SURFER

Assessing the impacts of the French energetic transition over the period 2015-2050
Key challenges

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Energy transition

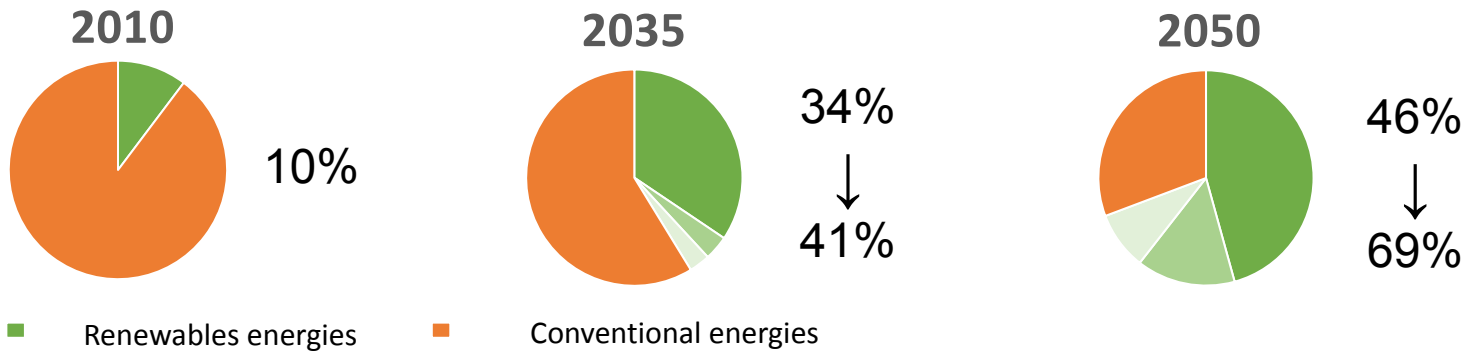
- Frame
  - French law on energy transition (LTECV) – august 2015
  - Paris agreements – november 2016
    - *Climate change < 2°C*
    - *Carbon neutrality in the 2nd half of the XXIst century*
- Objectives in France
  - **GHG** emissions: minus 40 % between 1990 and 2030, division by 4 between 1990 and 2050
  - Final energy **consumption**: minus 50% in 2050 / 2012
  - Primary **fossils**: minus 30% in 2030/ 2012
  - **Renewable** energy: 23% of final consumption in 2020, 32% in 2030
  - **Nuclear**: 50% of electricity in 2025

ADEME Scenarios « Visions 2035-2050 » (version 2017)

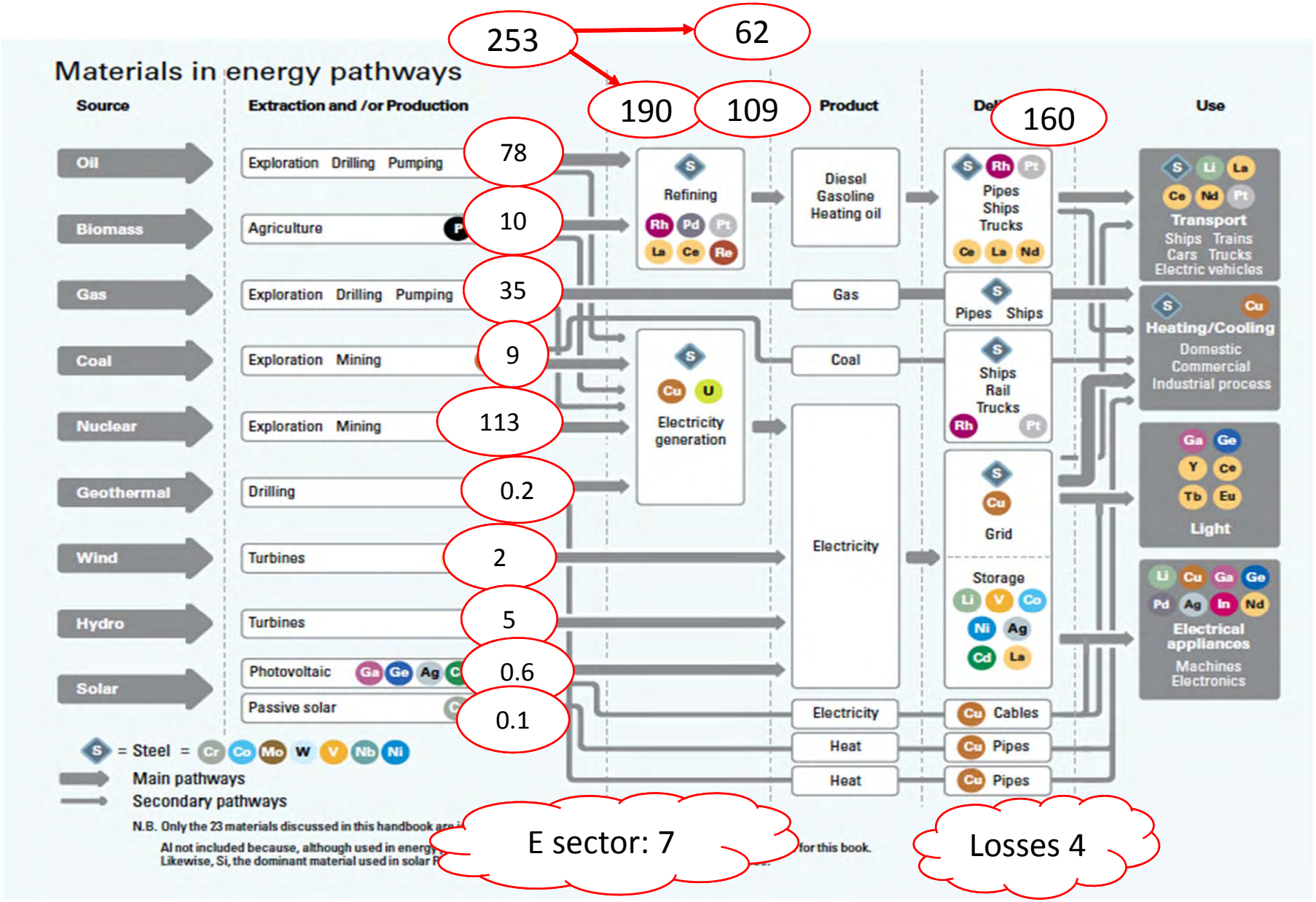
Final energy demand (Mtoe)

2010		2035		2050
149	- 29% →	105	- 45% →	82

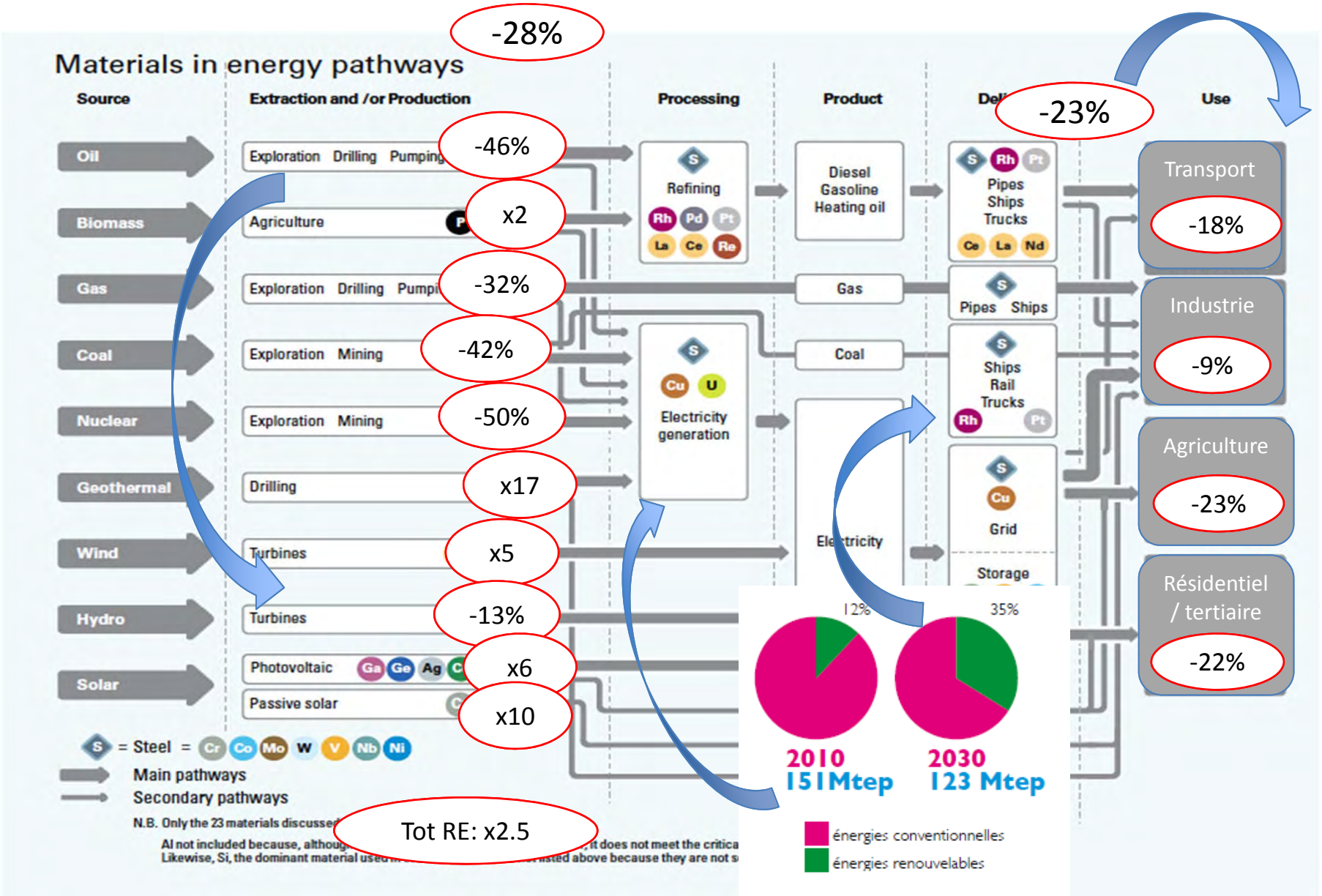
RE part in the final demand (3 variants)



Energy system in France (stats 2015 – Mtoe)



Scenario France 2030: whole system impacted



Environmental assessment of scenarios in SURFER

Temporal assessment of requirements – direct and indirect

- Raw materials consumption
- Needs in energy, water, land…
- What evolution of these consumptions with the evolution of the energy mix in France and worldwide ?

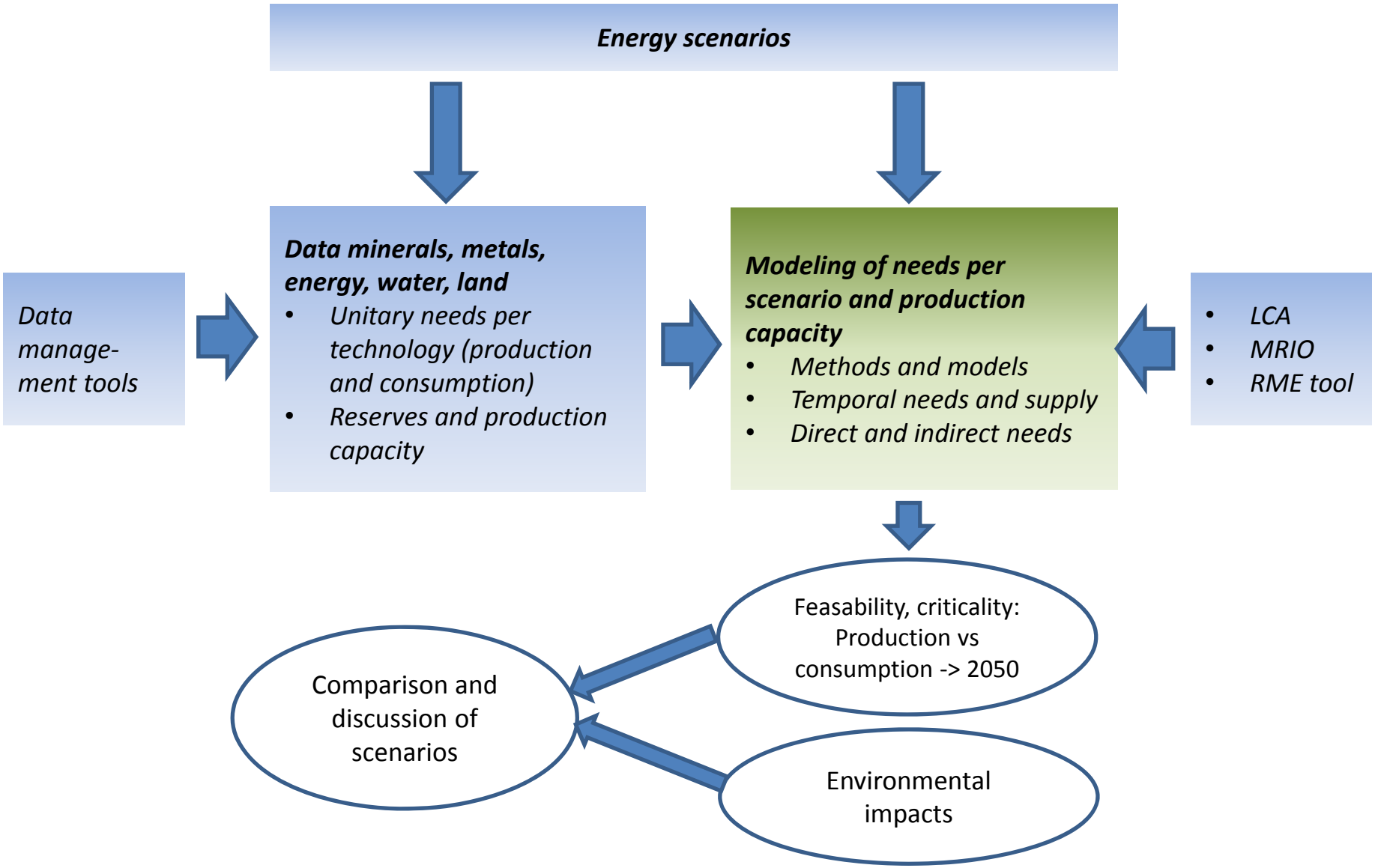
Feasability?

- What these needs representent in national consumption?
- What these needs represent for global world production capacity (in a context of world ET)?

Impacts?

- How much, where, when?
- Balance? Shift of the dependance on fossils to the dependance on minerals? At which term?

3 steps project: database, modelling, interpretation



Difficulties/1

Data (materials intensity)

- Choice of technologies (all?)/substances
- Diversity of technologies (spread of materials intensity)
- Evolution of technologies (learning curves uncertainties)
- Prospective technologies (no data)
- Agregation of literature/manufacturer data

Priority 1	
Structural substances	Copper
	Aluminium
	Iron
	Concrete
Technological substances	Lithium
	Cobalt
	Nickel
	Manganese
	Silicium Metal
	Neodynuim et Praseodynium
	PGM

Difficulties/2

Direct needs (foreground)

- For energy production: same **perimeter** of the supply chain (cradle to gate (to grid): extraction, transport, storage (allocation), transformation (if any), grid and storage?)
- For consumption: grid and storage?, mobility: (functional unit: **kWh consumed**), buildings, industry, agriculture: (**kWh saved**)
- Calculated in the frame of scenarios (**temporal aspect**) in order to fulfill a multi-functional unit of the energy system: « to satisfy the demand for energy and energy services »

Indirect needs (background)

- Associated to the production of the direct needs using LCI or RME data
- Regionalised (EXIOBASE?)
- Temporalised (evolution of the energy mix woldwide)

Conclusion

I skip difficulties 3/4/5/6/…

A core investment of SURFER is the database of materials, energy, water, land intensities of technologies involved in the energy transition

- Help!!!!

The « materials » impact assessment of the ET is linked to the availability of « temporal » LCI data, themselves linked to the ET

- How do we run that circular « thinking » without driving out of the curve?

Annex - Other substances included

Priorité 2	
Métaux porteurs et sous-produits impliqués dans l'électronique, TIC, connectique	Zinc
	Plomb
	Argent
	Gallium
	Germanium
	Indium
Métaux à enjeux potentiels en fonction des évolutions technologiques	Vanadium
	Magnésium
	Dysprosium
	Graphite
Métaux d'alliage à enjeux potentiels en fonction des évolutions technologiques	Tungstène
	Chrome
	Molybdène
	Rhénium
	Niobium
	Tantale
Priorité 3	
Eléments impliqués dans la production de biomasse	Azote
	Phosphore
	Potassium
Autres éléments	Or
	Sélénium
	Tellure
	Cadmium
	Scandium
	Zirconium (→ Titane)
	Uranium
	Graphite
Autres	
Autres flux à prendre en compte	Energie
	Eau
	Sols