CAETS 2021
ARGENTINA
Engineering a Better World
THE FUTURE OF ENERGY

Buenos Aires, September 17-24, 2021

Energy demand and decarbonization: some remarks

Yves Bamberger

Decarbonization: enough resources ?

❑ **No limit in low carbon energy resources**

- The energy sent by the Sun is “infinite” (the quantity and the duration)
- The resource from nuclear fission may cover needs for centuries

❑ **The problem is thus NOT to limit energy demand but to decouple affordably**

Energy demand *and* **GHG generation (CO2, CH4)+Pollutions**

How to decarbonize: choosing the right indicators

Low primary energy consumption and low carbon emission are not synonymous

Heating needs
4 MWh

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Electricity mix: 50 % REN, 25 % NUC, 25 % THM (Eff. 50 %, 400 gCO_2/kWh)

E_p/E_f = 1.75 100 gCO_2/kWh

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Heating needs
4 MWh

Gas furnace (Eff 90%)

E_p = 4 MWh

Consumption: 4 MWh gas

880 kg CO_2

Heat pump (SCOP 3)

E_p = 4 x 1.75 = 7 MWh

Consumption: 1.33 MWh electricity

133 kg CO_2

How to decarbonize (the energy demand)

Energy efficiency is useful but…

Energy efficiency first and low carbon first are not synonymous

Heating needs
4 MWh
Gas furnace
880 kgCO2

How to decarbonize (the energy demand)

Energy efficiency is useful but…

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Heating needs
4 MWh
Gas furnace
880 kgCO2

50 % insulation
2 MWh gas
440 kgCO2

Heat pump with a SCOP 3
1.33 MWh
Electricity mix 100 gCO2/kWh
133 kgCO2

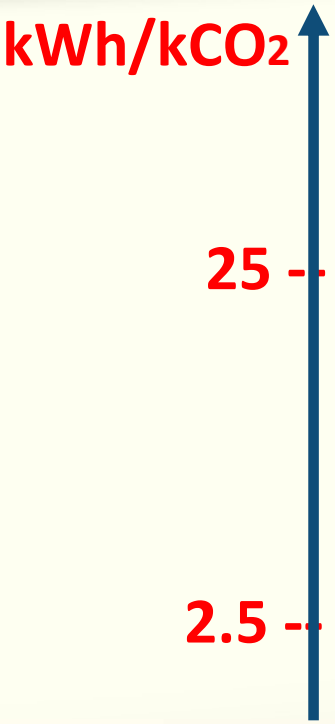
How to decarbonize: with which vectors?

- DIRECT USE of SUN
- DIRECT USE of FOSSIL ⟶
- DIRECT USE of BIOMASS ⟶
- USE of HEAT NETWORK ⟶
- USE of ELECTRICITY ⟶

How to decarbonize: with which vectors?

- DIRECT USE of SUN
- USE of ELECTRICITY ⟶ DECARBONIZE
- USE of HEAT NETWORK ⟶ DECARBONIZE
- DIRECT USE of BIOMASS ⟶ DISCUSS
- DIRECT USE of FOSSILE ⟶ CCS or REPLACE

How to decarbonize: with which vectors?



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How to decarbonize: some AVAILABLE key technologies

- HEAT PUMPS
  - Residential, tertiary, industry sectors
  - Geothermal, air-air, air-water,...
- Electric vehicles, hybrid vehicles
- Industrial process using low-carbon electricity or hydrogen

How to decarbonize: some AVAILABLE key technologies

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TIME SCALE
10 yr, 20 yr, 30 yr

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Use the BAT, don't wait for the future ones!

Adjusting demand to generation may contribute to decarbonization (systemic approach)

Anticipate or postpone the need to shave/increase the load of the electric power system:

- Heating water or charging EV batteries nightly or when the wind blows or the Sun shines!
- Rotating temporary reduction of heating or cooling systems in residential and office buildings.

yb1

How to decarbonize: last (but first) key point

CREATING MOTIVATION FOR THE MUTATION

Diapositiva 15

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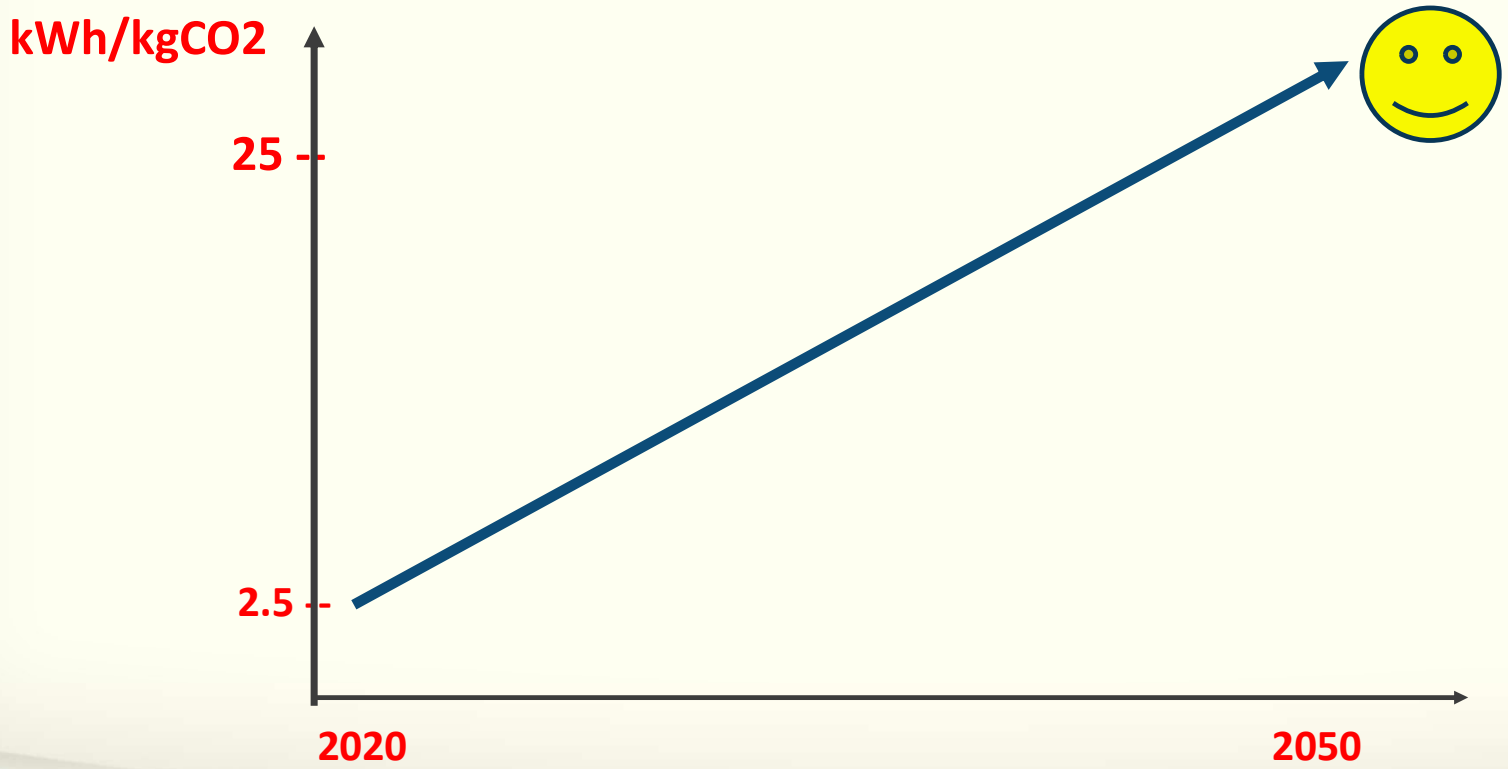

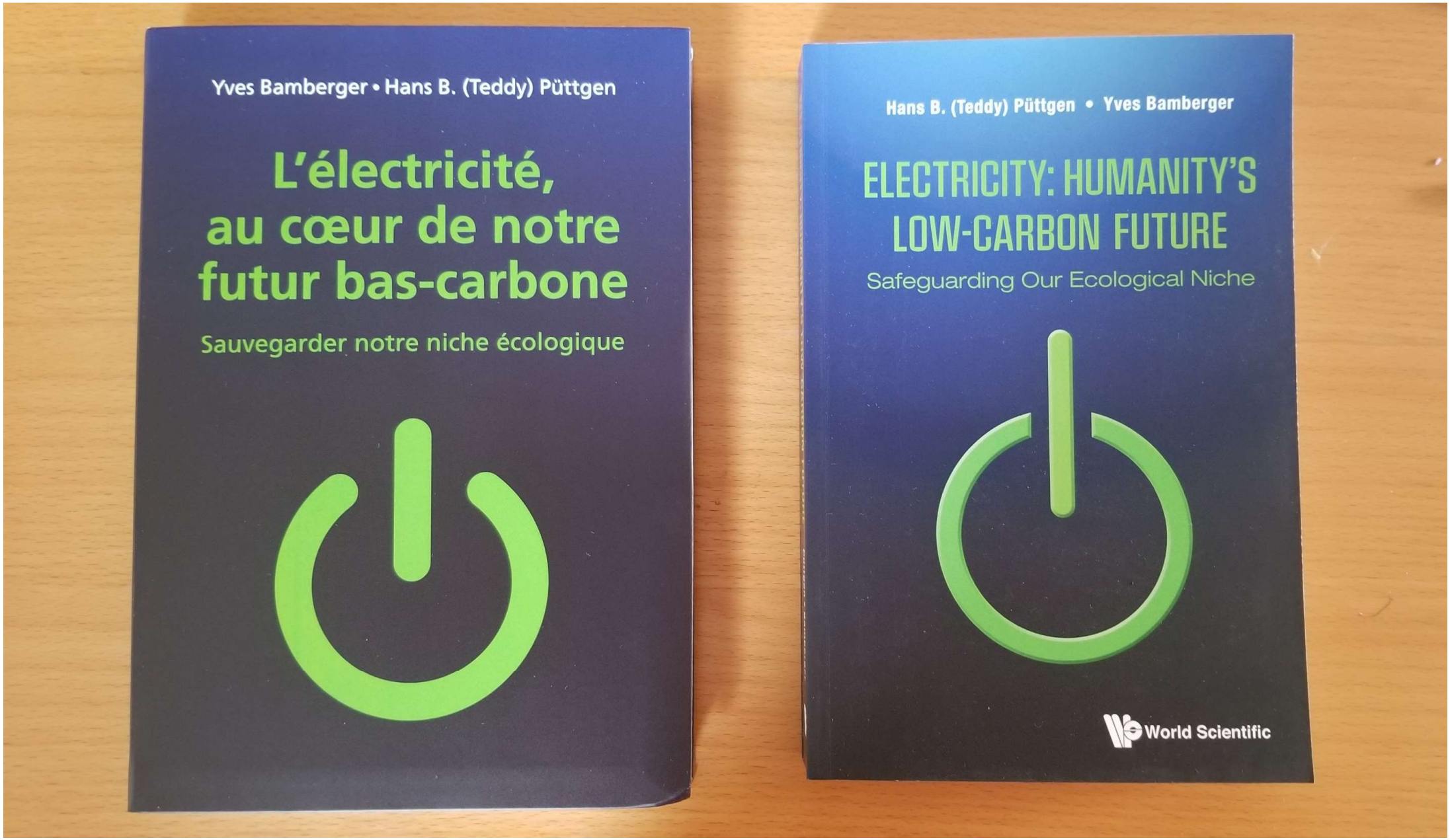
Yves Bamberger • Hans B. (Teddy) Püttgen
L'électricité, au cœur de notre futur bas-carbone
Sauvegarder notre niche écologique
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ELECTRICITY: HUMANITY'S LOW-CARBON FUTURE
Safeguarding Our Ecological Niche
World Scientific

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THANK YOU

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