Life Cycle Assessment and tourism services

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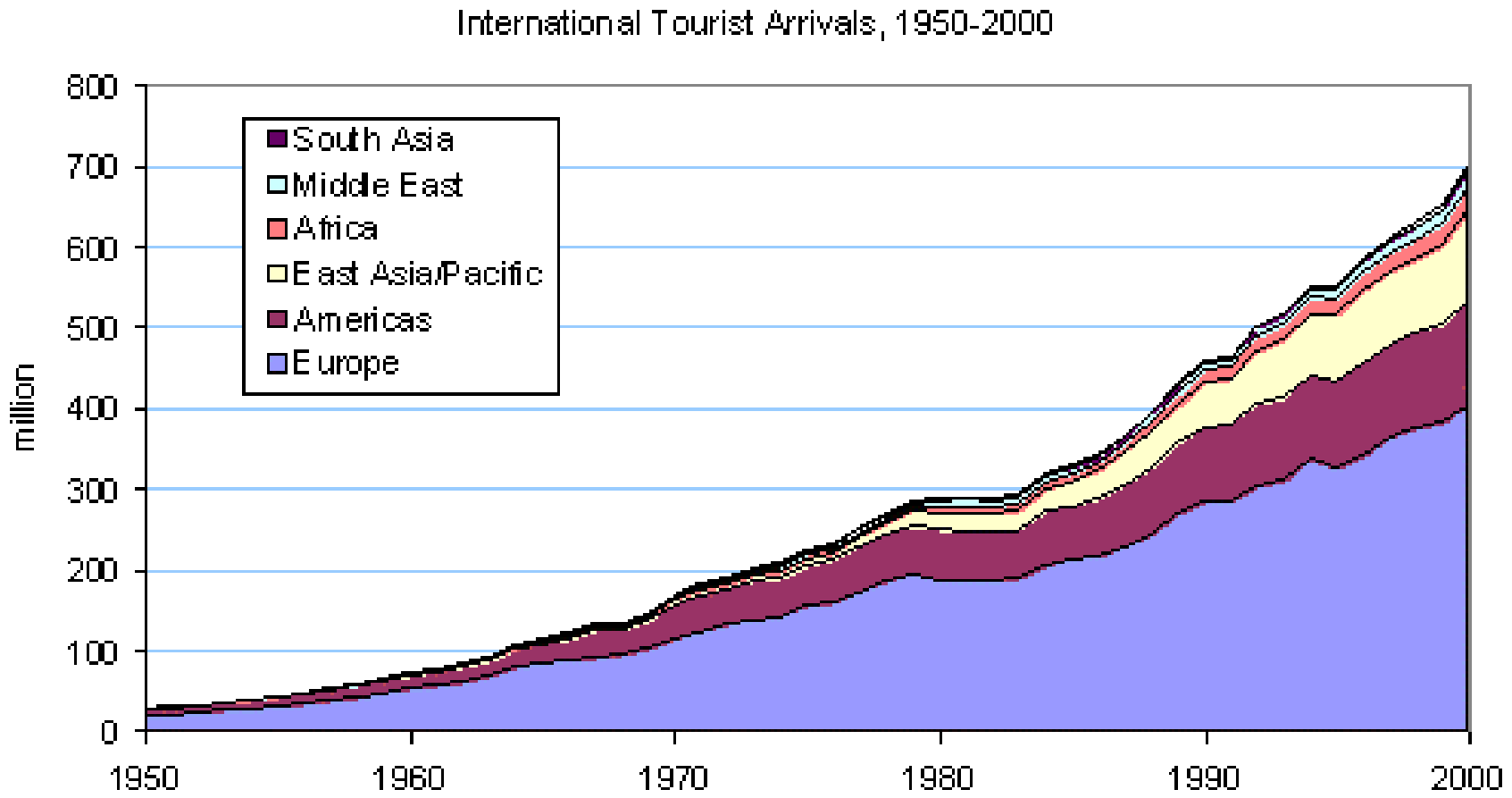
Service Industries and Industrial Ecology

- Consistently with the principles of industrial ecology, economies are expected to dematerialise
- As a consequence, the relative contribution of the service industries to the overall economic output is expected to increase
- This trend should entail a growing focus on service-related activities and their ability to actually meet environmental requirements

- In general, service industries tend to generate less environmental impact at the point of use than throughout their extensive supply chain.
- An integrated understanding of the full implications of service supply-chains is needed for improved decision-making
- Service systems descriptions are needed to help identify life-cycle stages and components of services and assess their environmental impacts

- Despite the service economy accounts for a significant share of the GDP of most industrialized countries, LCA models and case studies for services have only recently been appearing.
- Indeed, services present unique challenges for LCA:
  - their definition and boundaries are complicated and varied
  - in view of the multiplicity of service sectors, *common criteria* for LCA cannot be developed
  - less conventional LCA approaches may be preferable



Source: World Tourism Organization, 2003

Tourism industries and the environment

- Tourism industries are expected to contribute to long-term sustainable development
- Tourism and the natural environment are strongly interconnected:

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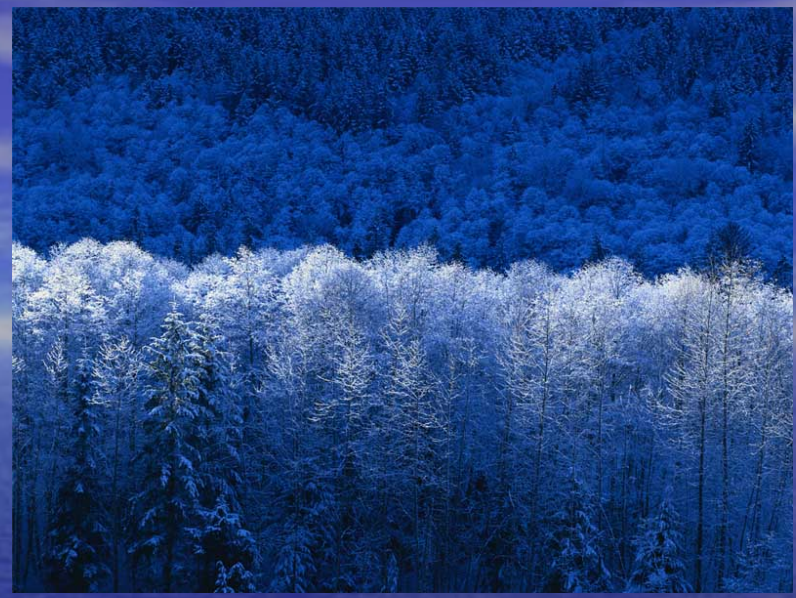
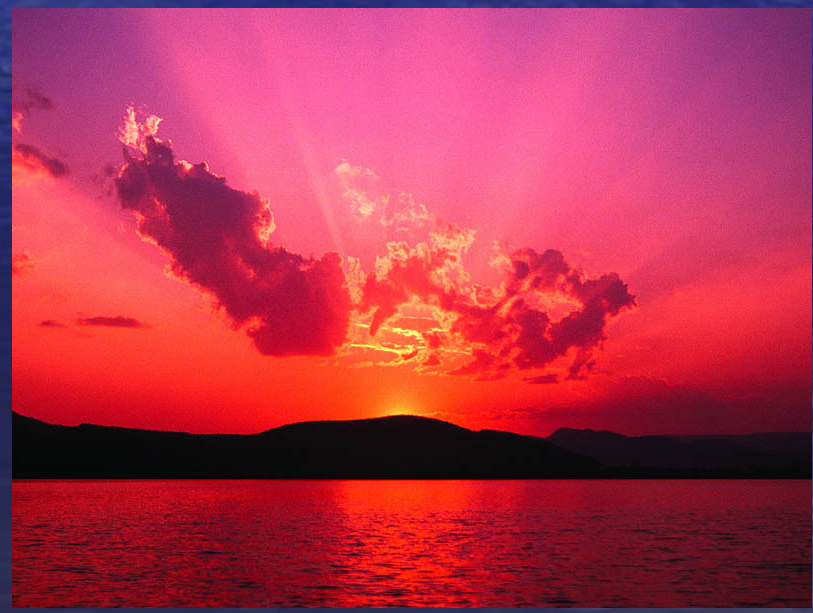
  - the natural environment itself may be considered as a major input resource to the processes of tourism industries





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  - the natural environment itself may be considered as a major input resource to the processes of tourism industries
  - the development of tourism as a mass industry may severely increase the overall impact on the environment

LCA Case-studies

- LCA is still uncommon in tourism industries
- A limited amount of case-studies have been identified, among which:
  - ***British Airways Holidays:* LCAs of key destinations (Seychelles and St. Lucia)**
  - ***University "G. d'Annunzio" and FEBE EcoLogic: LCAs of hospitality service by Italian hotels***
  - ***Carnegie Mellon University and University of California at Berkeley: I/O LCA of U.S. Hotel Industry***

BAH’s key destinations

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- Seychelles (1994) – St. Lucia (1998)
- Aim: assessment of the islands as holiday destinations and promotion of sustainable tourism
- LCA methodology tailored to the demands of the tourism sector by an external consultant, the UK Centre for Economic and Environmental Development (UK CEED).
- Impacts addressed: water pollution, air pollution, noise, aesthetic damage, habitat loss, natural resource exploitation and disruption of natural cycles

BAH's key destinations

- The benefits included environmental improvements and better quality holidays for visitors.
- The challenges included:
  - Convincing stakeholders that it was needed, even though not required by legislation
  - Good leadership and a long-term view were needed
  - Full support from local organisations was needed
  - Data on holiday products are often hard to find or unavailable

Hotels in Italy

- The following case-studies are being carried out:
  - Hotel Prestige - Montesilvano
  - Club Hotel Dante - Cervia
  - Hotel Duca d'Aosta - Pescara

Goal and Scope Definition

- Goals include:
  - identifying environmental “hot spots”
  - supporting EMS development
  - gaining experience for the development of Product Category Rules (PCR) for a Type-III ecolabelling system
- Functional unit chosen:
  - accommodation service for one person-day

Goal and Scope Definition

- System boundaries include:
  - Activities closely related to the accommodation service (e.g. cleaning, lighting of rooms, etc.)
  - other hotel services (e.g. bar, restaurant, swimming pool, sauna, etc.), which were analysed separately
  - Production of consumables and energy needed for hotel services
  - Transport of guests to reach the hotel
  - End of life of wastes produced by the hotel
- System boundaries do not include:
  - Buildings and furniture

Inventory Analysis

- On-site data have been collected at the hotels and at some direct suppliers (e.g.: laundries, printing-offices)
- Data collection was suited to the features of each hotel
- Specific collection activities carried out include:
  - On-site visits
  - Personnel and management interviews
  - Sampling
  - Direct contacts with suppliers

Impact Assessment

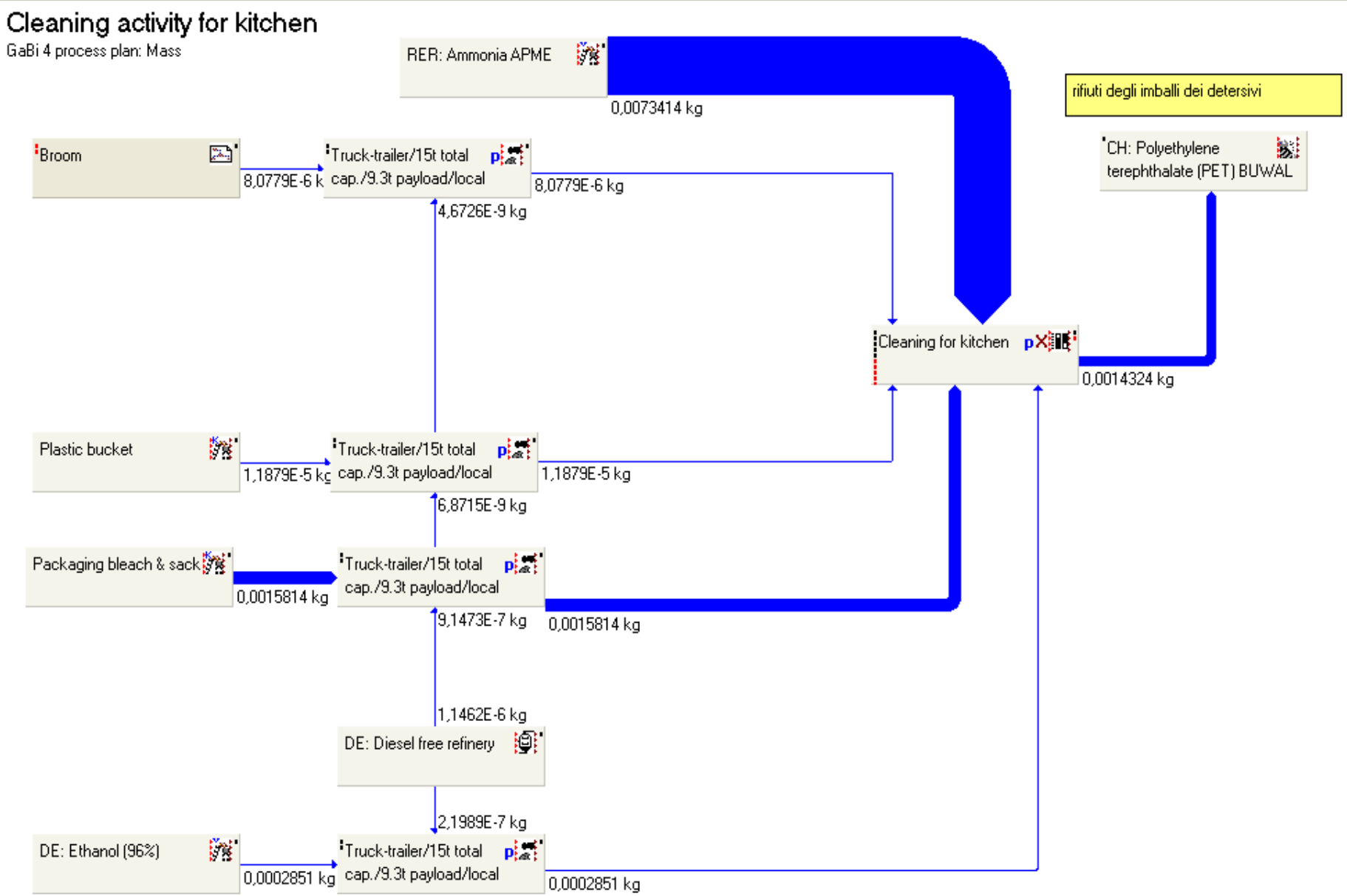
- GaBi software tool was used to model life cycle systems and process data

Cleaning activity for kitchen [Activities] -- DB Plan

Object Edit View Help

Cleaning activity for kitchen

GaBi 4 process plan: Mass



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Catering Service [Balances] -- Balance

Object Edit View Tools Help

Name: Catering Service

Rows 1 Columns 1

Quantity | Evaluation | Quantity view | Unit | Normalization

Mass | kg

In/out aggregation | Columns relative | not filtered

LCA | LCC | LCWT

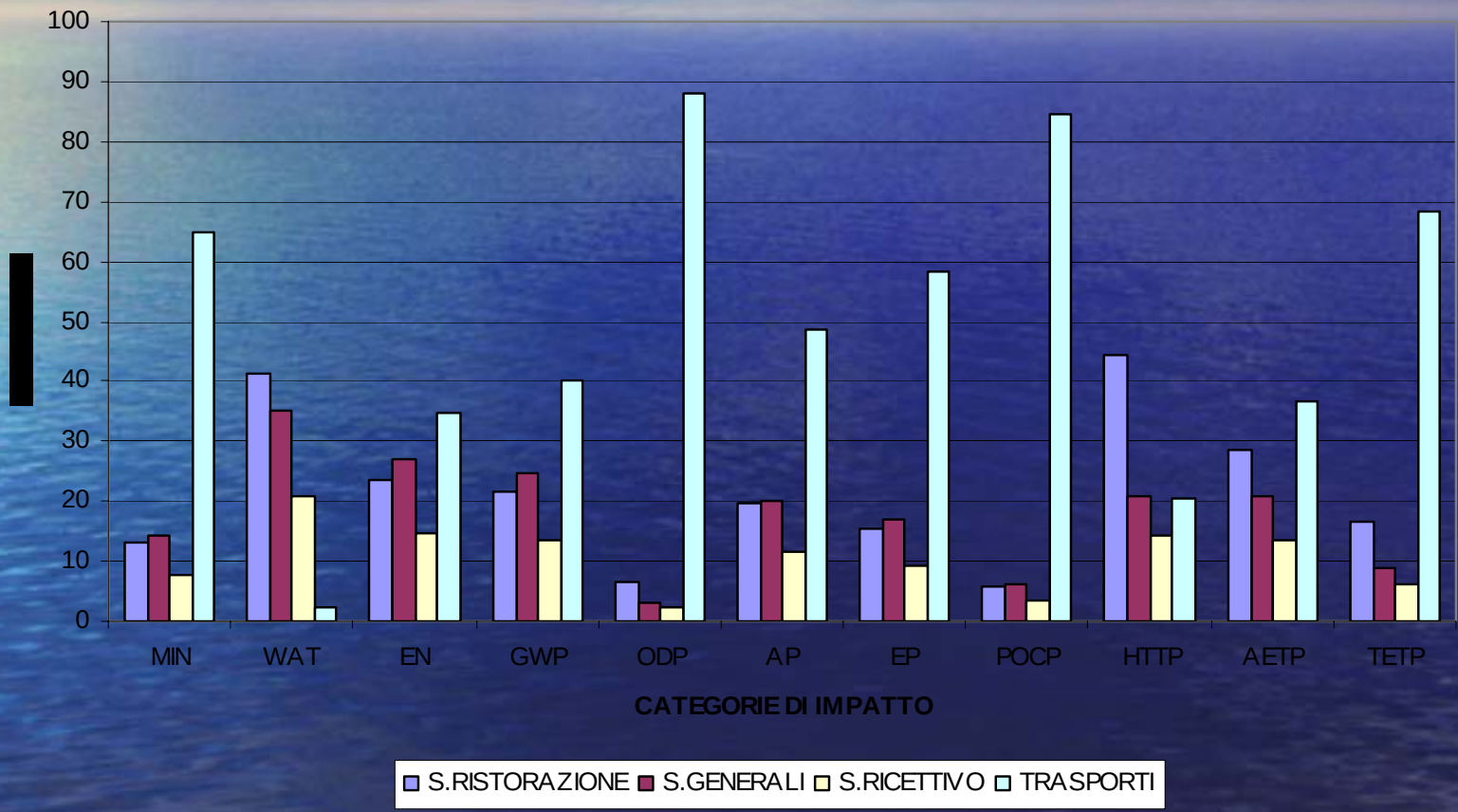
Inputs

	Catering Servi	Cleaning activ	Laundry for kit	Catering servic	DE: Diesel fre	IT: Power Gric	IT: Thermal er	Truck-trailer/1
Quantities								
Technical quantities								
Energy (gross calorific value) [MJ]	100 %	0,266 %	0,598 %		0,0231 %	33,2 %	65,9 %	0,0202 %
Energy (net calorific value) [MJ]	100 %	0,276 %	0,654 %	78,6 %	0,0248 %	30,8 %	68,2 %	0,0216 %
Energy ren. (gross calorific value) [MJ]	100 %	0,0197 %	0,177 %		0,00013 %	99,8 %	0,0169 %	
Energy ren. (net calorific value) [MJ]	100 %	0,0197 %	0,176 %		0,000129 %	99,8 %	0,0166 %	
Mass [kg]	100 %	48,4 %	3,15 %	4,97 %	0,000941 %	31,3 %	12,2 %	0,000217 %

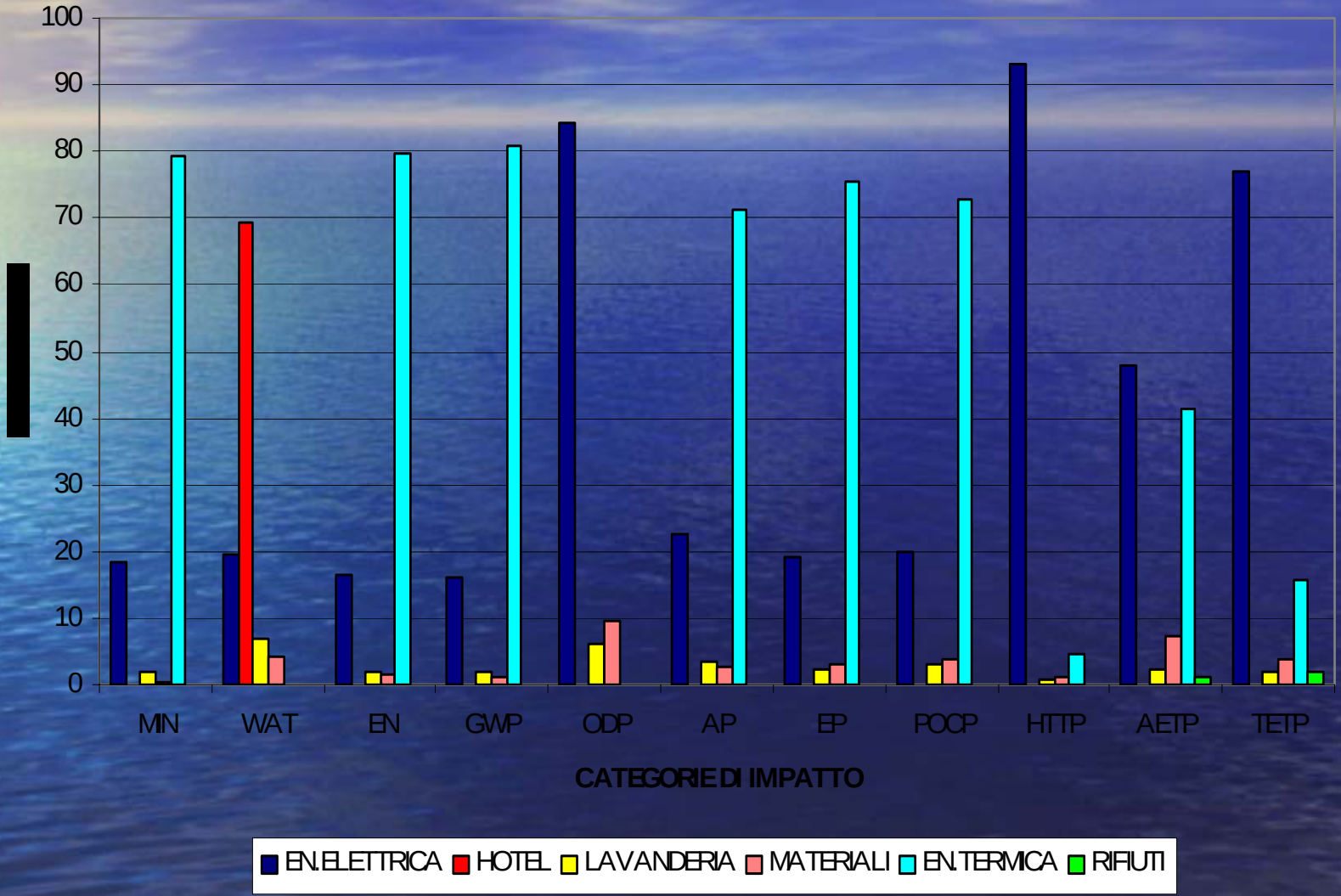
Outputs

	Catering Servi	Cleaning activ	Laundry for kit	Catering servic	DE: Diesel fre	IT: Power Gric	IT: Thermal er	Truck-trailer/1
Quantities								
Technical quantities								
Economic quantities								
Environmental quantities								
A Global warming potential (GWP 100 years) [kg CO2-Equiv.]	100 %	0,218 %	0,552 %		0,00332 %	32,4 %	66,8 %	0,0252 %
B Ozone depletion potential (ODP, catalytic) [kg R11-Equiv.]	100 %	0,0577 %	0,989 %		0,215 %	98,7 %		
C Acidification potential (AP) [kg SO2-Equiv.]	100 %	0,171 %	1,09 %		0,00574 %	42,9 %	55,8 %	0,0626 %
Carcinogenic substances (EI 95) [kg PAH-Equiv.]	100 %	0,00134 %	0,218 %		0,00326 %	99,4 %	0,33 %	
D Eutrification potential (EP) [kg Phosphate-Equiv.]	100 %	0,165 %	0,684 %		0,00635 %	37,6 %	61,5 %	0,0923 %
E Photochemical oxidant potential (POCP) [kg Ethene-Equiv.]	100 %	0,414 %	0,761 %		0,0759 %	39,5 %	59,2 %	0,0835 %
F Human toxicity potential (HTP) [kg DCB-Equiv.]	100 %	0,0831 %	0,231 %		0,00364 %	97,7 %	1,96 %	0,00199 %
G Aquatic ecotoxicity potential (AETP) [kg DCB-Equiv.]	100 %	0,235 %	0,549 %		0,0162 %	73,1 %	26,1 %	
Global warming potential (GWP 20 years) [kg CO2-Equiv.]	100 %	0,245 %	0,529 %		0,0038 %	30,9 %	68,3 %	0,023 %
Global warming potential (GWP 500 years) [kg CO2-Equiv.]	100 %	0,206 %	0,565 %		0,00309 %	33,1 %	66,1 %	0,0263 %
H Terrestric ecotoxicity potential (TETP) [kg DCB-Equiv.]	100 %	0,0392 %	0,345 %		0,019 %	91,8 %	7,75 %	
Heavy metals (EI 95) [kg Pb-Equiv.]	100 %	0,58 %	0,449 %		0,0349 %	95,9 %	3,01 %	
Ionizing radiation (EI 95 RF) [Bq I129-Equiv.]	100 %	0,00217 %	0,209 %		0,00178 %	99,8 %	0,0185 %	
Winter smog (EI 95) [kg SO2-Equiv.]	100 %	0,264 %	2,53 %		0,00686 %	71,3 %	25,8 %	0,0452 %

CARATTERIZZAZIONE DEGLI IMPATTI AMBIENTALI



CARATTERIZZAZIONE DEGLI IMPATTI AMBIENTALI:SERVIZIO RICETTIVO



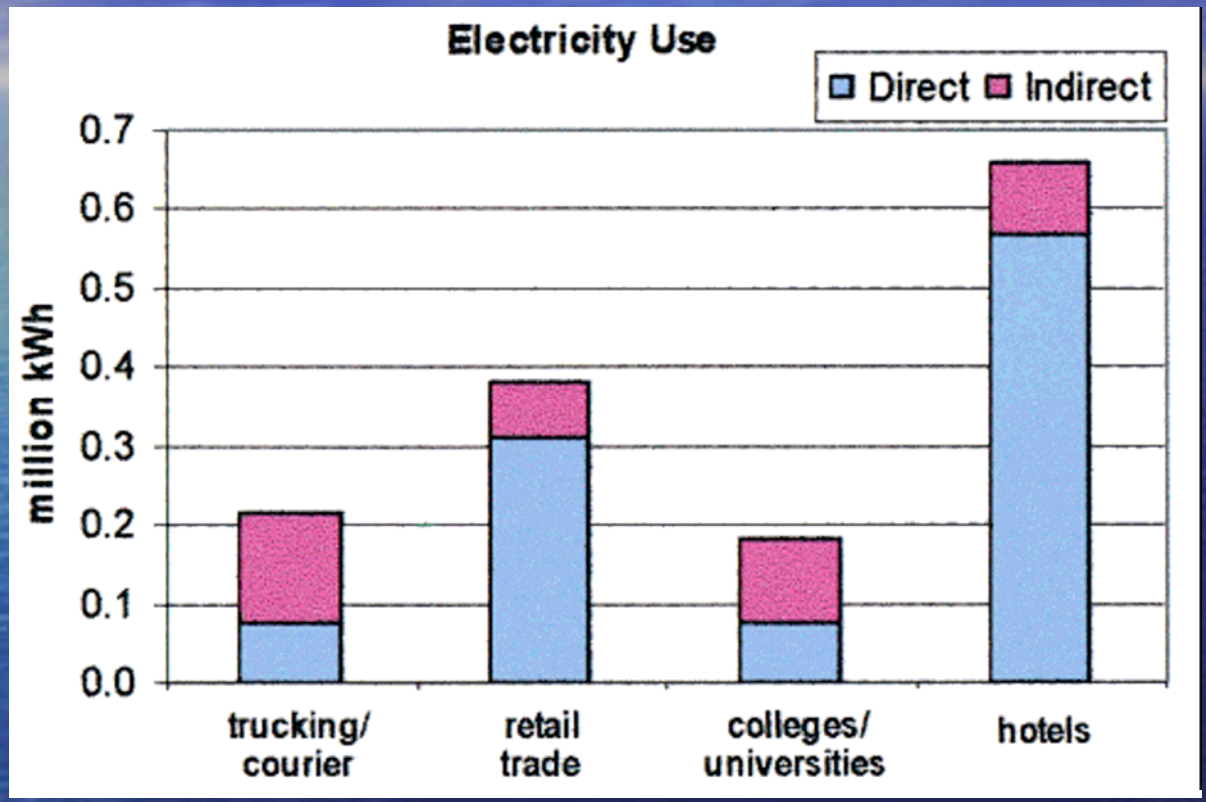
Interpretation of the results

- Some general comments:
  - Energy use is a major aspect
  - Transport of guests (where included) is also a critical aspect
  - Production of materials (e.g.: detergents, toilet paper) and some processes (e.g.: laundry activity, waste disposal) may make a significant contribution to some impact categories

US tourist industry

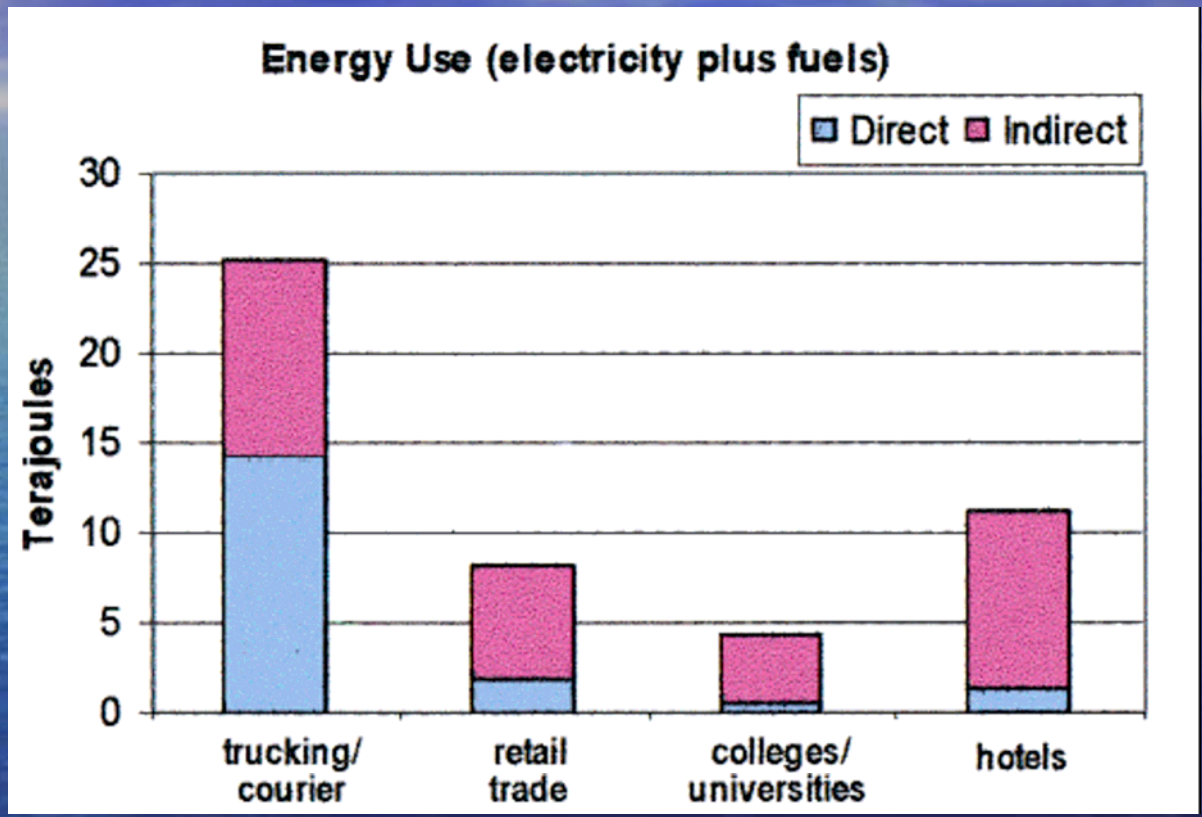
- The Authors have developed the Economic Input-Output Life Cycle Assessment (EIO-LCA) method using U.S. data
- Representatives of major U.S. service industries were selected: trucking and courier services, retail trade, colleges and universities, and hotels
- The EIO-LCA model was used to estimate the resource inputs and environmental outputs, both direct and indirect
- A purchase of one million dollars of services from these four sectors was simulated

US tourist industry



Electricity inputs of four U.S. service industries for $1 million dollars of demand for each industry (source: Rosenblum et al., 2000)

US tourist industry



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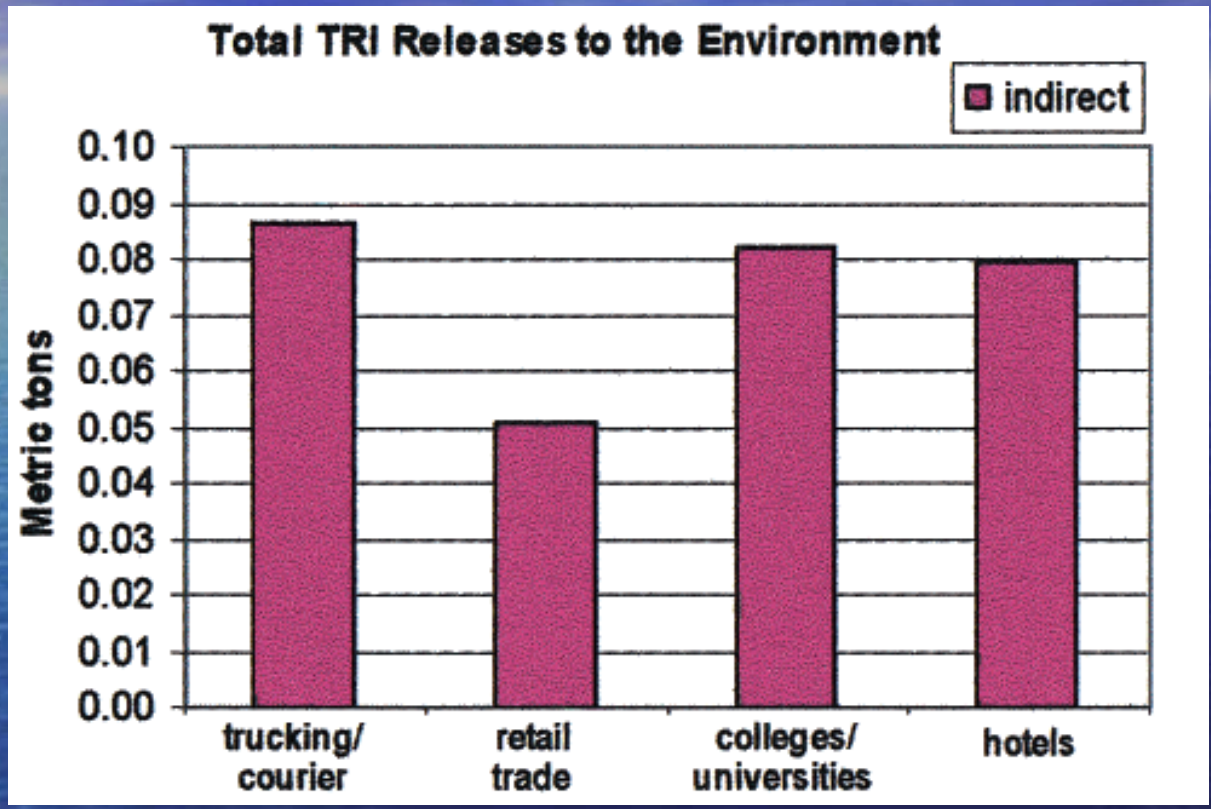

U.S. EPA's Toxics ReleaseInventory (TRI) emissions of four U.S. service industries for $1 million dollars of demand for each industry (source: Rosenblum et al., 2000)

Main conclusions and future developments

- Case-study implementation have so far suggested the potential of various LCA approaches to:
  - introduce Life Cycle Thinking into the decision making processes of the firms involved
  - support efficient data management and resource optimisation
  - support public policy making

- Improvement are still needed concerning several issues:
  - accurate identification of tourism activities and services (what is being investigated)
  - system boundaries
  - data availability, data quality and documentation
  - methodological issues
  - integration with other tools
  - ……..