

## Handouts

### La voiture électrique: la seule solution à notre future mobilité?

In this document you will find the slides and notes of the presentation: **La voiture électrique: la seule solution à notre future mobilité?**.

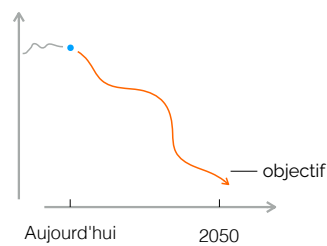
If you have any question, don't hesitate to contact us by email ([francesco.contino@uclouvain.be](mailto:francesco.contino@uclouvain.be)). You can also find more information about our research on the following website: [TFL website](#).

### La voiture électrique

la seule solution à notre future mobilité?

Francesco Contino  
Professeur

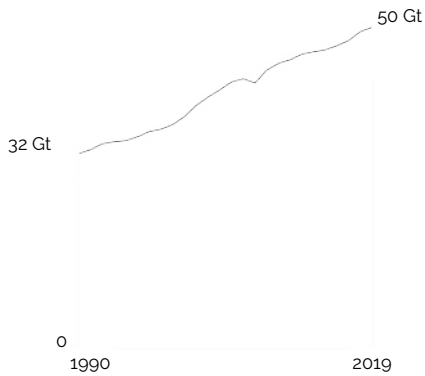
UCLouvain



Combine technology and sobriety

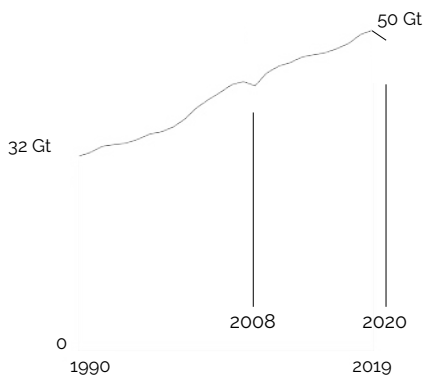
Change the paradigm

Despite awareness, greenhouse gas emissions increases



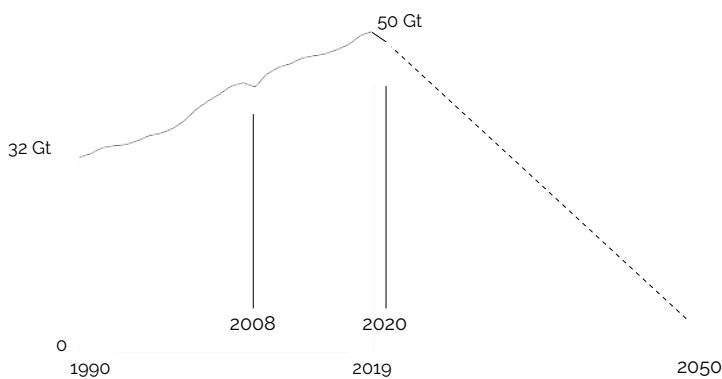
The primary energy consumption increases continuously in the world. We reached 14000 millions tonne of oil equivalent (Mtoe) in 2019, despite the efforts to slow down this progress, we cannot see any change in the slope.

Except during crises



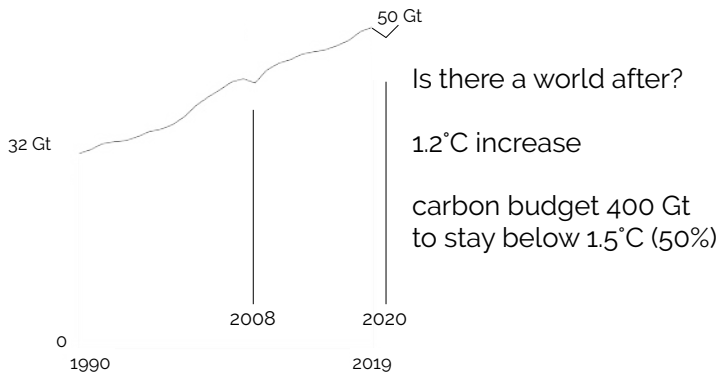
Due to lockdown, the primary energy consumption in 2020 decreased.

With some hope...



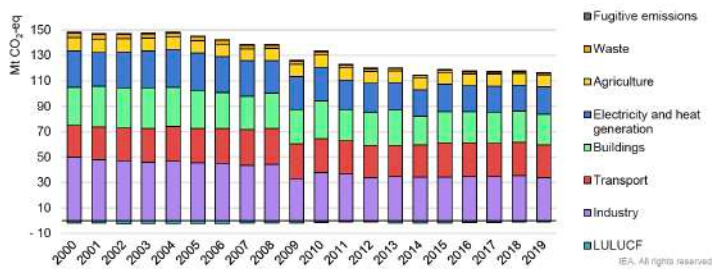
We had some hope for the decrease of CO2 emissions.

...a short-lived one



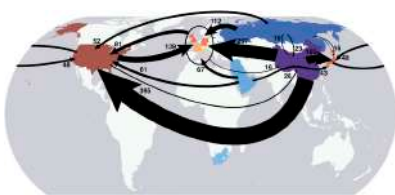
But the hope was short-lived.

Belgium emissions are going down but not for the good reasons



The CO2 emissions in Belgium decreases but mostly because of the crises and in the industry.

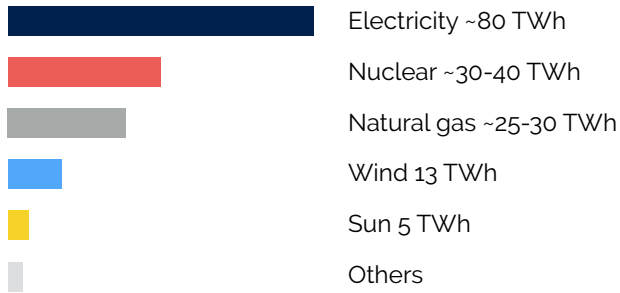
Careful the imported CO2



Official statistics  
10 t/(person year)  
With import  
+/- 15 t/(person year)  
Sustainability:  
2 t/(person year)

But we need to be careful because instead of producing in Belgium we import from outside and our apparent decrease is more than compensated by CO2 crossing our border.

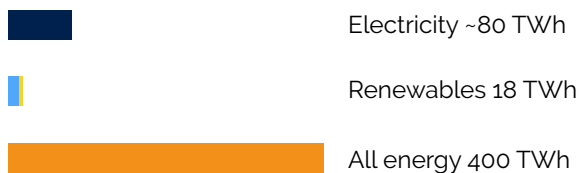
A bit more than 20% of our electricity is produced from renewable sources



A bit more than 20% of our electricity is produced from renewable sources



But electricity is only 20% of our energy consumption



But electricity is only 20% of our energy consumption



Energy consumption building, transport, industry

**Building:** heating, cooling, electricity

**Transport:** 60% by car  
20% remaining on road  
15% air

**Industry:** manufacturing, construction, ...

There are mainly three types of end use: building (mostly thermal comfort), transport (mostly cars), and industry (mostly steel and construction).

Each around one third of the final energy

A long way to get to the potential and this will not be for 100%

Maximum potential in Belgium: around 1/3 of our consumption

PV panels multiplied by 12  
Wind (on- and offshore) multiplied by 4

About 100 billions euros for capacity (but how much for infrastructure when nimby?)

Most of our energy will still be imported in various forms

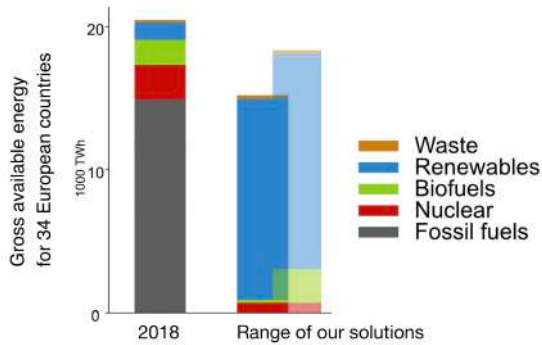
Similarly to today (natural gas and oil) we will import a lot of energy

Around 2/3 of our consumption if demand does not change

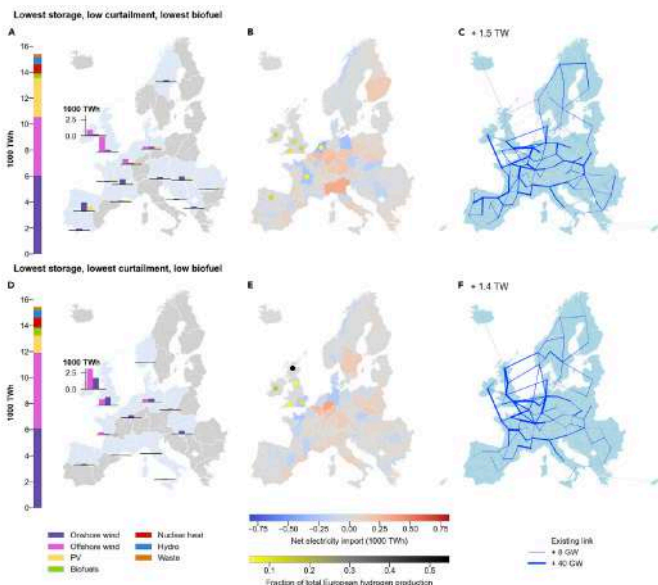
Electricity through interconnection, but also e-fuels by boat and pipeline

Only 20-30 TWh for the moment is imported through electricity and interconnection will suffer a lot from the exchanges due to renewables.

In Europe, we have the potential but it is not evenly distributed



source: Pickering et al., 2022

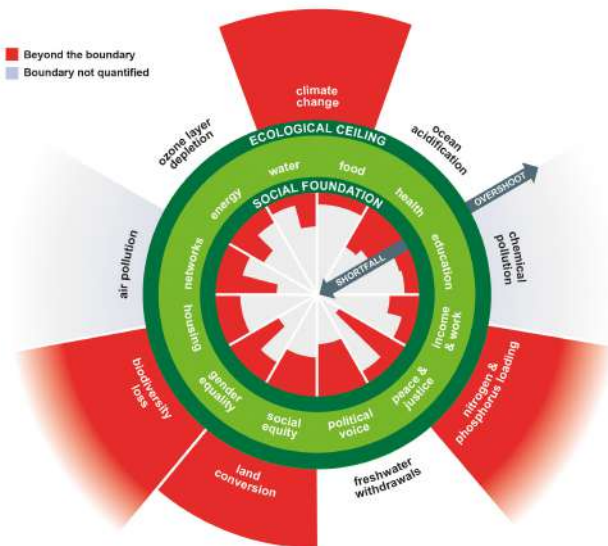


We cannot look at the problem independently in each sector

We need a systemic view to properly understand the issue

Energy has many forms

We need to include air quality, biodiversity, employment, traffic, happiness



The Doughnut of social and planetary boundaries - Kate Raworth (<https://www.kateraworth.com/doughnut/>)

Nothing beats an electric vehicles when considering tank-to-wheel

High efficiency of the electric motor  
low CO2 even with electricity production

Direct use of the renewable energy without further conversion

Good for air quality

But electric vehicles are not the only solution

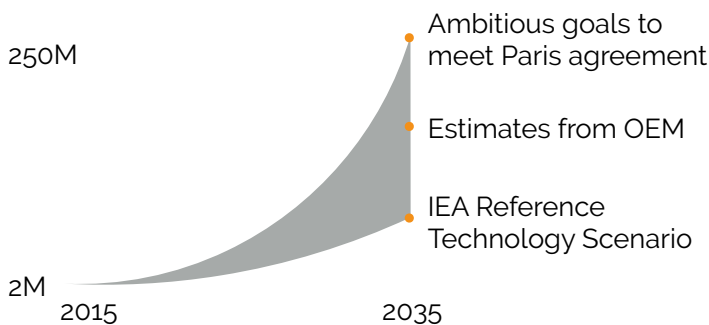
Since we will import a lot of energy carriers it makes sense to use them directly

We will have issues of electricity storage the system needs to be robust

Currently, life cycle analysis is questionable and trend towards big electric SUV

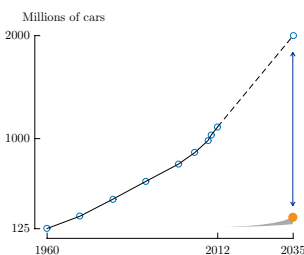
The shift project advocate for a tax on the weight of the vehicle and a limitation to 50 kWh batteries.

Electric cars are growing fast but will they keep the pace?



The market of electric vehicles is growing fast. According to the latest IEA world energy outlook, these are potential growth scenarios, from conservative to ambitious goals.

Piston engine is a well known technology proven to scale on a large market



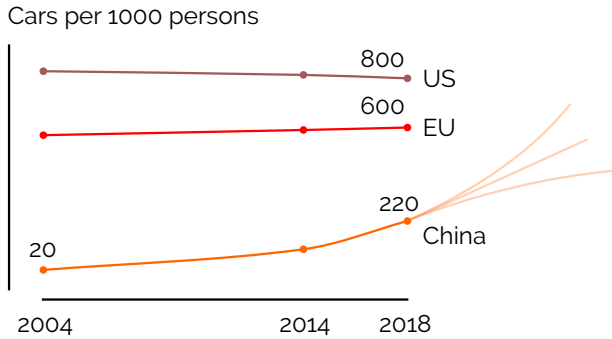
Difference covered by fuel operated cars

When placing this impressive growth in the overall market of cars, there is still a huge gap that will be covered by fuel operated cars. This is also perhaps the first key element, internal combustion engine has proven to scale.

source: Stacy et al. 2014



What will happen next?



The trend in countries like China explains how scary the global trend is.

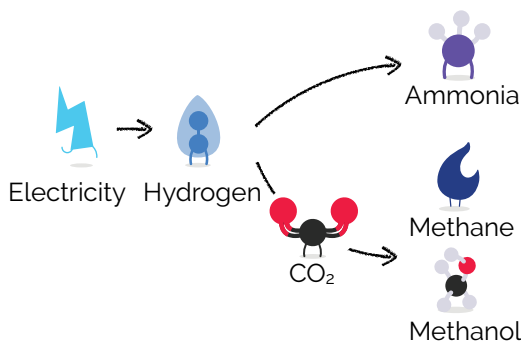
Power-to-fuel is not only hydrogen and fuel cells

Power-to-fuel often with fuel cells but not the only solution

Internal Combustion Engine (could) work well with all these fuels

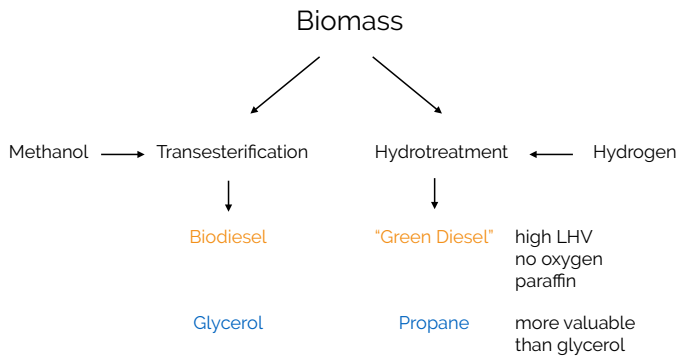
This route could potentially make more sustainable transport

With or without CO<sub>2</sub>, fuels can be produced

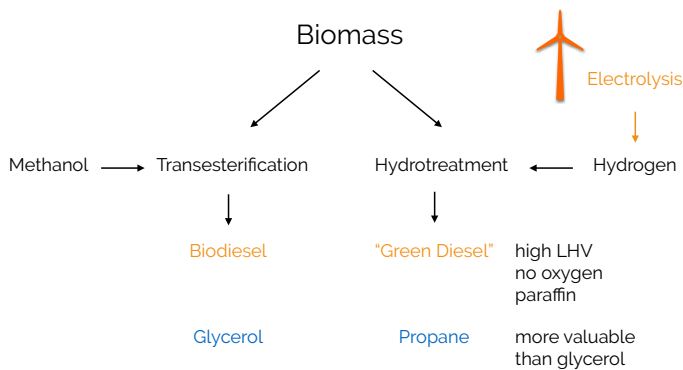


When storing electricity into fuels. Several options are available. The first step is generally water splitting and the production of hydrogen in an electrolyser. When no CO<sub>2</sub> is available, we can use the nitrogen from air and produce ammonia (NH<sub>3</sub>). When CO<sub>2</sub> is available, we can further convert hydrogen into methane or methanol.

Another example for renewable hydrogen:  
Hydrotreated Vegetable Oil



Another example for renewable hydrogen:  
Hydrotreated Vegetable Oil



It is all about potential production

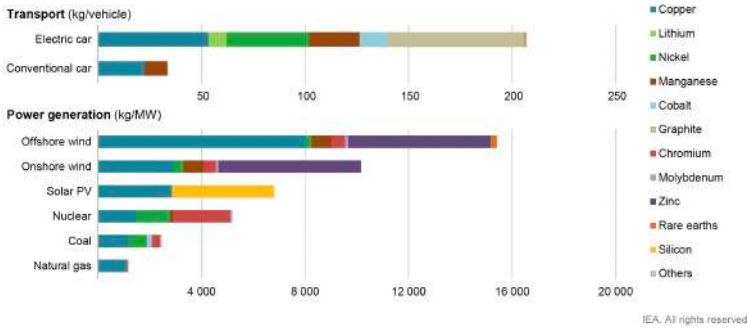
Arable land (FAO)	1.6 10 <sup>9</sup> ha
Biofuels net production	x 1 toe/ha
Potential production	1.6 10 <sup>9</sup> toe
Transport consumption	÷ 3 10 <sup>9</sup> toe
	<hr/>
	50+ %

50% of the vehicles are still running  
but we don't eat anymore

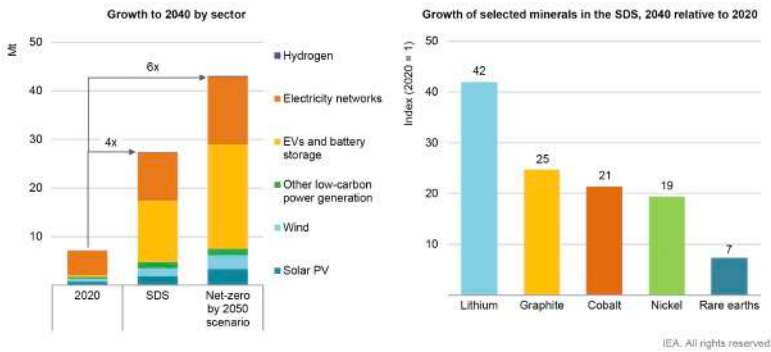
As much as quantity is important—first law of thermodynamics—quality also matters—second law of thermodynamics.

See report on critical materials from the IEA.

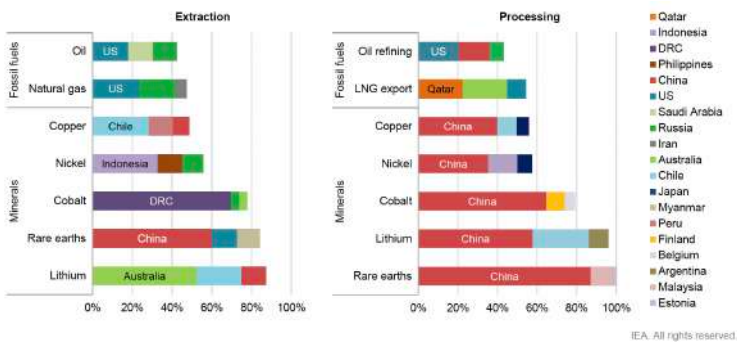
Transition requires a lot of raw materials



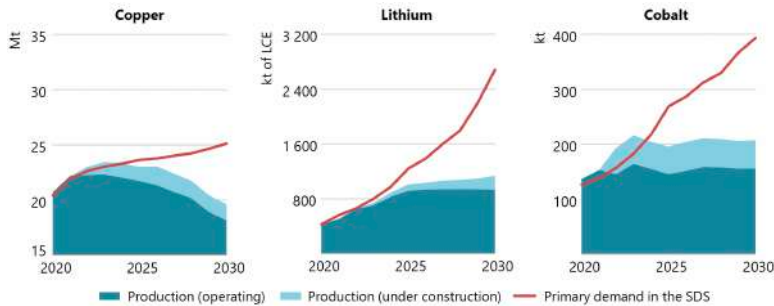
Transition requires a lot of raw materials



Lot of raw materials in a few hands



Some critical raw materials will have a gap



Caution: typical lead time = 10 years



Wish to be the first one

It is an opportunity to be the first to sustainably succeed

The cost of going through planetary limits is **dramatically** bigger than short-term cost

Students wants ~~green washing~~ true commitment to sustainability

Ingés en transition  
[sites.uclouvain.be/ingesentransition](https://sites.uclouvain.be/ingesentransition)

One example among many others:  
end of salary cars

Anomaly of the Belgian fiscal system

Skew the social practice of transport

Students do not care anymore



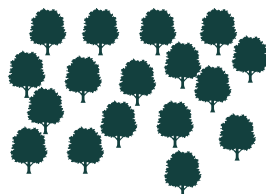
Scope 3 is not someone else's problem

scope 1&2

the tree in front  
of the forest



scope 3



Focusing all effort on scope 1 (& 2)  
will not solve the problem

There are many levers at your level  
to decrease indirectly scope 3

Combine technology and sobriety

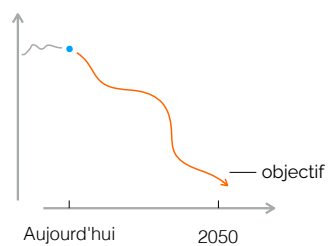
Combine technology and sobriety\*

Change the paradigm

*\*sobriety means controlled degrowth*

L'avenir énergétique  
une question de choix plus que de technologie

Francesco Contino  
UCLouvain



Podcast

*Exergie*

Regards croisés sur l'énergie  
sous toutes ses formes

 UCLouvain

Suggestions d'interview?



Retrouver le podcast : <https://www.podcastics.com/podcast/exergie>