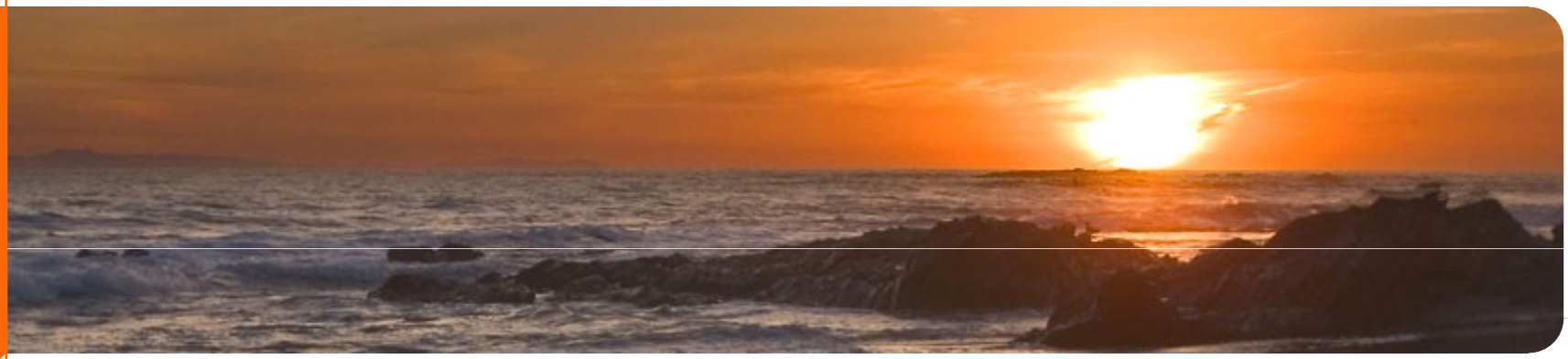
Midpoint Event "Creating sustainable growth in Europe"
29-30 November 2007, Berlin, Germany



Global dimensions of European natural resource use

Presentation of the Global Resource Accounting Model (GRAM) and discussion of preliminary results

Stefan Giljum, Martin Bruckner (SERI)
Christian Lutz, Ariane Jungnitz (GWS)

SERI Sustainable Europe Research Institute

www.seri.at

Structure

Background: trade and material flows

Indirect material flows: concepts

The Global Resource Accounting Model (GRAM)

Presentation and discussion of preliminary results

Further research

Resource productivity and environmental tax reform in Europe
www.psi.org.uk/petre

Background: trade and material flows

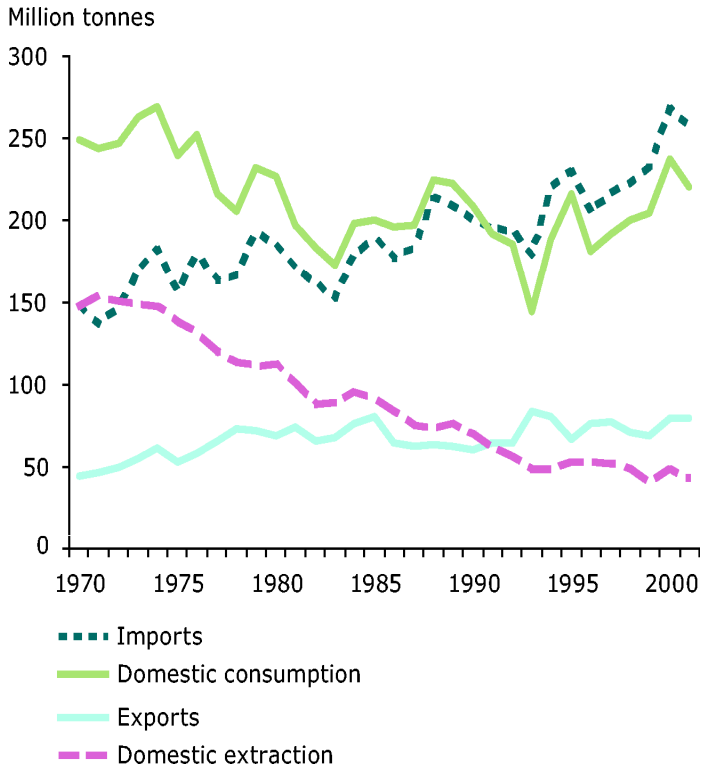
Increasing international trade (6.5% p.a., 1990-2005)

Outsourcing of material intensive stages of production processes

Environmental indicators should include trade dimension

Relocation of environmental burden / Increasing dependency on imports

Production vs. consumption indicators



Metal Ores, EU-15 (EEA, 2006)

Indirect material flows: concepts

Material requirements along the production chain to produce imports (and exports) - „embodied“ materials / “ecological rucksacks”

Two main approaches

(1) Life Cycle Assessment (LCA)-oriented approach:

„Rucksack factors“ at product level
Advantage: disaggregation into single products
Problem: limited data availability for higher manufactured products

(2) Input-output analysis:

Advantage: coverage of whole production system (national/international)
Problem: higher level of aggregation (sectors/product groups)

So far: assumption of similar production structures

The Global Resource Accounting Model (GRAM)

Foundations

+ Multi-regional environmental IO model (MRIO)

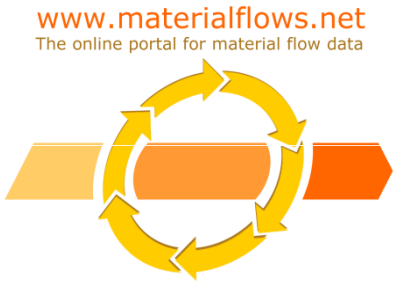
+ Economic core model: IO tables linked by bilateral trade
+ Coverage: 52 countries plus 2 regions (OPEC & RoW)

+ Extended by material flow accounts in physical units

  188 countries; > 200 material categories, 1980-2002
  (see www.materialflows.net)
  Currently update to 2005 for petrE scenarios

  GRAM: 9 aggregated material categories

  Planned: extension by other env. data (CO2 emissions, water, land, etc.)



The Global Resource Accounting Model (GRAM)

Data Sources

+ **IO tables**:
  - OECD 2006 edition: 37 countries / 48 harmonised sectors
  - Assumptions for economic structure of 15 additional countries and 2 world regions
+ **Trade data**:
  - OECD Bilateral trade data: 61 trading partners / 25 product groups (harmonised with IO tables)
  - Completed by UN COMTRADE data for trade between non-OECD countries
+ **Material input data**:
  - Global MFA data set

The Global Resource Accounting Model (GRAM)

Implementation

Based on approach introduced by Ahmad and Wyckoff (2003) for CO2 emissions embodied in international trade of OECD countries

Four categories of material use:

(1) Extracted domestically → consumed domestically

(2) Extracted domestically → exported

(3) Imported → consumed domestically

(4) Imported → re-exported

Material flow-based indicators:

Raw Material Consumption (**RMC**) = 1 + 3
Physical Trade Balance (**PTB**) = 3 – 2

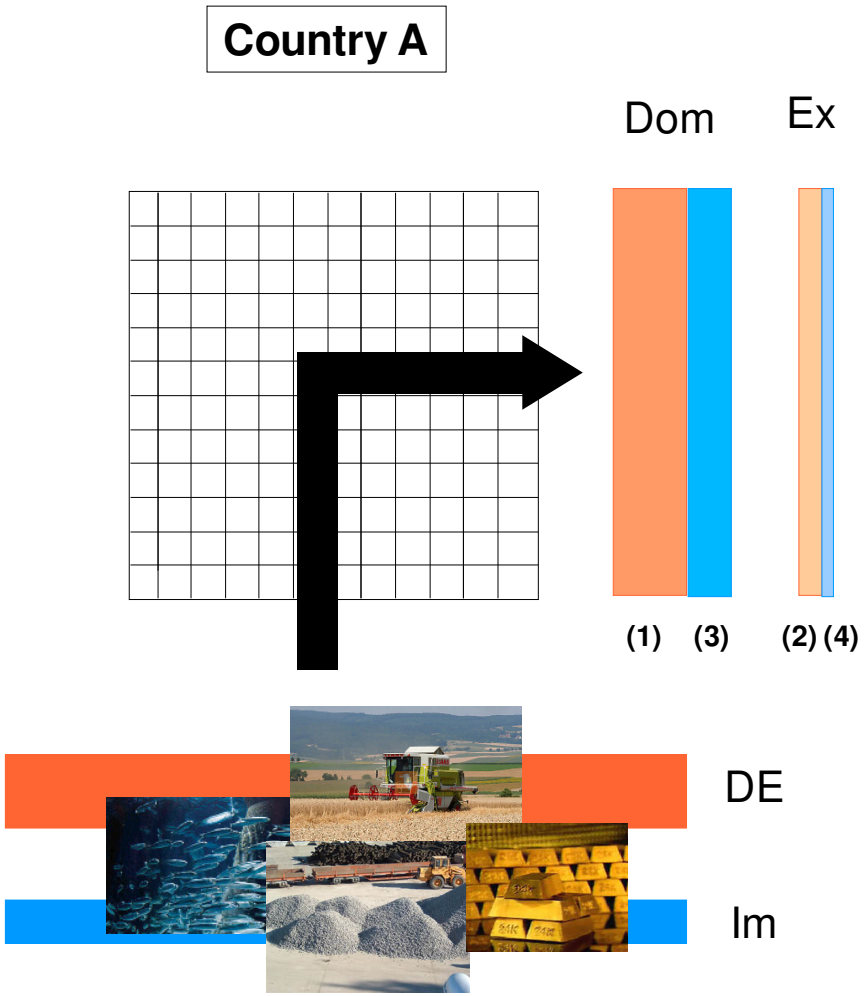
The Global Resource Accounting Model (GRAM)

Country A

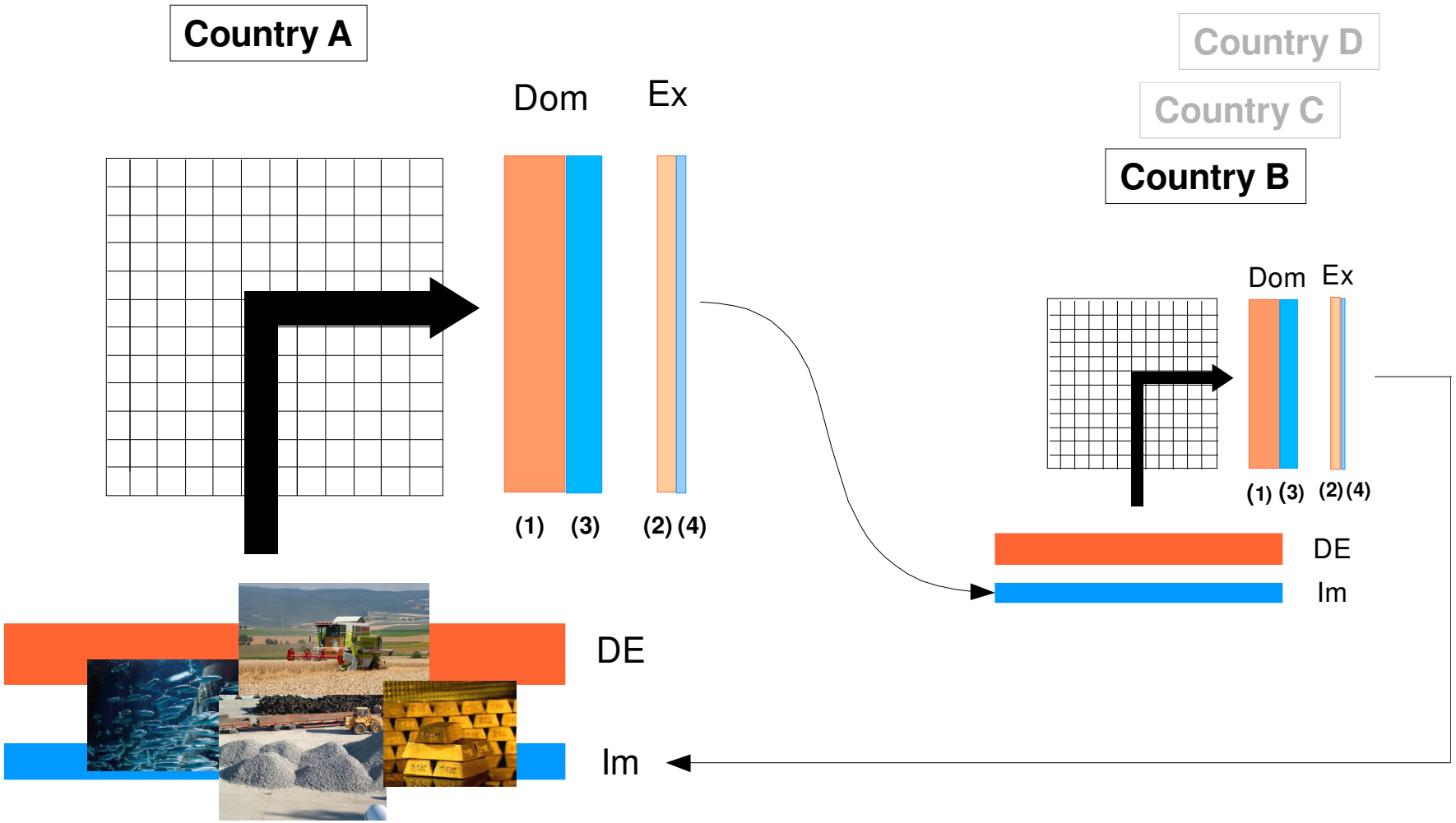
DE

Im

The Global Resource Accounting Model (GRAM)



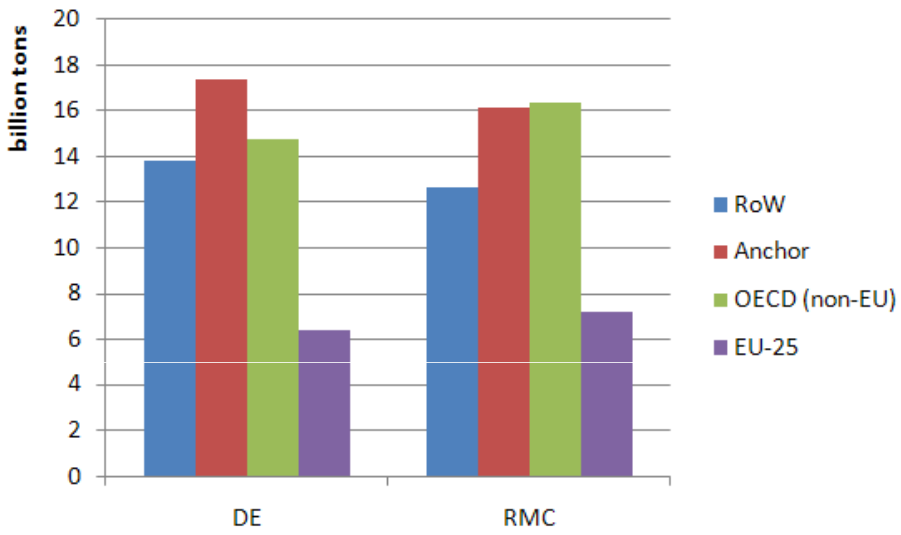
The Global Resource Accounting Model (GRAM)



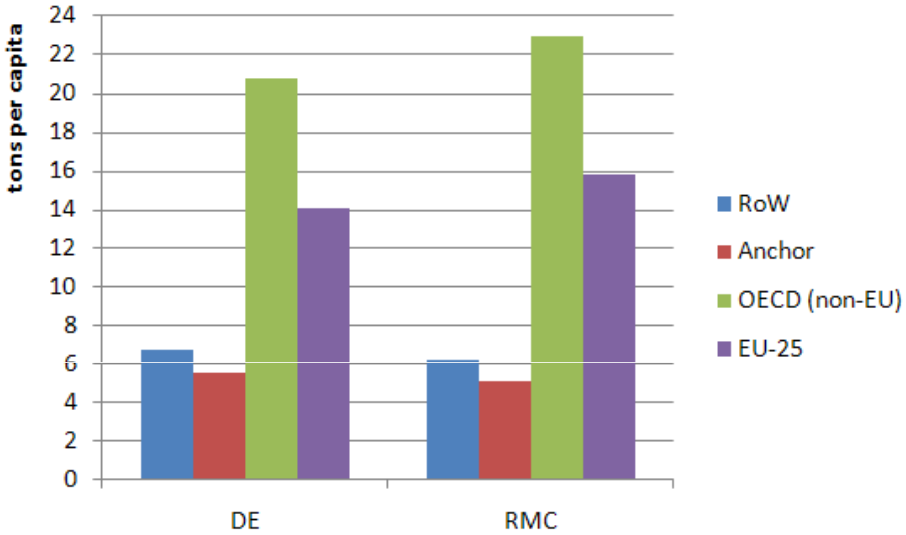
Preliminary Results

+ Material Extraction vs. Material Consumption in 4 World Regions (2000)

Absolute numbers



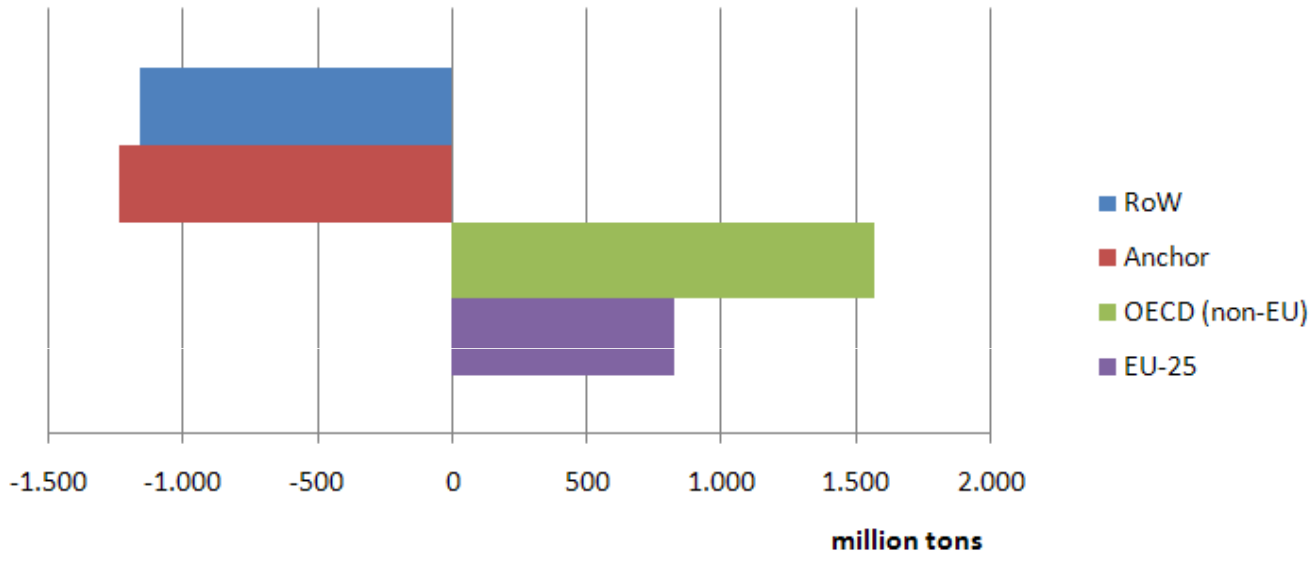
Per capita



Preliminary Results

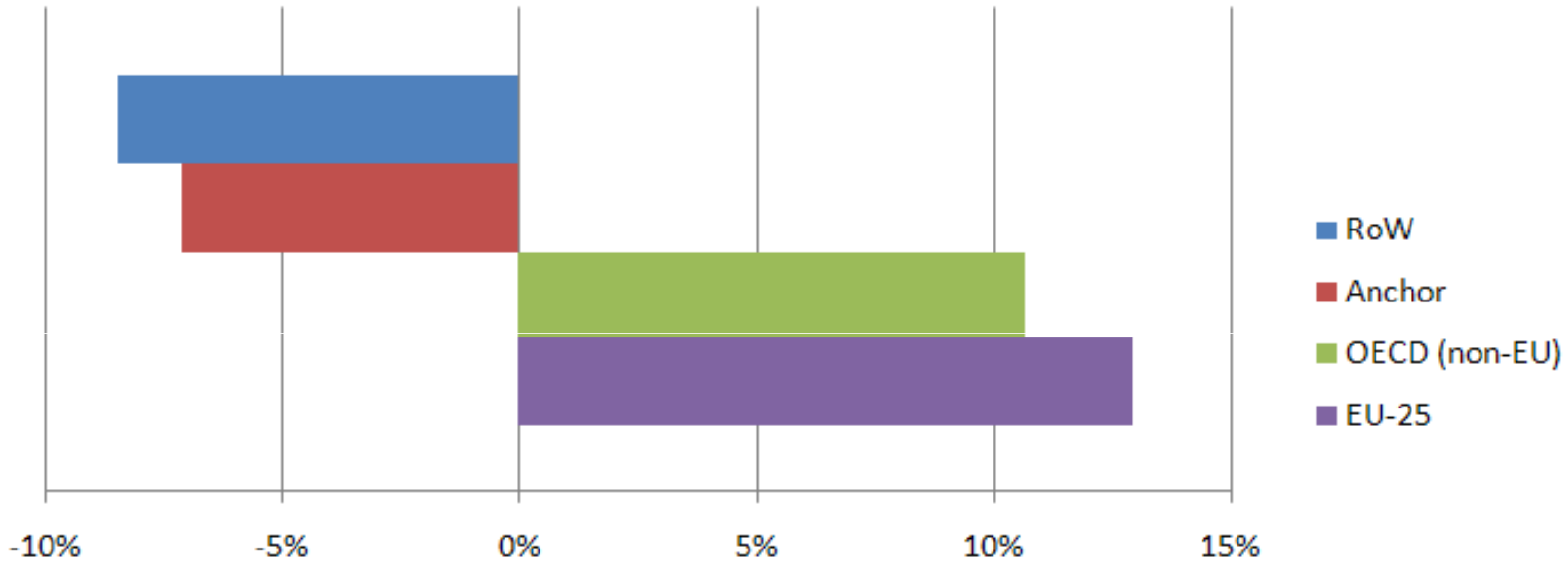
+ Physical Trade Balance in 4 World Regions (2000)

Absolute numbers



Preliminary Results

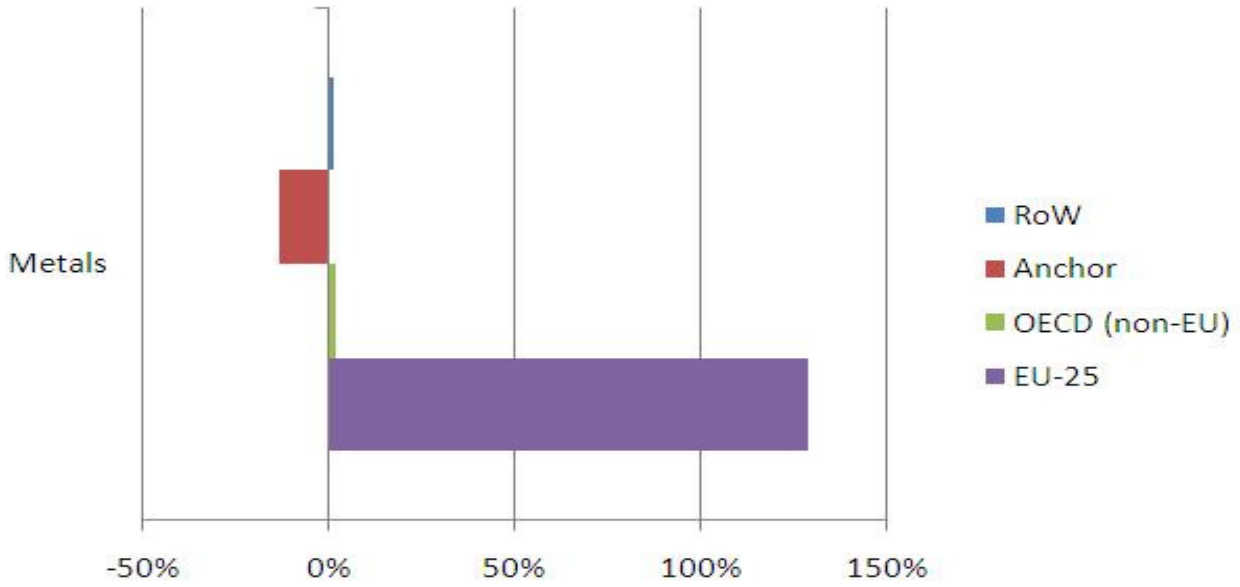
+ Imports/Exports and Domestic Extraction (2000)



Preliminary Results

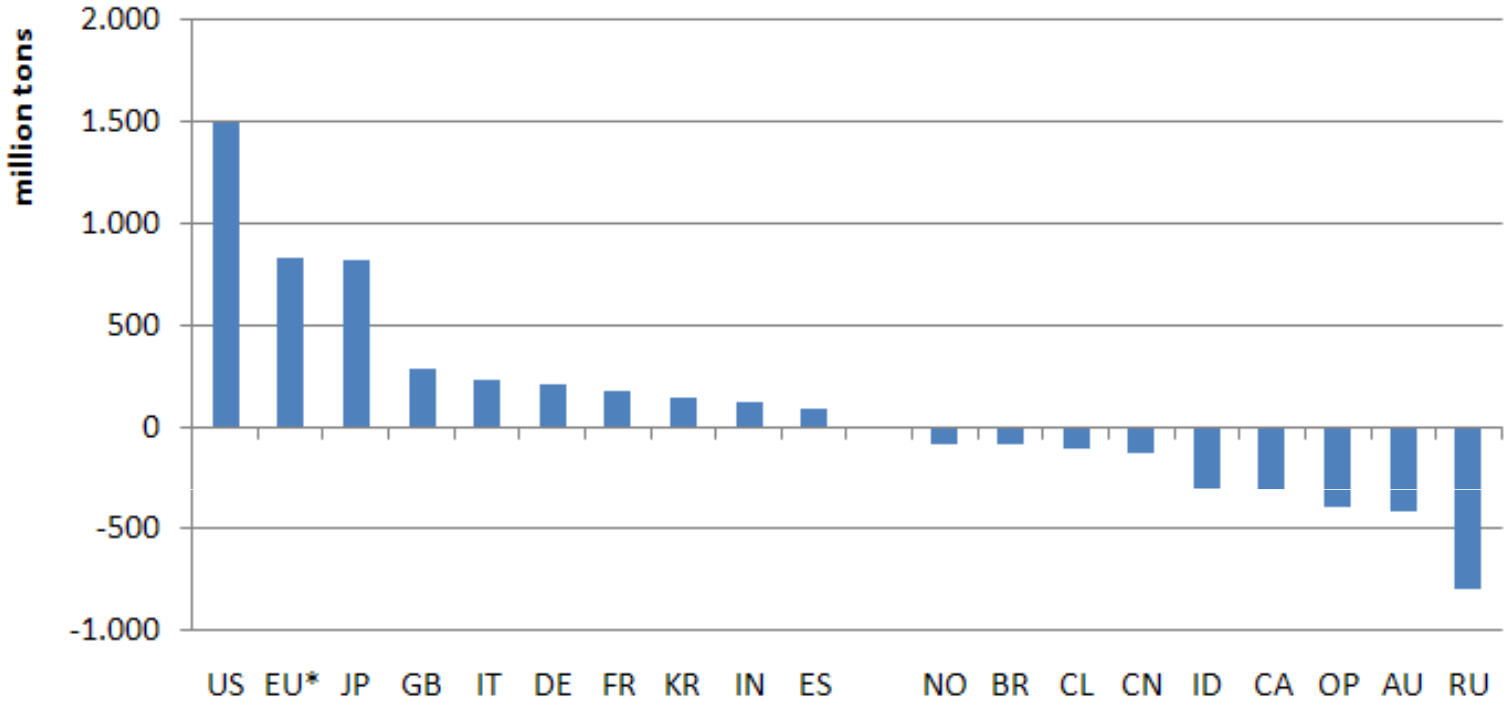
+ Imports/Exports and Domestic Extraction (2000)

Net-Imports as % of Domestic Extraction; Metals



Preliminary Results

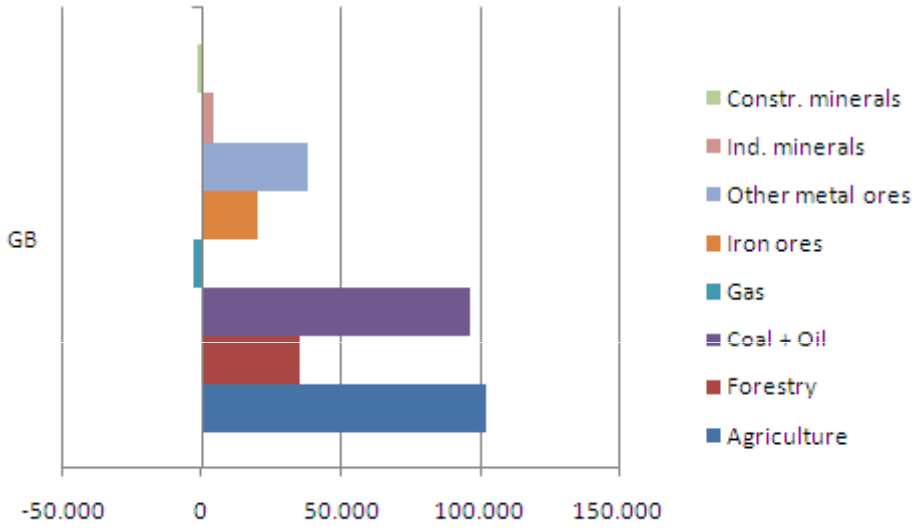
+ Net-Importers vs. Net-Exporters



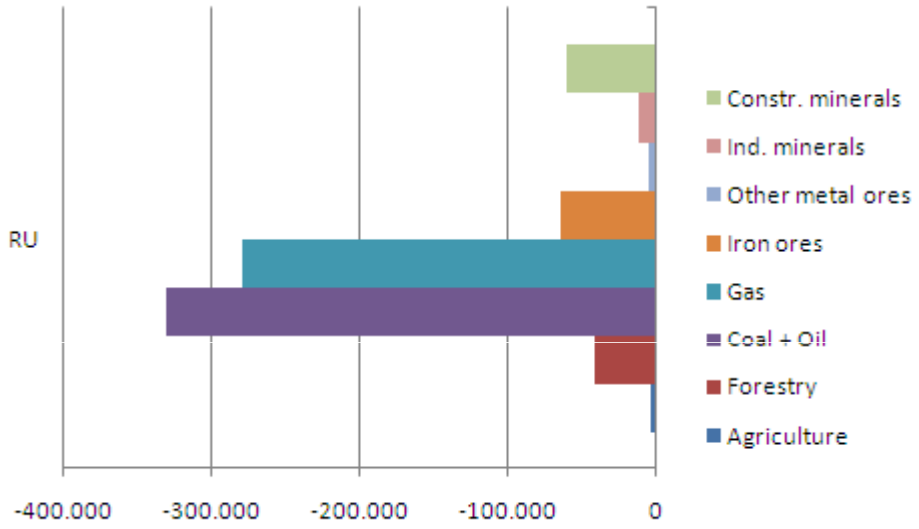
Preliminary Results

+ Trade profiles of embodied resources by countries / world regions

Great Britain



Russia



Preliminary Results

+ **Resource trade and consumption by sectors / product groups (to come)**

- Analysis of the most material-intensive sectors
- Analysis of direct vs. indirect resource requirements
- Net-exporting / net-importing sectors

Discussion of preliminary results

+ Per capita resource extraction differs significantly; international trade reinforces current inequalities in per capita consumption

+ Policy implications:

- EU environmental and SD policies (EU SDS, 6th EAP / Thematic Strategies): consideration of trade aspects (GRAM: indicators; hot spots for policy action)
- EU economic policies: secure and stable access to resources vs. increasing net-imports
- EU trade and development policies: increasing material welfare in developing countries (combat poverty) vs. net-exports of resources (winners and losers in export-oriented development)

Discussion of preliminary results

+ Re-allocation of resources not as pronounced as expected ("20% of rich population consumes 80% of world's resources")

+ Possible interpretations:

- Increasing number of "new consumers" in emerging and developing countries
- Construction minerals (40% of DE, used for domestic infrastructure) influences results
- High-exporting countries (e.g. Germany) have large amounts of "embodied" resource exports

Further research

Key objective: produce robust results and indicators

+ Checking country and sector data

- E.g. service sector
- Exporting countries (in particular, RoW)

+ **Sensitivity analysis**

- Assumptions regarding economic structure of RoW
- Allocation of domestic extraction to economic sectors

Further research

Medium-term perspectives (beyond petrE):

+ Adding more IO tables

+ Calculating time series

+ Analysing international production chains and structural paths

+ Extending GRAM by other environmental categories

The end .... Thank you!

More information:

www.seri.at

www.gws-os.de

stefan.giljum@seri.at