

# **Direct and up-stream energy and carbon flows in the Czech Republic: An overall picture and metal commodities**

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# Introduction

## Within which project:

- Work done as a part of the project “Methods and Tools for Integrated Sustainability Assessment (MATISSE)” funded through the Sixth Framework Programme in 2005-2008.

## Rationale:

- Reported energy requirements and carbon emissions of commodities usually comprise direct requirements and emissions (i.e. those related to the last step of production).
- Accounting for up-stream energy and carbon includes all energy and carbon consumed/emitted during the whole production process of a given commodity.
- Total energy and carbon flows better reflect environmental pressure related to production of commodities and can be used to assess shifts of environmental pressure across countries.



# Methodology and Data

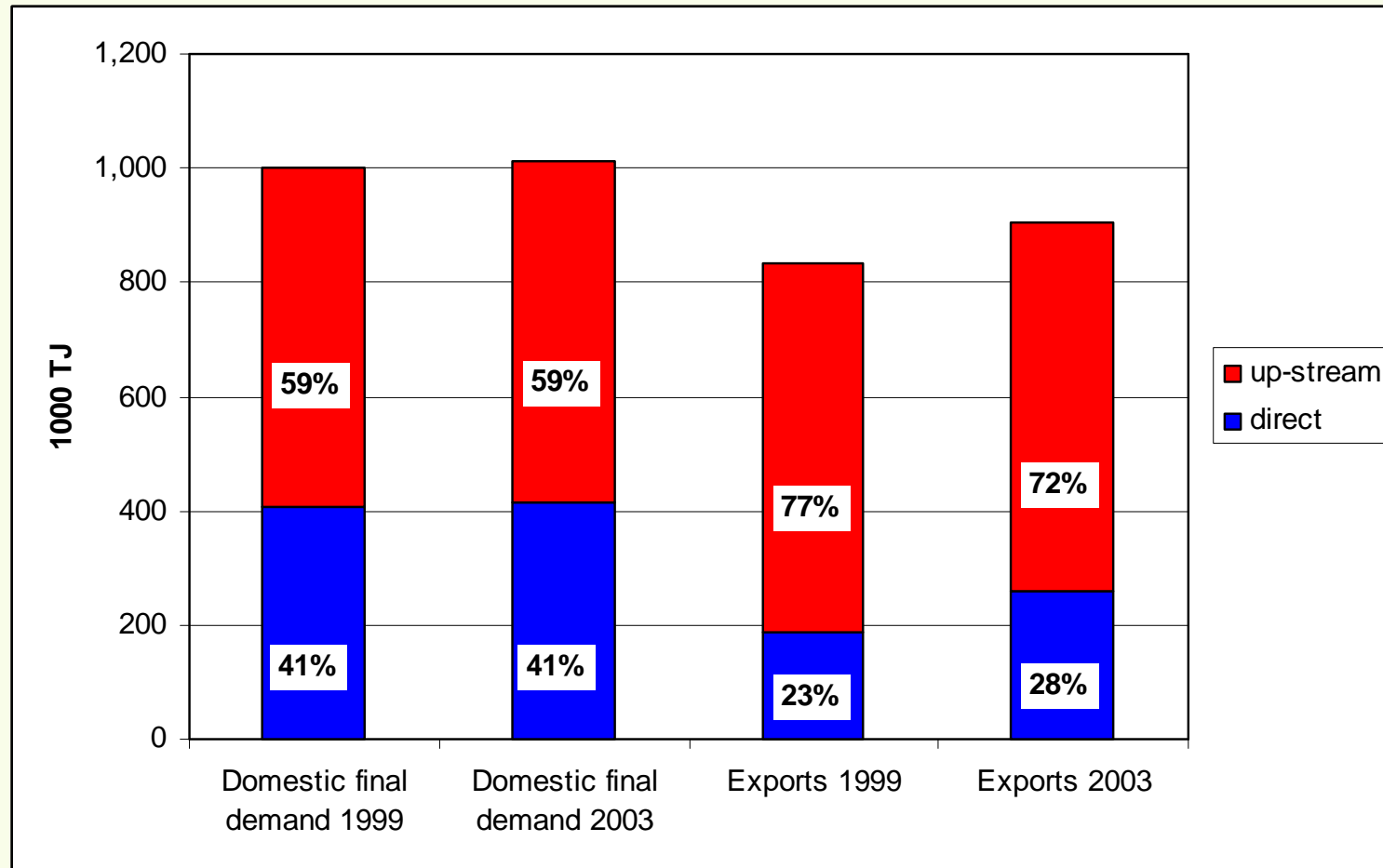
- Input output approach

$$X = (I - A)^{-1} * Y$$

- Hybrid input-output model
  - Based on supply and use tables: the energy carriers presented in physical units in the use matrix; other values in monetary units
  - Calculation of hybrid product-by-product input output tables and hybrid A and  $(I - A)^{-1}$  matrices
  - Quantification of total energy/carbon flows by multiplication of  $(I - A)^{-1}$  matrix by final demand (domestic and exports)
- Data: supply and use tables and consumption of energy carriers for 1999 and 2003 broken down by 52 commodity groups and 52 sectors (CZSO)



# Results: energy requirements for all commodities

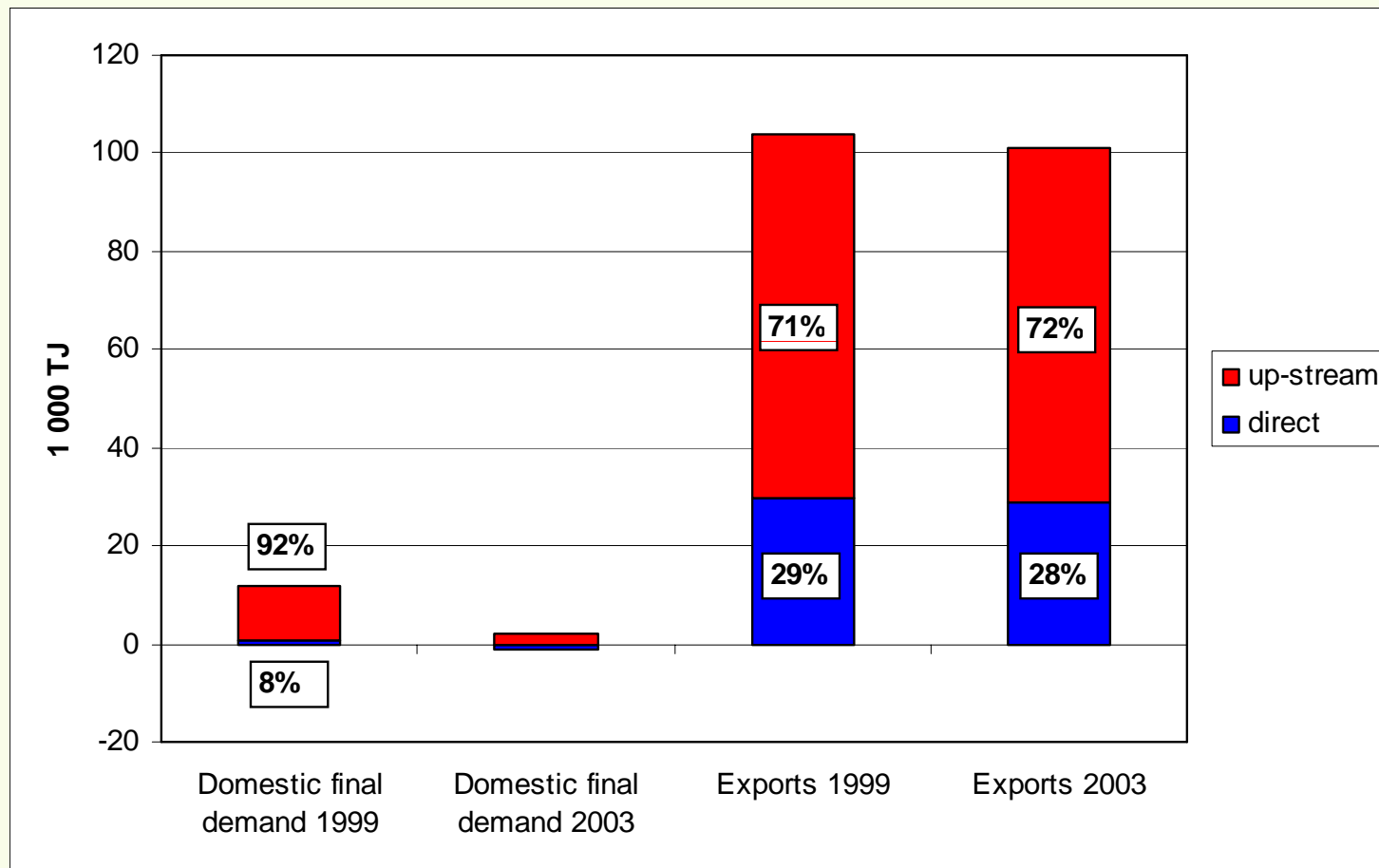


## Results: energy and carbon flows by commodities

Commodity category	1999		2003		Change in %	
	PJ-E	Mt-C	PJ-E	Mt-C	E	C
Construction work	85.3	1.9	73.4	1.5	-13.9	-22.1
Basic metals	77.3	1.0	68.6	0.9	-11.2	-11.5
Chemicals.chemical products	70.5	1.1	88.9	1.4	26.1	27.0
Food products and beverages	68.5	1.5	57.8	1.0	-15.6	-34.2
Machinery and equipment	60.3	1.1	74.1	1.2	22.8	8.0
Motor vehicles.trailers	55.5	1.0	62.9	1.0	13.4	-3.3
Real estate etc. services	40.7	1.1	33.8	0.9	-17.0	-19.4
Fabricated metal products	38.4	0.7	33.7	0.5	-12.1	-21.7
Non-metallic mineral products	32.8	0.7	29.3	0.6	-10.7	-13.1
Other	1,305	28.6	1,394	31.2	6.8	9.2
<b>Total</b>	<b>1,834</b>	<b>38.7</b>	<b>1,916</b>	<b>40.2</b>	<b>4.4</b>	<b>3.8</b>



# Results: energy requirements for metal commodities



## Structural decomposition analysis of results

- Allows for attribution of changes in energy consumption/carbon emissions to changes in structure and volume of final demand (Y) and to changes in technology (T)

	$\Delta T$	$\Delta Y$	Total $\Delta$
Energy – all commodities	-19,2	23,7	4,5
Carbon – all commodities	-18,8	22,6	3,8
Energy – metal commodities	-9,8	-1,7	-11,5
Carbon – metal commodities	-13,5	-2,1	-15,6

Tab.: SDA of changes in energy requirements and carbon emissions attributed to final demand (in %), Czech Republic, 1999/2003



# Conclusions

- Growth in total energy requirements and carbon emissions driven by consumption abroad for energy and by domestic consumption for carbon.
- High shifts of pressure from abroad to the Czech Republic related to foreign trade of commodities. They were extremely high for metal commodities.
- Energy/carbon policies should focus on most energy and carbon intensive commodities, which include construction work, basic metals, chemical products, food and beverages, machinery and motor vehicles, real estate services and fabricated metal products.
- Results support further focus of energy/carbon policies on the consumption side (final demand) as the production side (technology) seems to be on a right track.



# Thank you for your attention

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