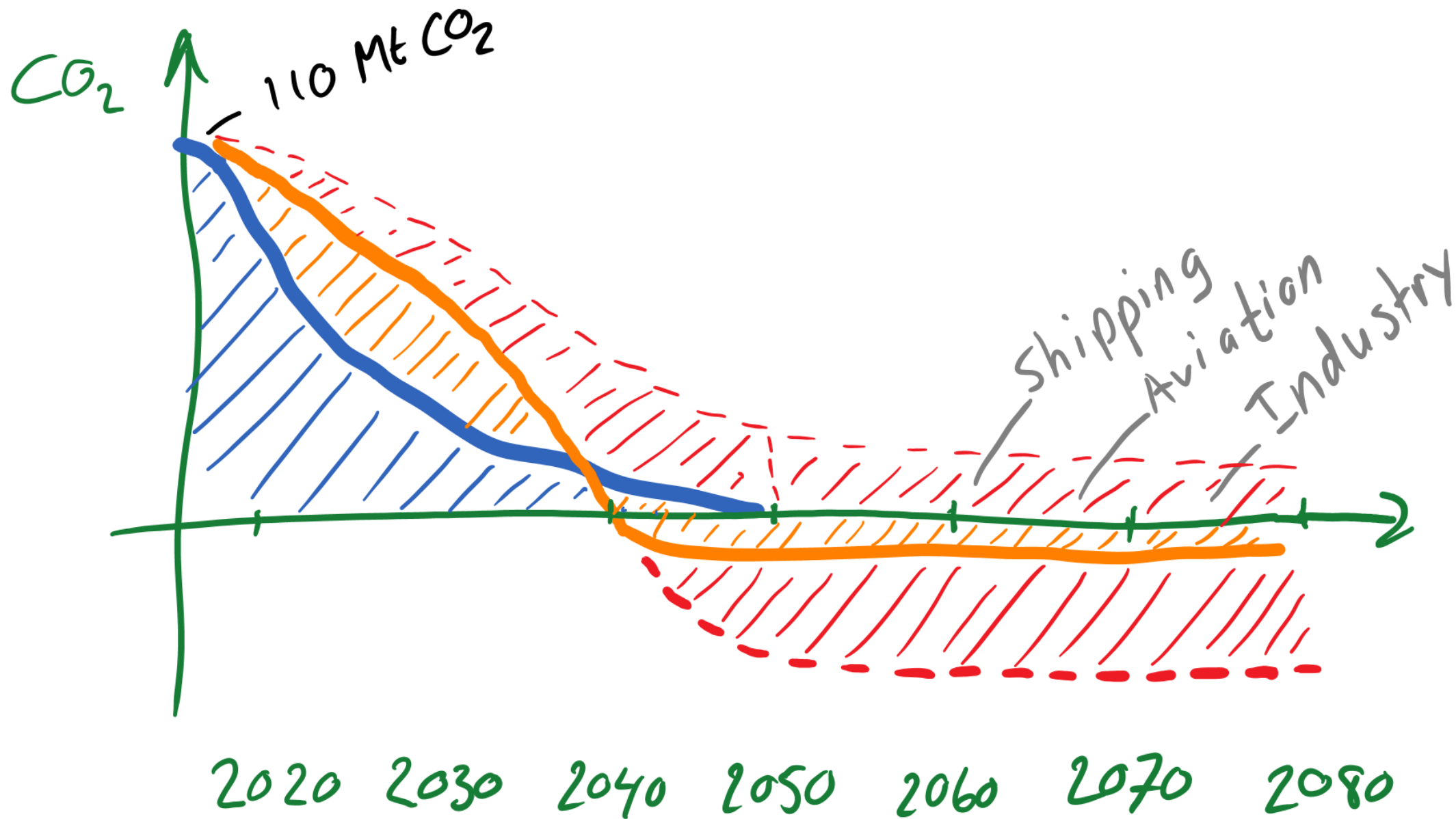
Transport



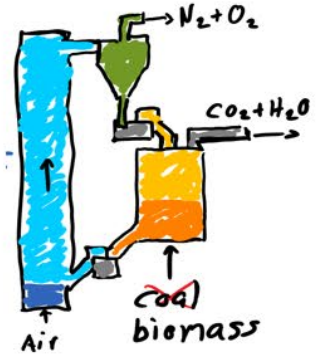
Storage



How much CO_2 should we store?



Yearly CO_2 stored
from 2040



Power sector
 $\sim 4 \text{ GW}$

Industry
 $\sim 3 \text{ GW}$

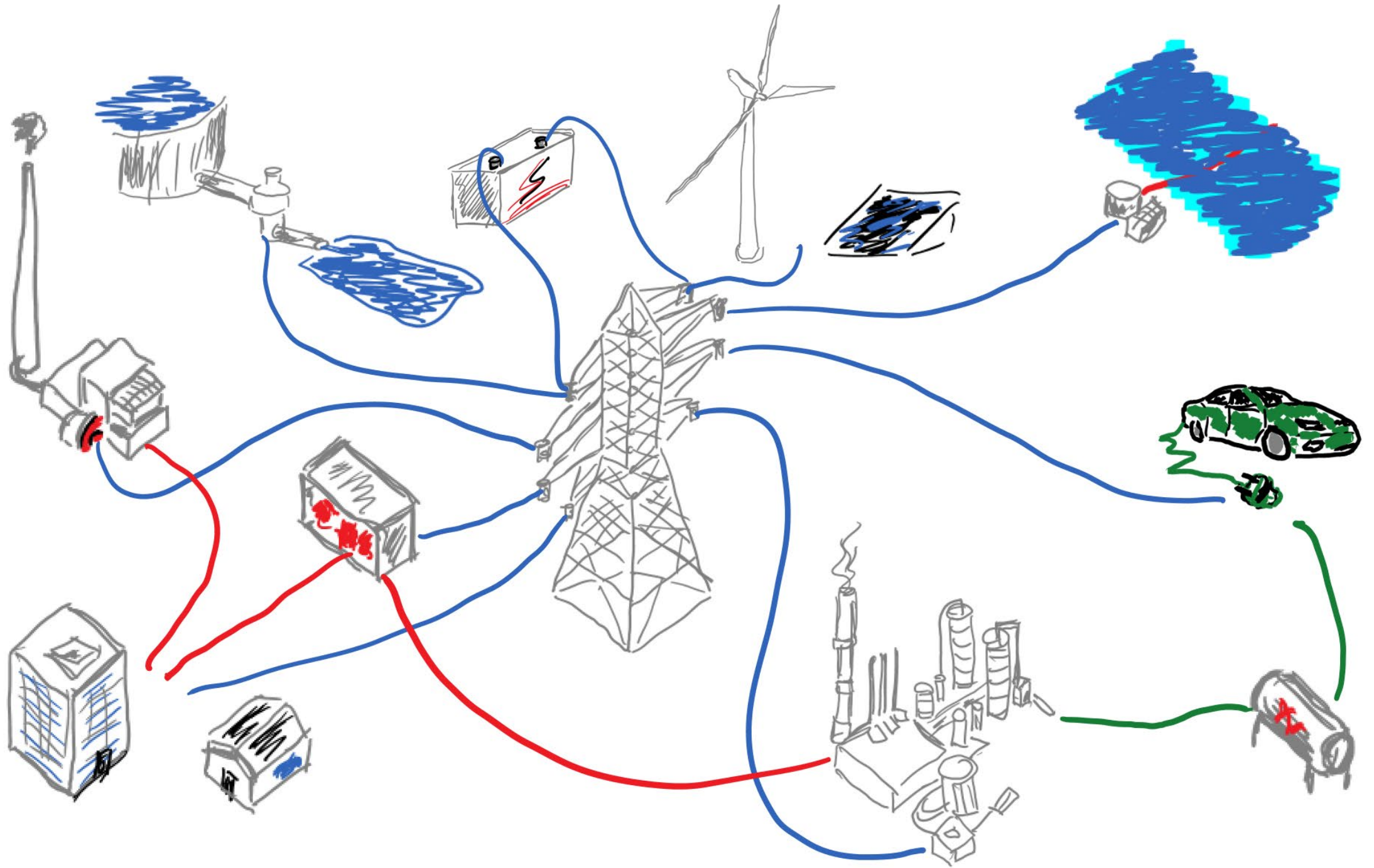
18 Mt/y



3.5 Mt/y

20 Mt/y





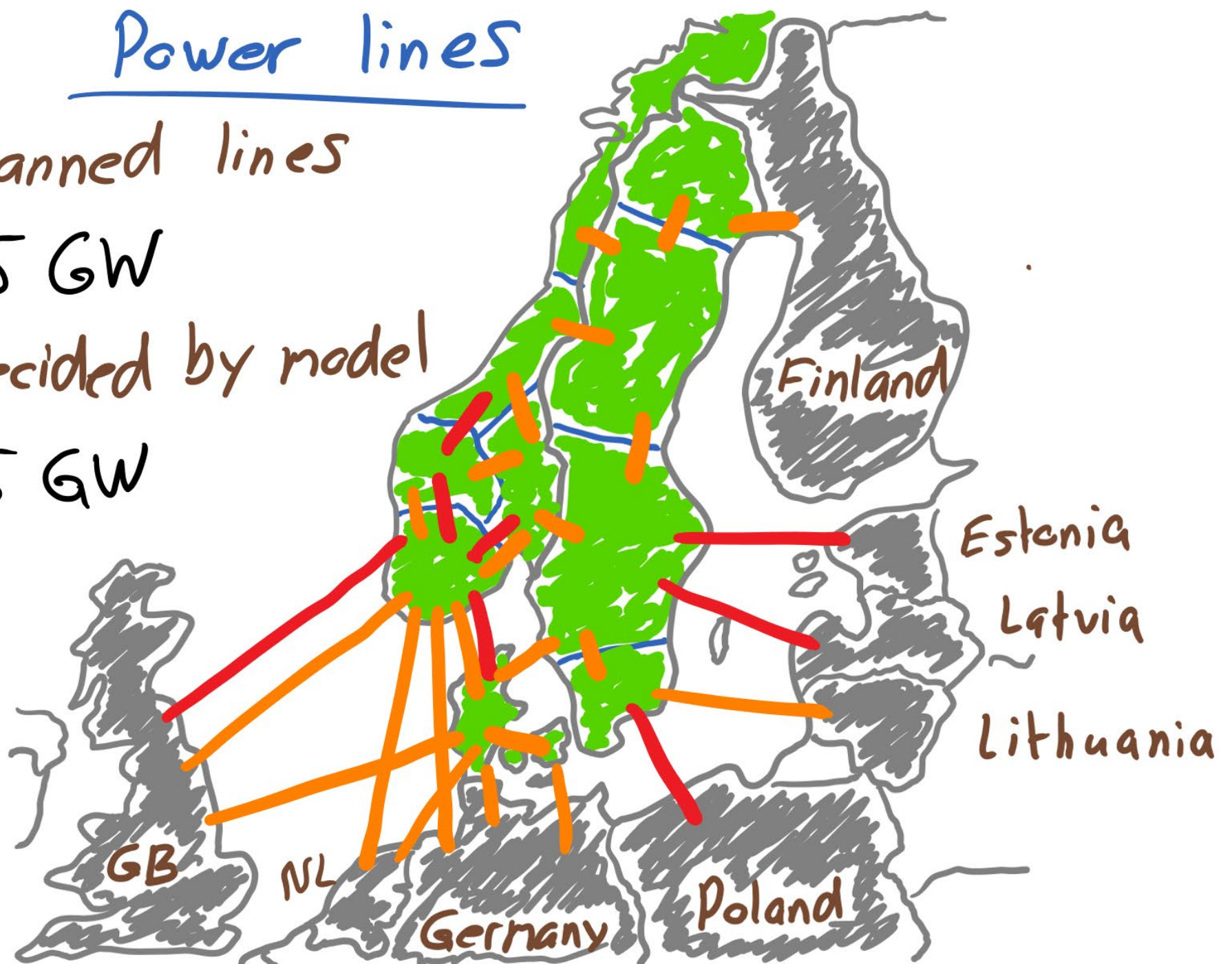
Power lines

Existing + planned lines

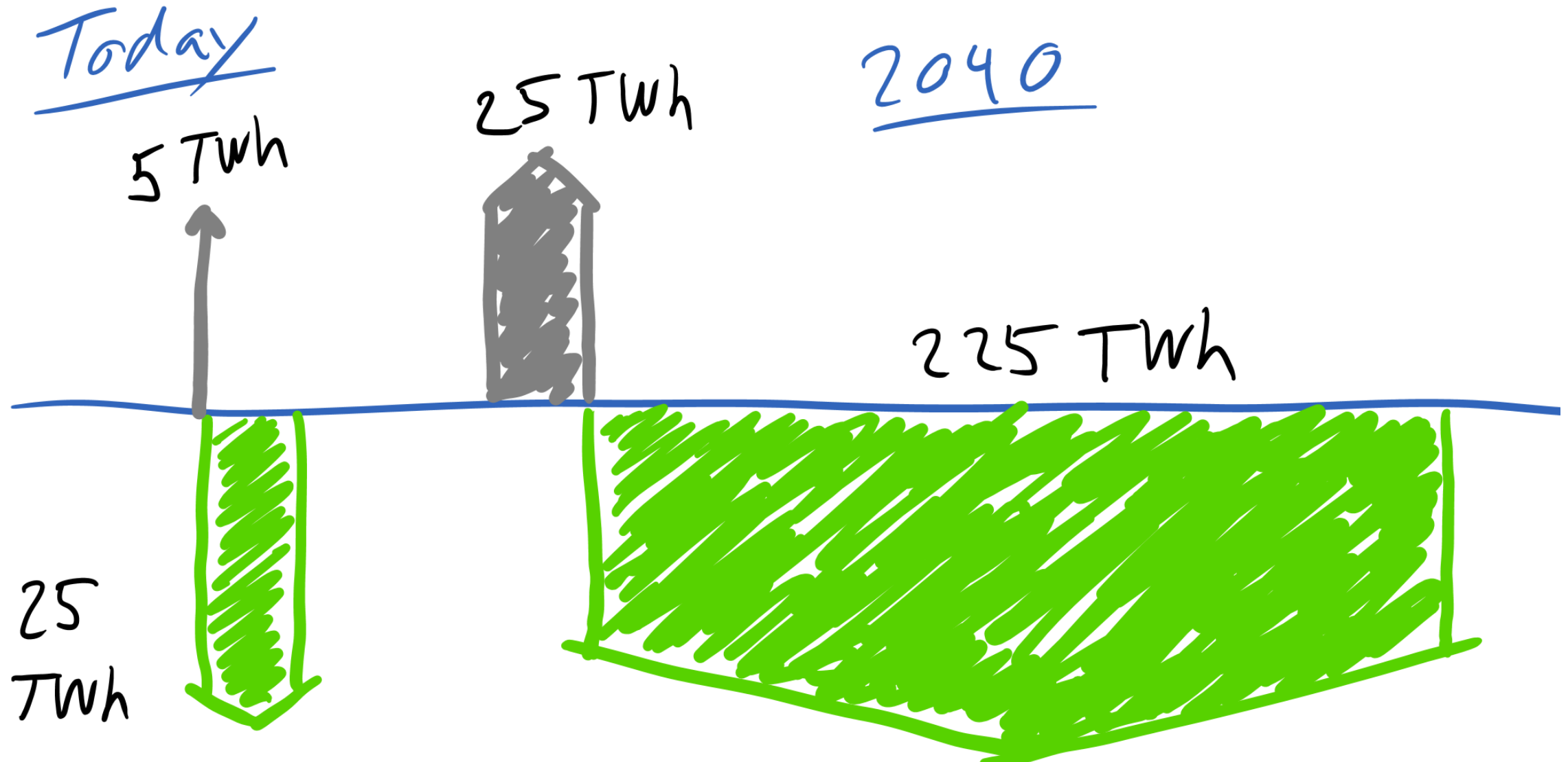
— 75 GW

New lines decided by model

— 35 GW



Power trade with other countries



Heat Pump

District heat Production

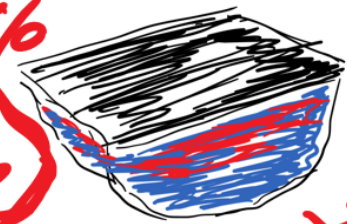
Heat Storage



150 PJ



50%

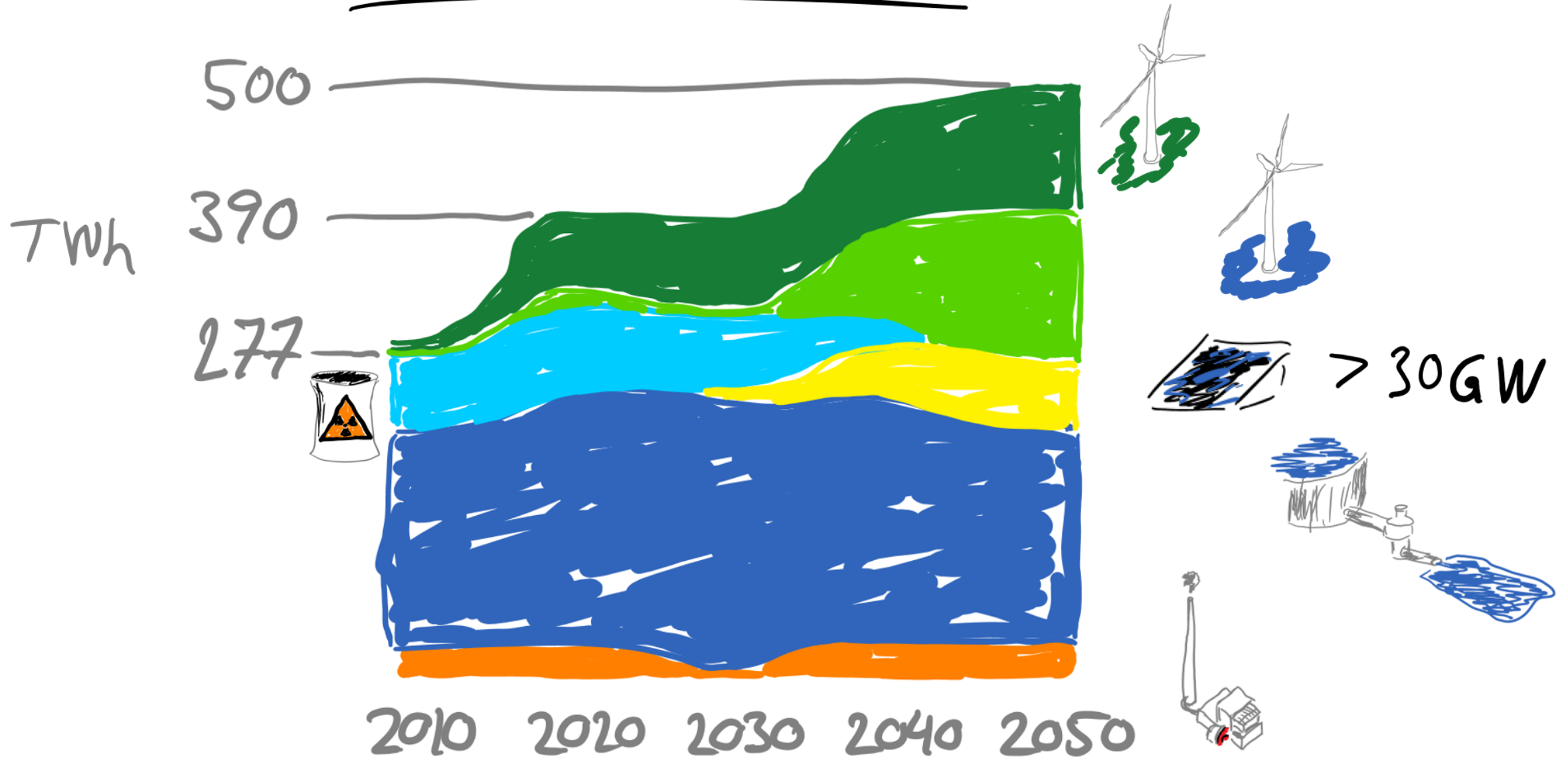


350 PJ

50%



Electricity production



The need for bio fuels

345 PJ



2013

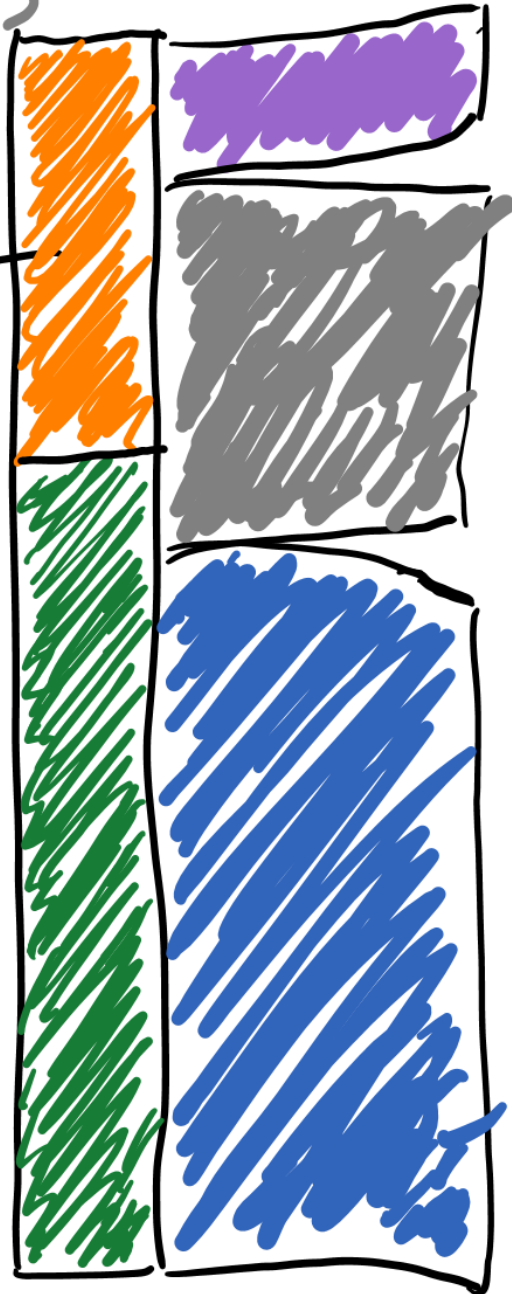
450 PJ



2050 Base

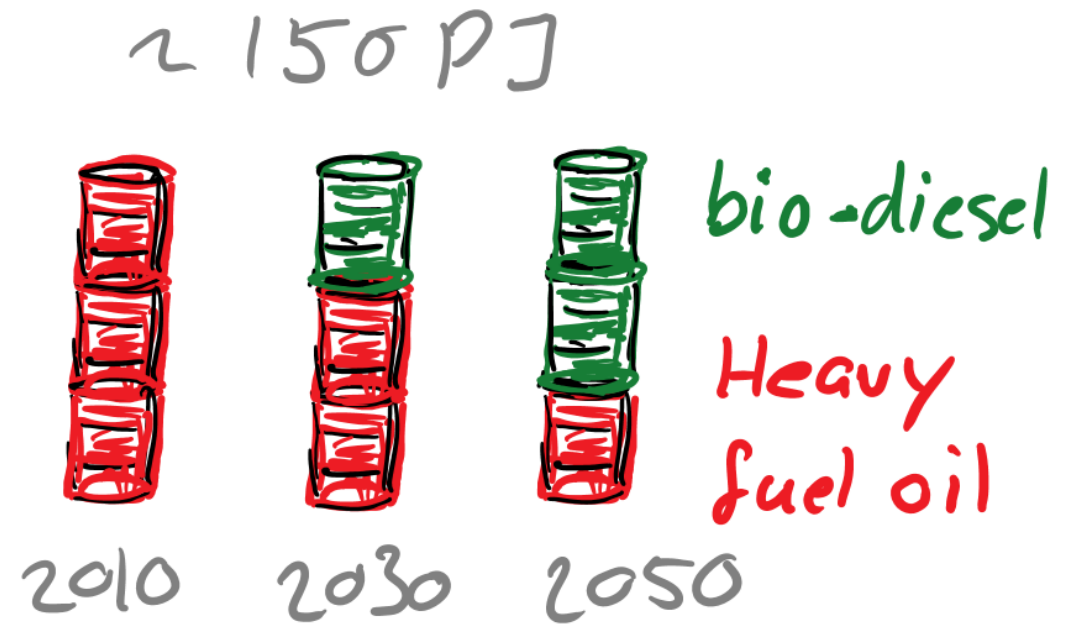
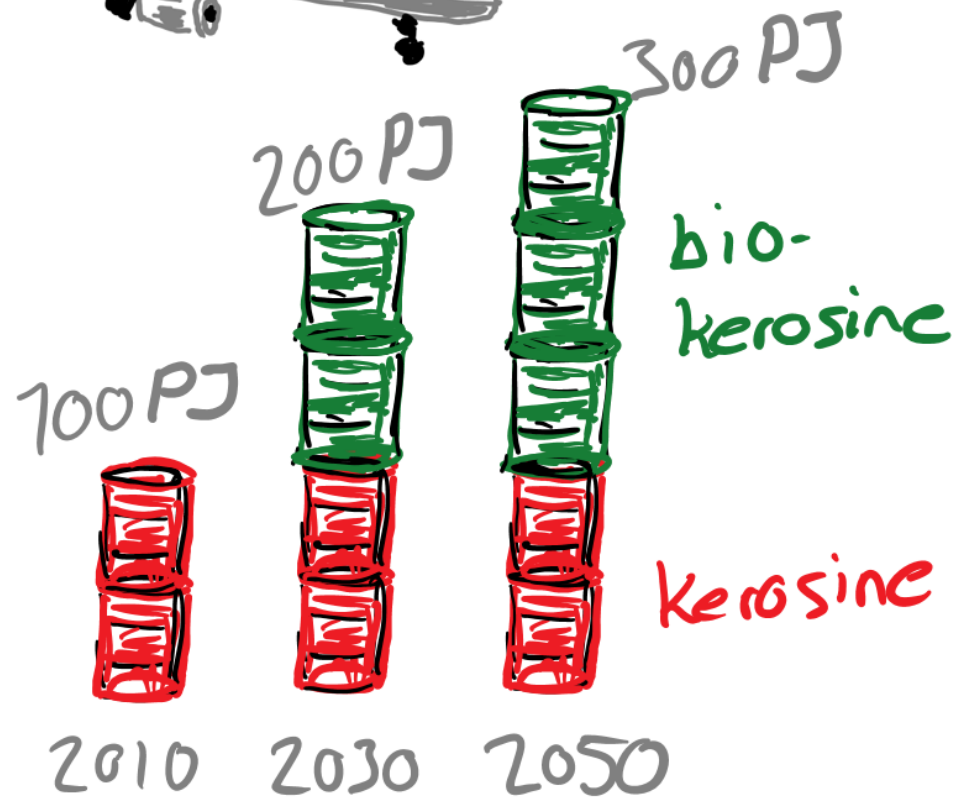
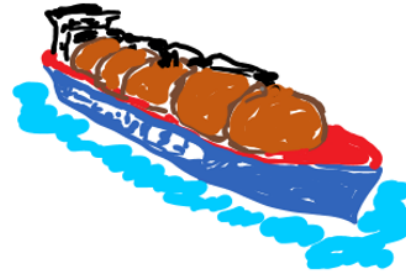
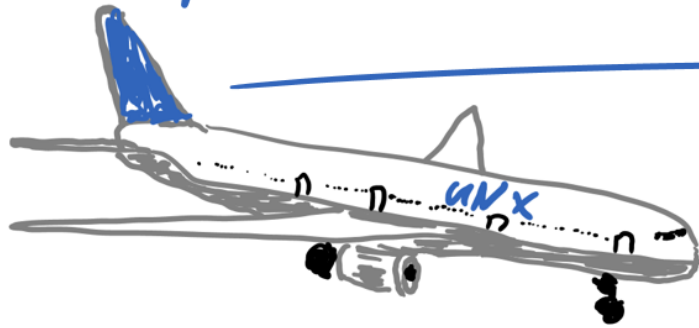
820 PJ

Import

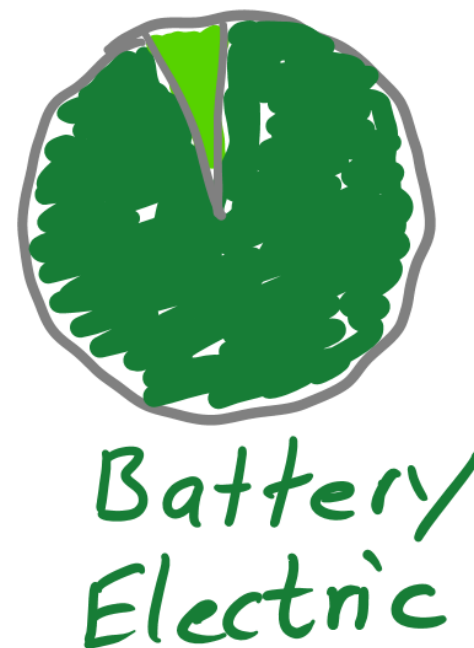


2050 CO₂ Negative

National and international aviation + shipping



Car
types



2010 ————— 2030 ————— 2050 —————>

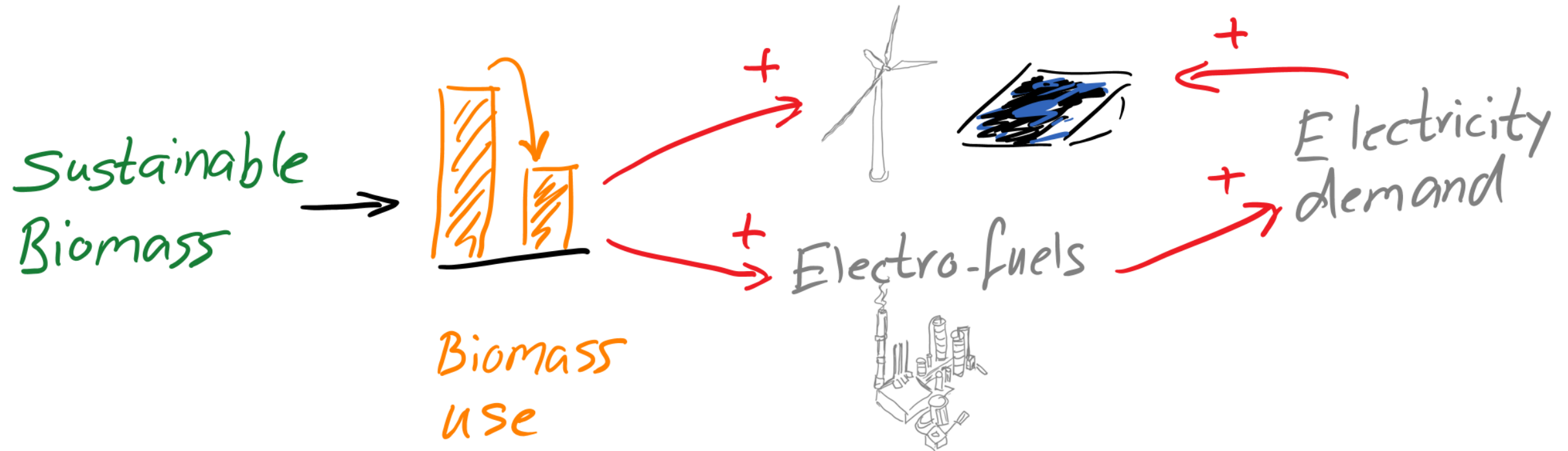
Road freight
fuel share



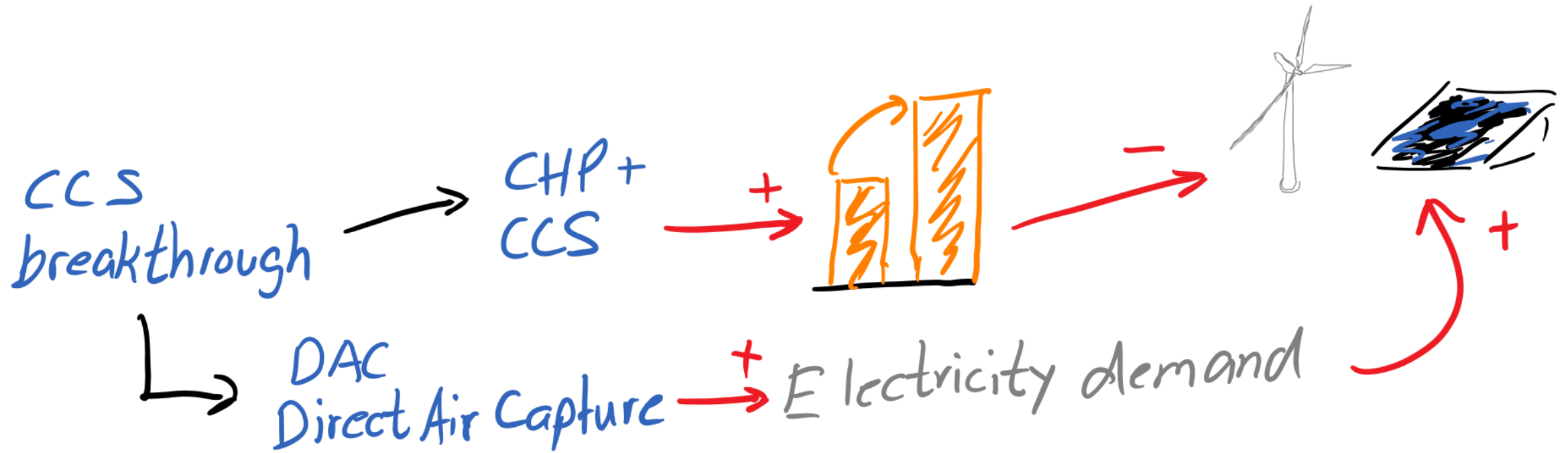
Natural
gas



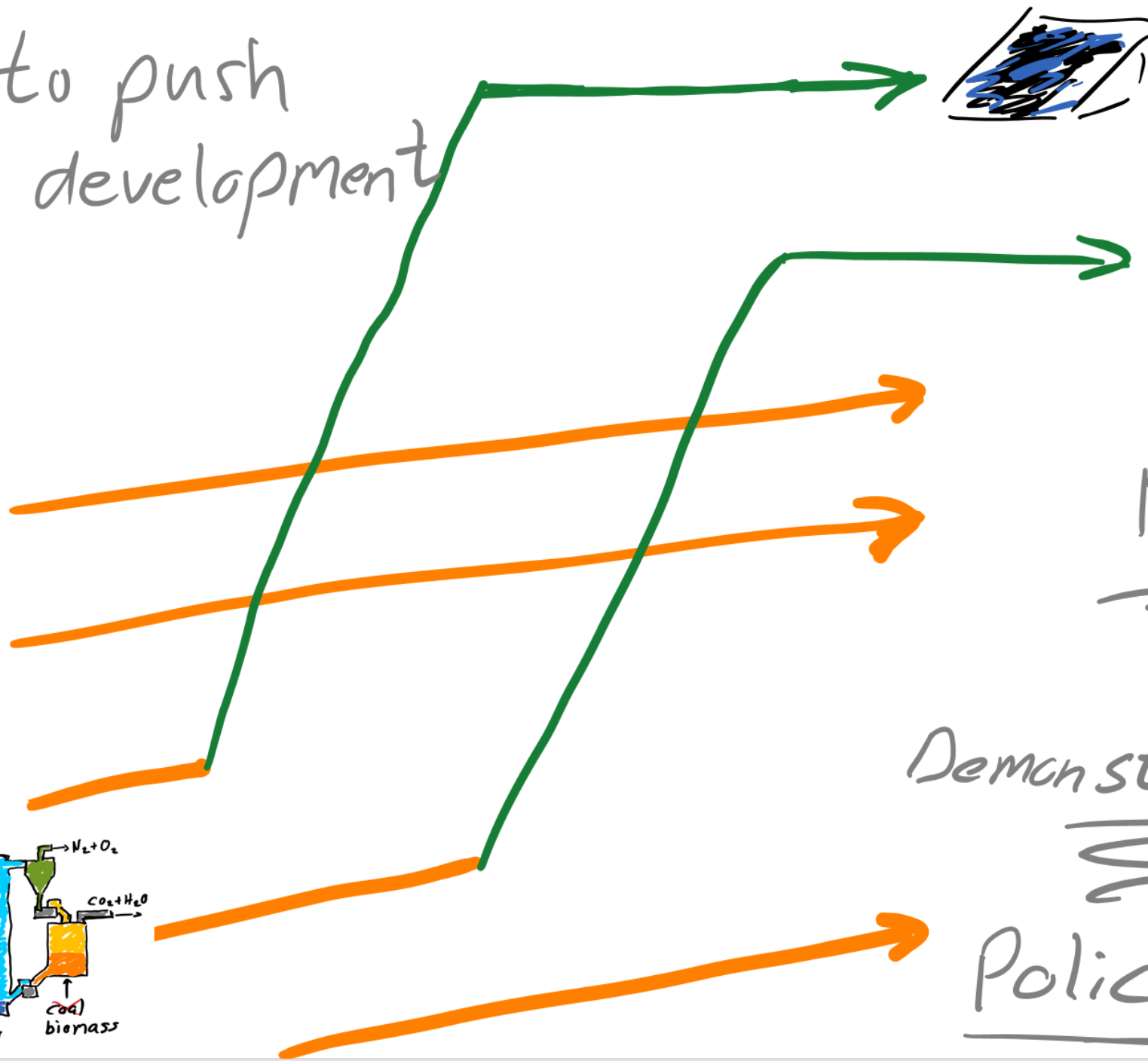
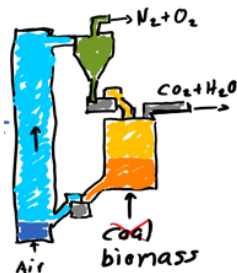
PV and Sustainable Biomass



PV and CCS



We need to push
technology development



R & D

Demonstration

Policies

Abraham Lincoln



"Best way to predict
the future is to
create it"

- Yes, but we need to speed up!

check results : <https://timesnordic.tokni.com>

Projects : www.nordicenergy.org/projects/

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Nordic Council of Min