



ETSAP WORKSHOP
Sophia-Antipolis
December 15-17th 2008

*A methodology for modelling
the Non-Energy Intensive
Industry*



MINES
ParisTech

Gondia S. SECK
Ecole des Mines Paris/EDF R&D



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Context

❖ *The industry can be divided in two large families of energy consumers:*

- *The energy-intensive industry (EI)*
- *The non-energy intensive industry (NEI) named also Diffuse Industry (DI)*


❖ *Nowadays, the weight in energy consumption of NEI sectors increases more and more in developed countries.*

Share in electricity consumption in french manufacturing industry

Year	NEI (%)	EI (%)
1993	45	55
1994	45	55
1995	45	55
1996	45	55
1997	45	55
1998	45	55
1999	45	55
2000	45	55
2001	45	55
2002	45	55
2003	45	55
2004	45	55
2005	45	55

Share in Natural gas consumption in french manufacturing industry


Year	NEI (%)	EI (%)
1993	40	60
1994	40	60
1995	40	60
1996	40	60
1997	40	60
1998	40	60
1999	40	60
2000	40	60
2001	40	60
2002	40	60
2003	40	60
2004	40	60
2005	40	60



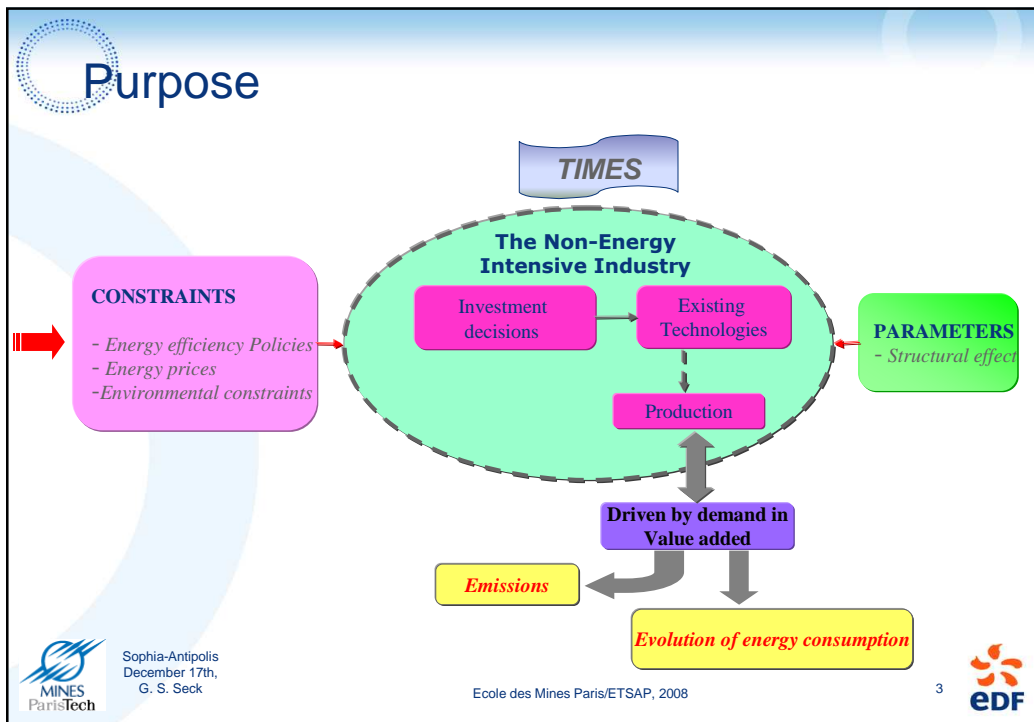
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2



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What is the NEI sector?

- ❑ **An approach of segmentation EI/NEI sectors**

Three approaches have been commonly adopted :

 - Single out few major energy-intensive sectors and treat the remainder as non energy intensive sectors;
 - Define the intensiveness of a sector via its process characteristics or via other « known » definitions, such as light and heavy industry;
 - ➔ ▪ Establish a limit that differentiates NEI from EI sectors by defining relevant multicriteria indicators based on their characteristics.
- ❑ **Characteristics of diffuse industry**
 - A considerable number of end products and processes
 - A considerable number of production sites
 - Less quantity of energy consumed per production site
 - Less energy intensity


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Segmentation of the industry

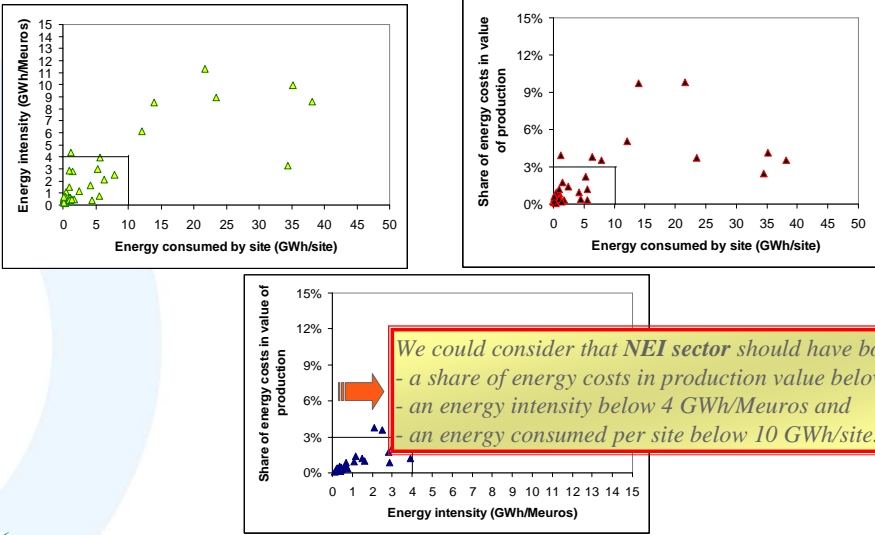
- ❖ We use three main criteria to establish this limit
 - The first criteria makes use of the existing differences in magnitude of energy intensity across manufacturing sectors;
 - The second criteria characterizes the NEI sectors by their share of energy costs in value of production.
 - The third criteria will focus on the quantity of energy consumed by production site;


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5 

Segmentation of the industry




Energy intensity (GWh/Meuros)
 Energy consumed by site (GWh/site)


Share of energy costs in value of production
 Energy consumed by site (GWh/site)

Share of energy costs in value of production
 Energy intensity (GWh/Meuros)

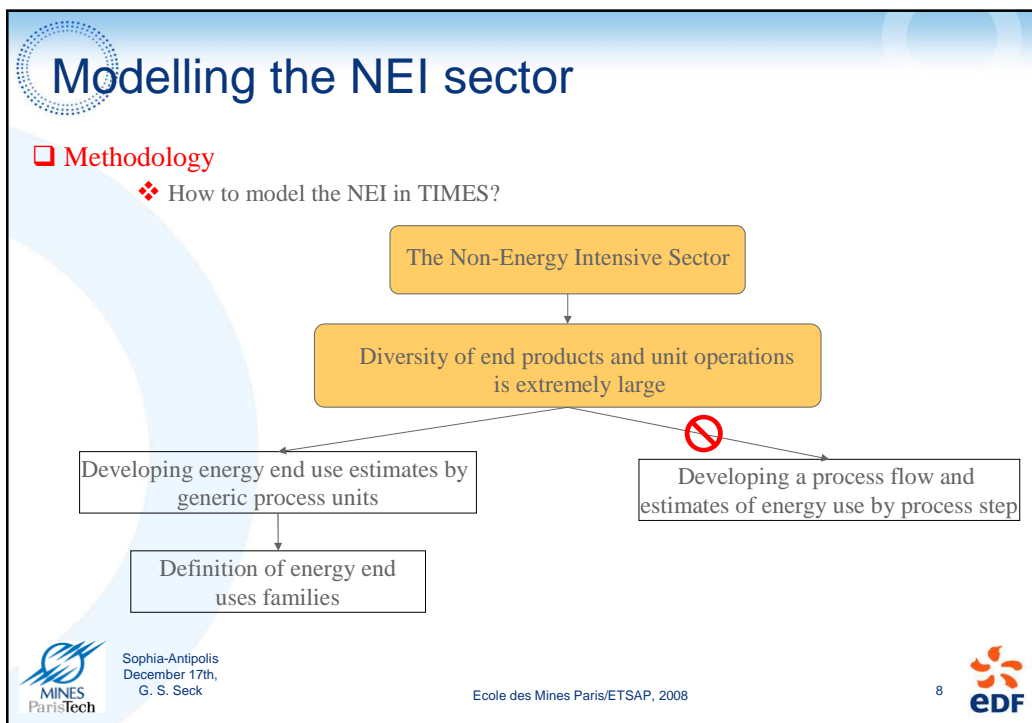
We could consider that **NEI sector** should have both
 - a share of energy costs in production value below 3%
 - an energy intensity below 4 GWh/Meuros and
 - an energy consumed per site below 10 GWh/site.


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6 


The Energy Intensive sector	The Non-Energy Intensive sector
<ul style="list-style-type: none"> ❑ Food and drink industry <ul style="list-style-type: none"> • Starches and starch products • Sugar ❑ Pulp, paper and paper products ❑ Chemicals, chemical products and man-made fibres <ul style="list-style-type: none"> • Basic chemicals • Man-made fibres ❑ Other non-metallic mineral products <ul style="list-style-type: none"> • Glass and glass products • Ceramic products • Ceramic tiles and flags • Bricks, tiles and construction products, in baked clay • Cement, lime and plaster ❑ Basic metals <ul style="list-style-type: none"> • Basic iron and steel and ferro-alloys • Manufacture of tubes • Other first processing of iron and steel • Basic precious and non-ferrous metals • Casting of metals 	<ul style="list-style-type: none"> ❑ Food and drink industry <ul style="list-style-type: none"> • Production, processing and preserving of meat and meat products • Processing and preserving of fish and fish products • Processing and preserving fruits and vegetables • Vegetable and animal oils and fats • Dairy products • Grain mill products • Prepared animal feeds • Other food products • Beverages ❑ Textile, textile products, leather and leather products ❑ Woods and wood products ❑ Publishing, printing and reproduction of recorded media ❑ Chemicals, chemical products and man-made fibres <ul style="list-style-type: none"> • Pesticides and other agrochemical products • Paints, varnishes and similar coatings • Pharmaceuticals, medicinal chemicals • Soap and detergents, cleaning and polishing preparations • Other chemical products ❑ Rubber and plastic products ❑ Other non-metallic mineral products <ul style="list-style-type: none"> • Articles of concrete, plaster and cement • Cutting, shaping and finishing of ornamental and building stone • Other non-metallic mineral products ❑ Fabricated metal products ❑ Machinery and equipment ❑ Office machinery and computers ❑ Electrical machinery and apparatus ❑ Radio, tv and communication equipment and apparatus ❑ Medical, precision and optical instruments, clocks ❑ Automobile ❑ Other transport equipment ❑ Manufacturing n.e.c




Modelling the NEI sector

❖ Definition of energy end uses families

<p>1) Dry</p> <ul style="list-style-type: none"> - Drying liquid, solid or paste products - Evaporation - Concentration 	<p>5) Chemical reactions</p> <ul style="list-style-type: none"> - Electrolysis - Oxidation - Reduction - Singeing - Buckling - Fermentation 	<p>9) Space heating</p> <ul style="list-style-type: none"> - Space heating - Air conditioning
<p>2) Heating liquid and gases</p> <ul style="list-style-type: none"> - Sterilization, pasteurization - Heating liquid or gas products - Production of hot water for cleaning - Heating bath, surface treatments 	<p>6) Mechanical process</p> <ul style="list-style-type: none"> - Motive power - Pumping - Compressed air - Ventilation 	<p>10) Lighting</p>
<p>3) Heating metal before deformation</p> <ul style="list-style-type: none"> - Reheating of ferrous products - Reheating of non-ferrous metals 	<p>7) Fusion</p> <ul style="list-style-type: none"> - Maintaining molten metal - Distillation of metals 	<p>11) Other operations</p> <ul style="list-style-type: none"> - Assembly - Filtration - Treatment of sewage - Heating of non metals solid products
<p>4) Heat treatment</p> <ul style="list-style-type: none"> - Quenching - Roasting - Baking 	<p>8) Process Cooling</p> <ul style="list-style-type: none"> - Refrigeration - Freezing 	




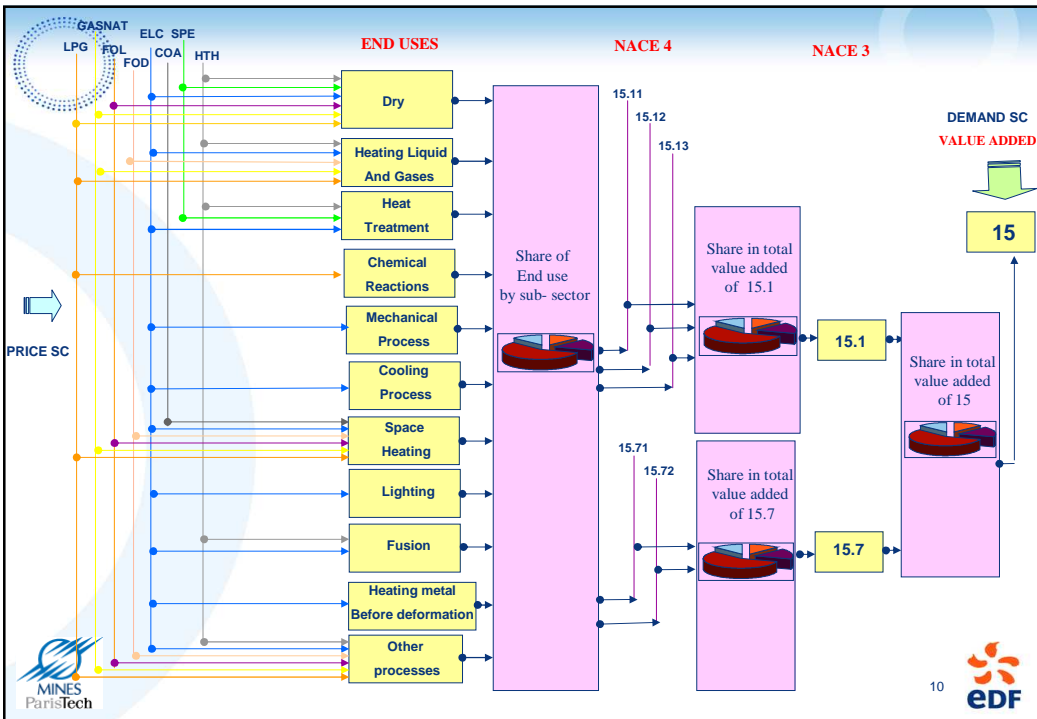


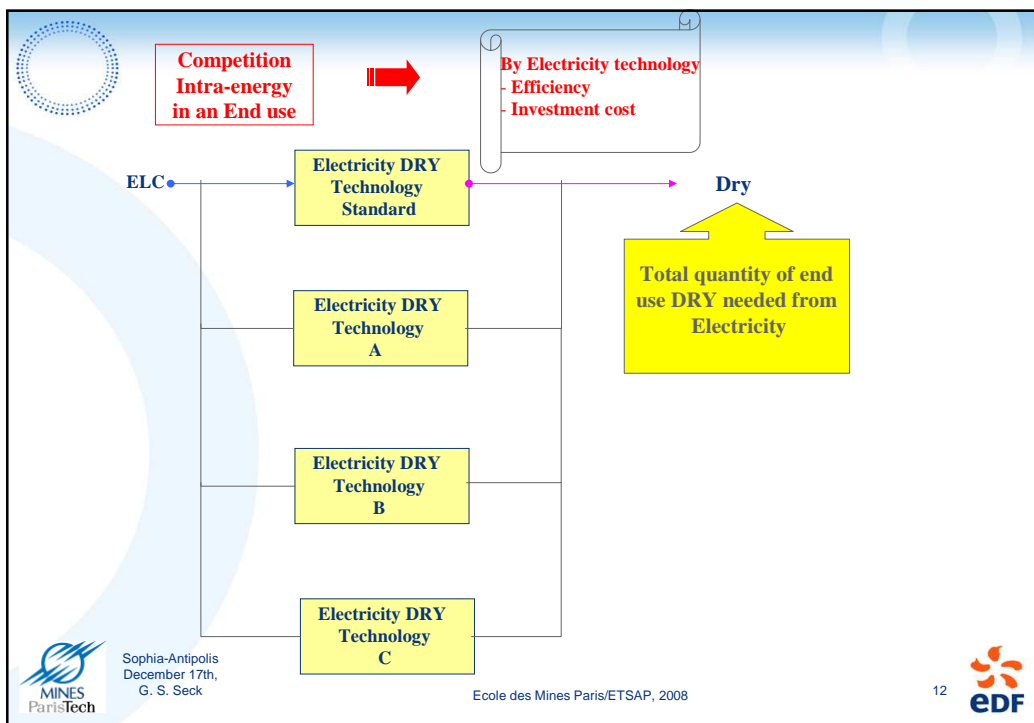
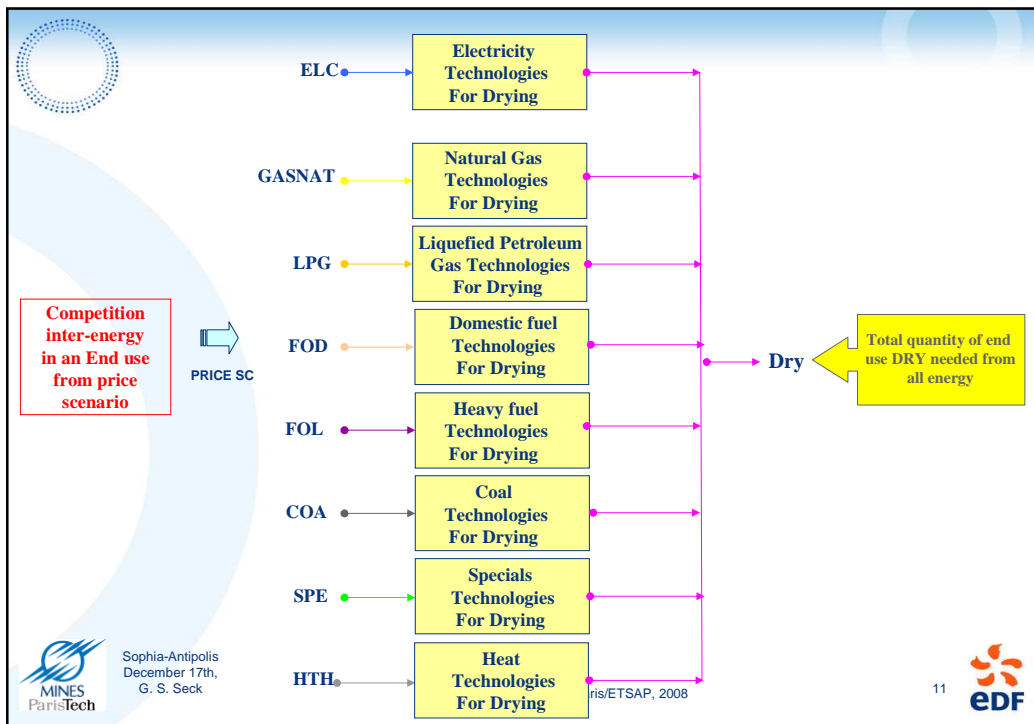
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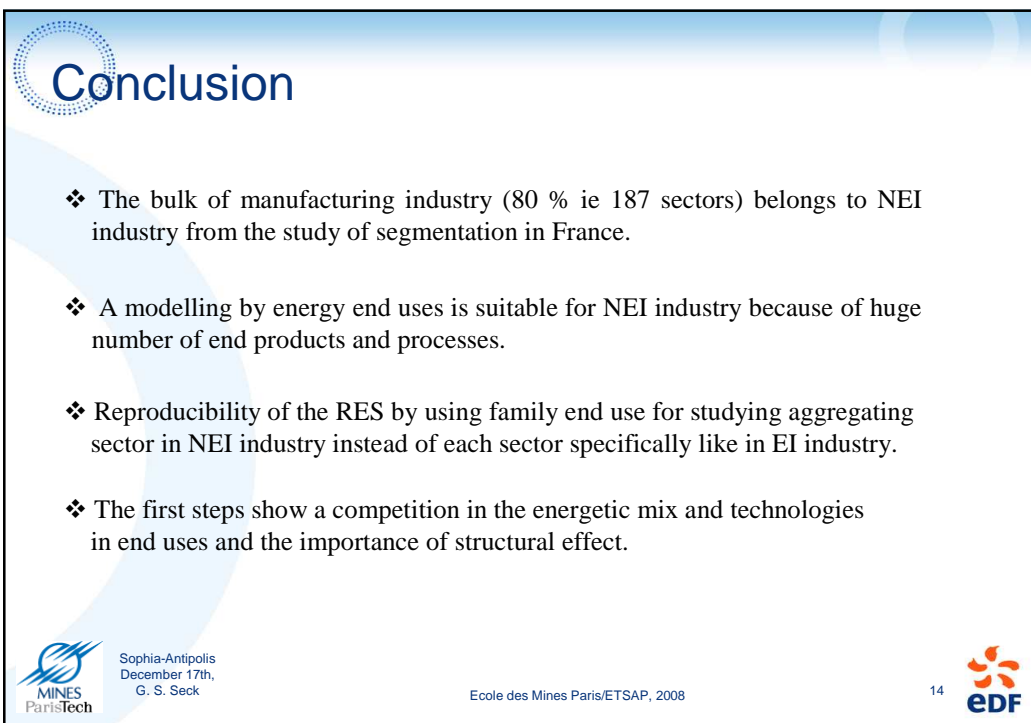
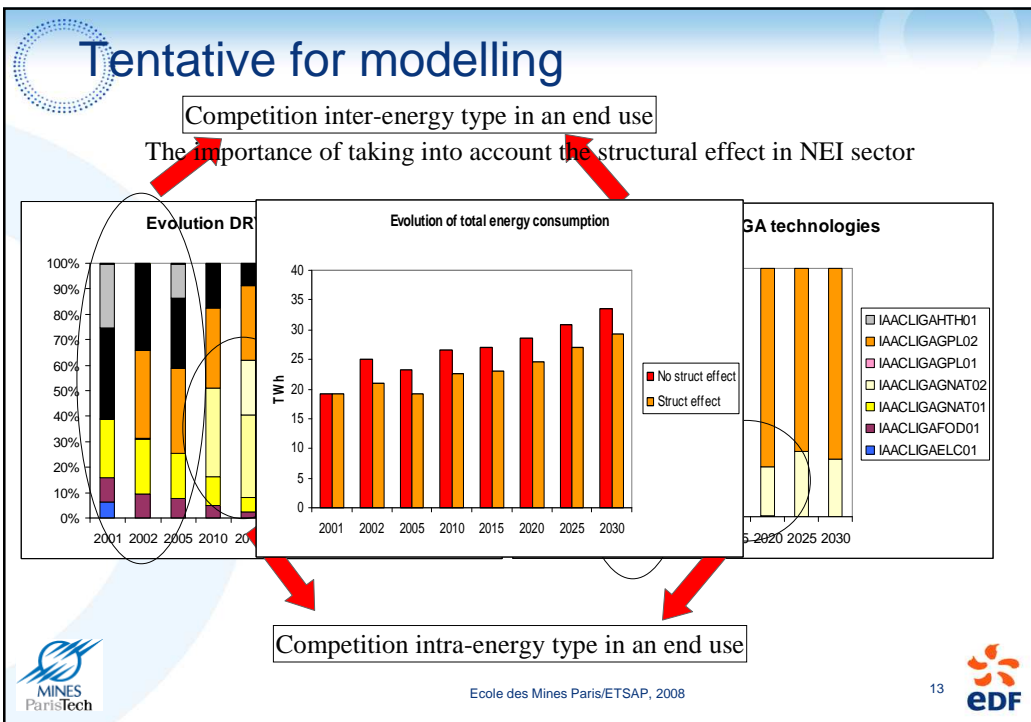
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9











Thank you for your attention...




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15




Modelling the NEI sector

♦ The structural effect


The structural effect can be defined as the influence on aggregate energy consumption of the change in economic share of sub-sectors “intensive” and “less intensive”



Cause mechanically an increase either stronger or more contained of this aggregate energy consumption




Problem in the accurate evaluation of the impact of new technologies on the energy efficient economy in the NEI sector

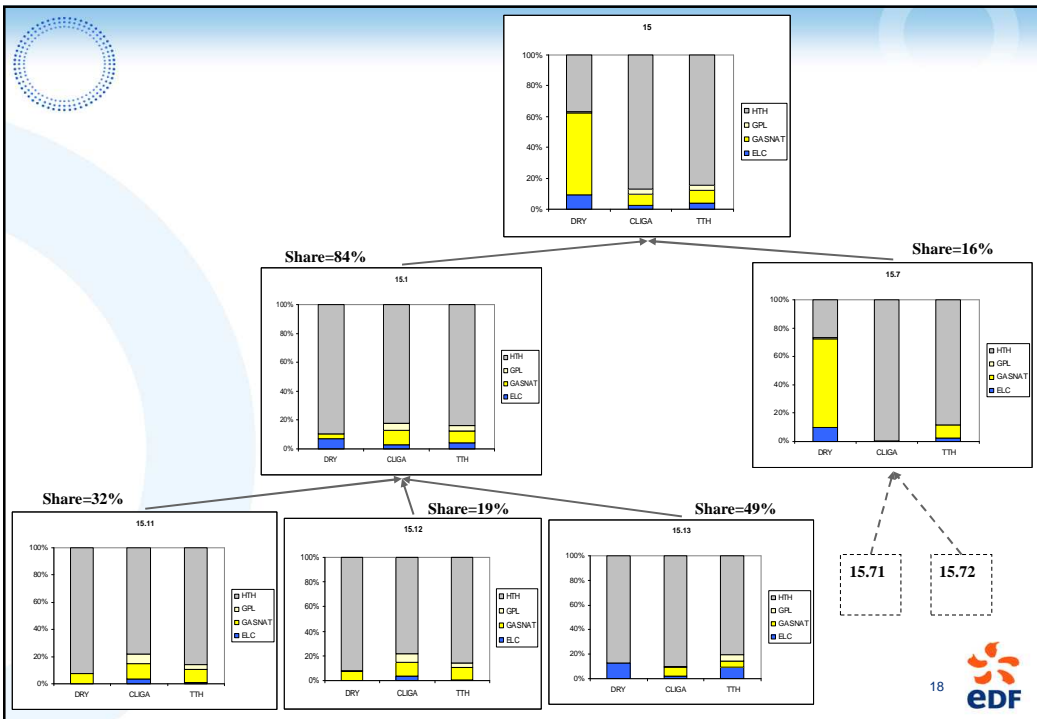
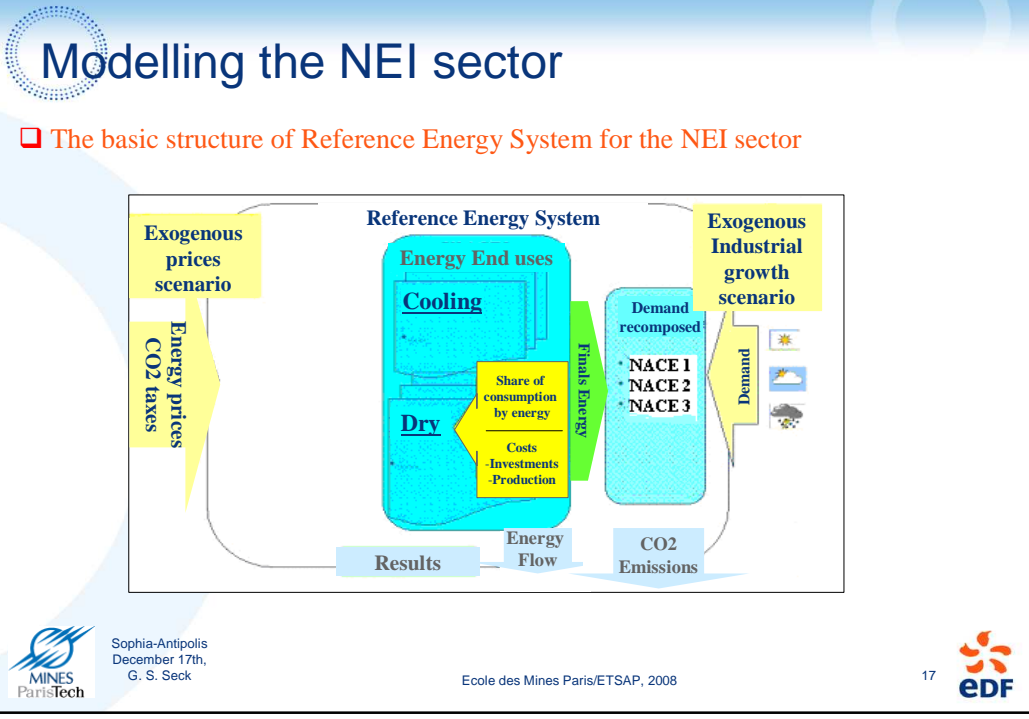
$$\begin{aligned}
 I_t &= \sum_{i=A,B} \frac{E_{i,t}}{VA_t} = \sum_{i=A,B} \frac{VA_{i,t}}{VA_t} \times \frac{E_{i,t}}{VA_{i,t}} = S_{A,t} \times I_{A,t} + S_{B,t} \times I_{B,t} \quad \Rightarrow \quad \Delta I = I_T - I_0 = S_{A,T} I_{A,T} + S_{B,T} I_{B,T} - S_{A,0} I_{A,0} - S_{B,0} I_{B,0} \\
 &= S_{A,0} (I_{A,T} - I_{A,0}) + S_{B,0} (I_{B,T} - I_{B,0}) + (S_{A,T} - S_{A,0}) I_{A,T} + (S_{B,T} - S_{B,0}) I_{B,T} \\
 \Delta I &= \sum_{i=A,B} S_{i,0} (I_{i,T} - I_{i,0}) \quad \text{Technology Effect} \quad + \quad \sum_{i=A,B} I_{i,T} (S_{i,T} - S_{i,0}) \quad \text{Structural Effect}
 \end{aligned}$$


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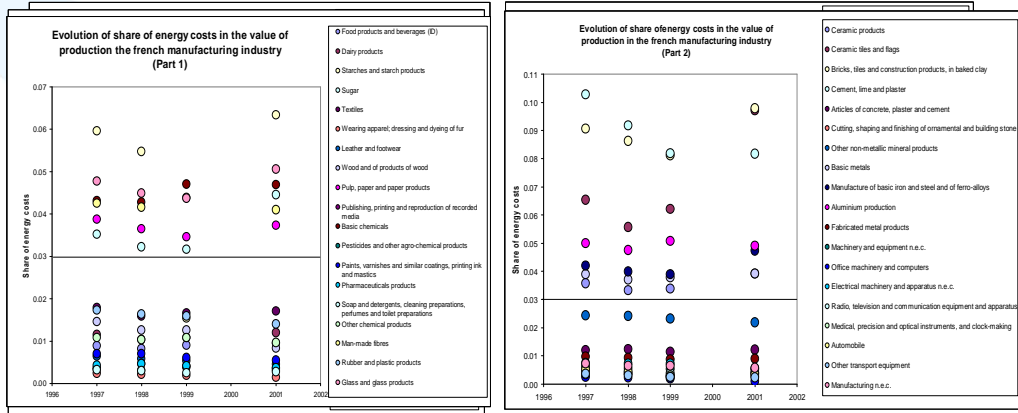
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16



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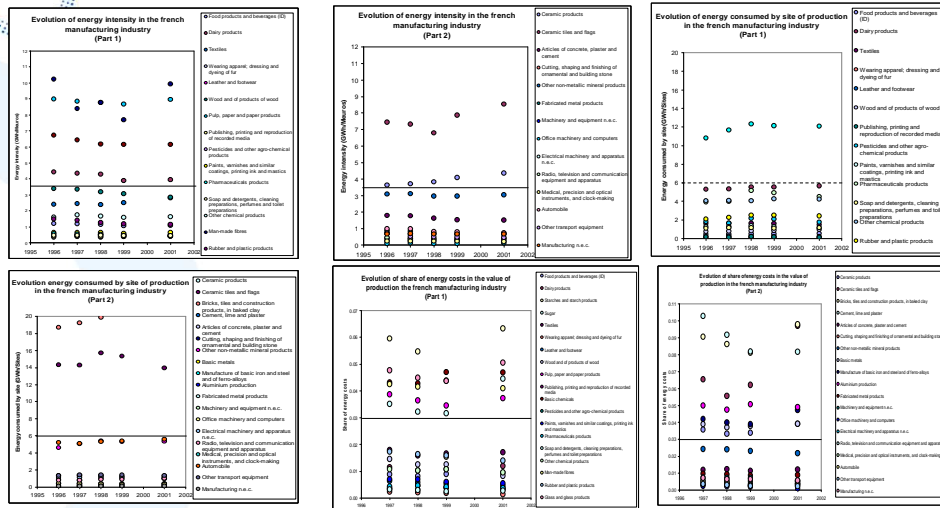


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19



What is the NEI sector?



We consider that NEIs should have both a share of energy costs below 3%, an energy intensity below 3.5 GWh/Meuros and an energy consumed by site below 6 GWh/site (in FRANCE).



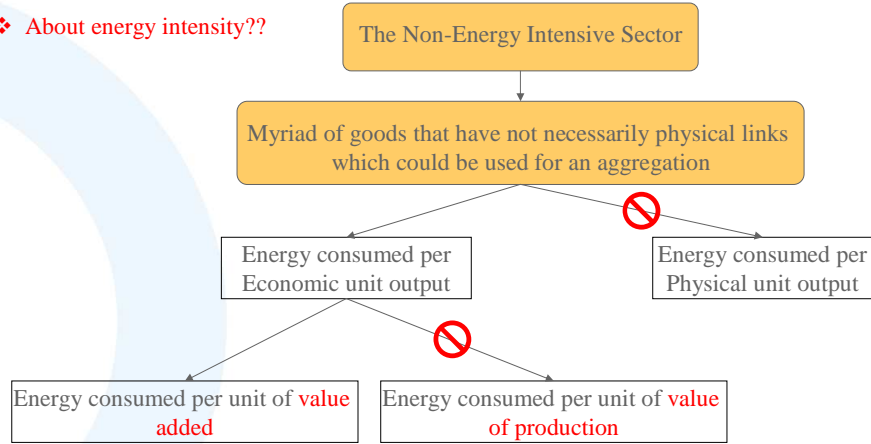
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Segmentation of the industry

❖ About energy intensity??



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21