The Interaction of Technological Innovations and Sustainable Development
The perspective and actions of Tekes

Jukka Leppälahti, Tekes

Towards Sustainable Futures-Tools and Strategies Conference
14-15.6., Tampere

TEKES

Tekes, the National Technology Agency

Tekes is the main financing organisation for applied and industrial R&D in Finland.

The funds for financing are awarded from state budget. Total Tekes R&D budget in 2004 is EUR 407 million.

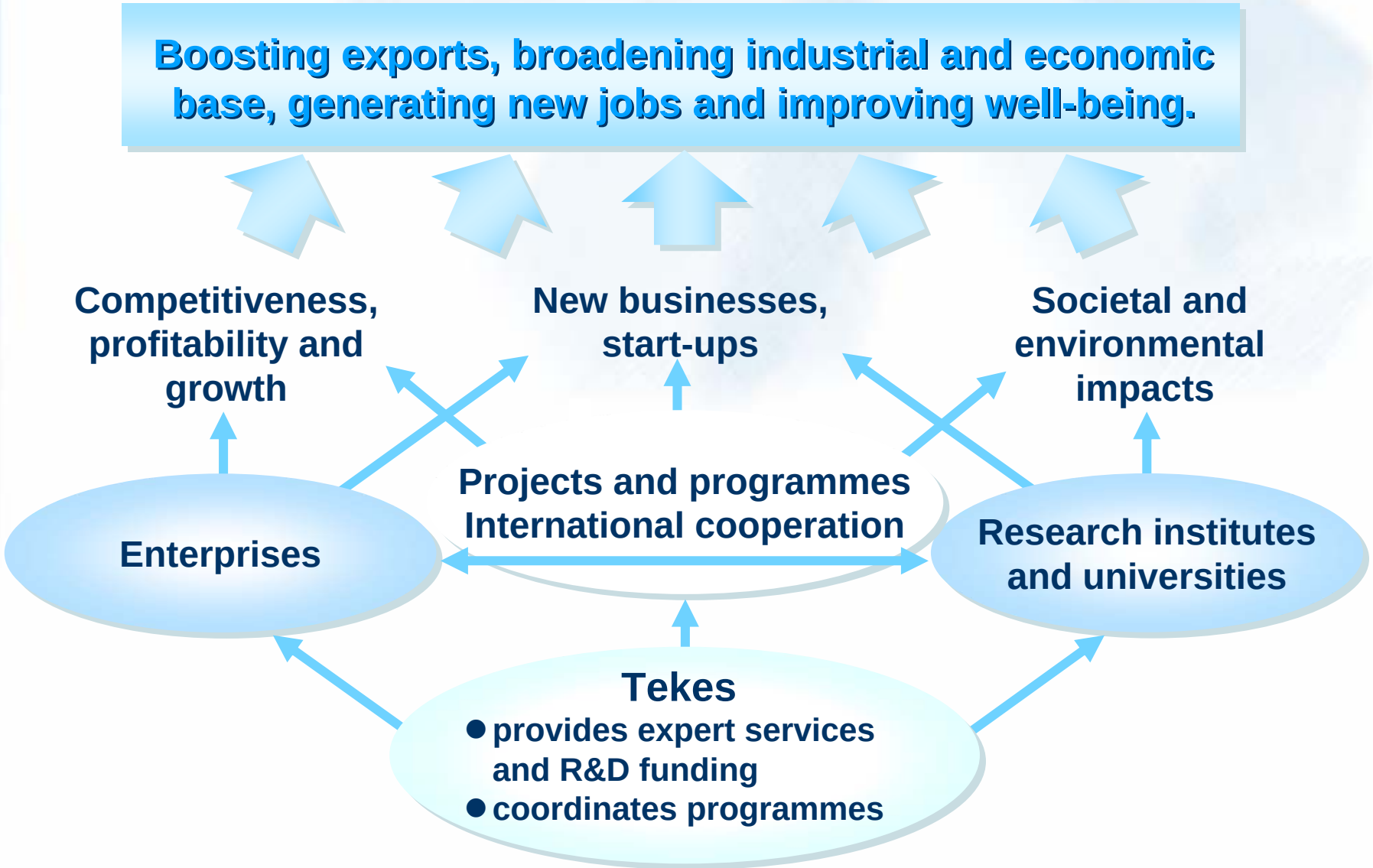
Mission

Tekes' primary objective is to promote the competitiveness of Finnish industry and the service sector by technological means.

Activities aim to diversify production structures, increase production and exports, and create a foundation for employment and societal well-being.

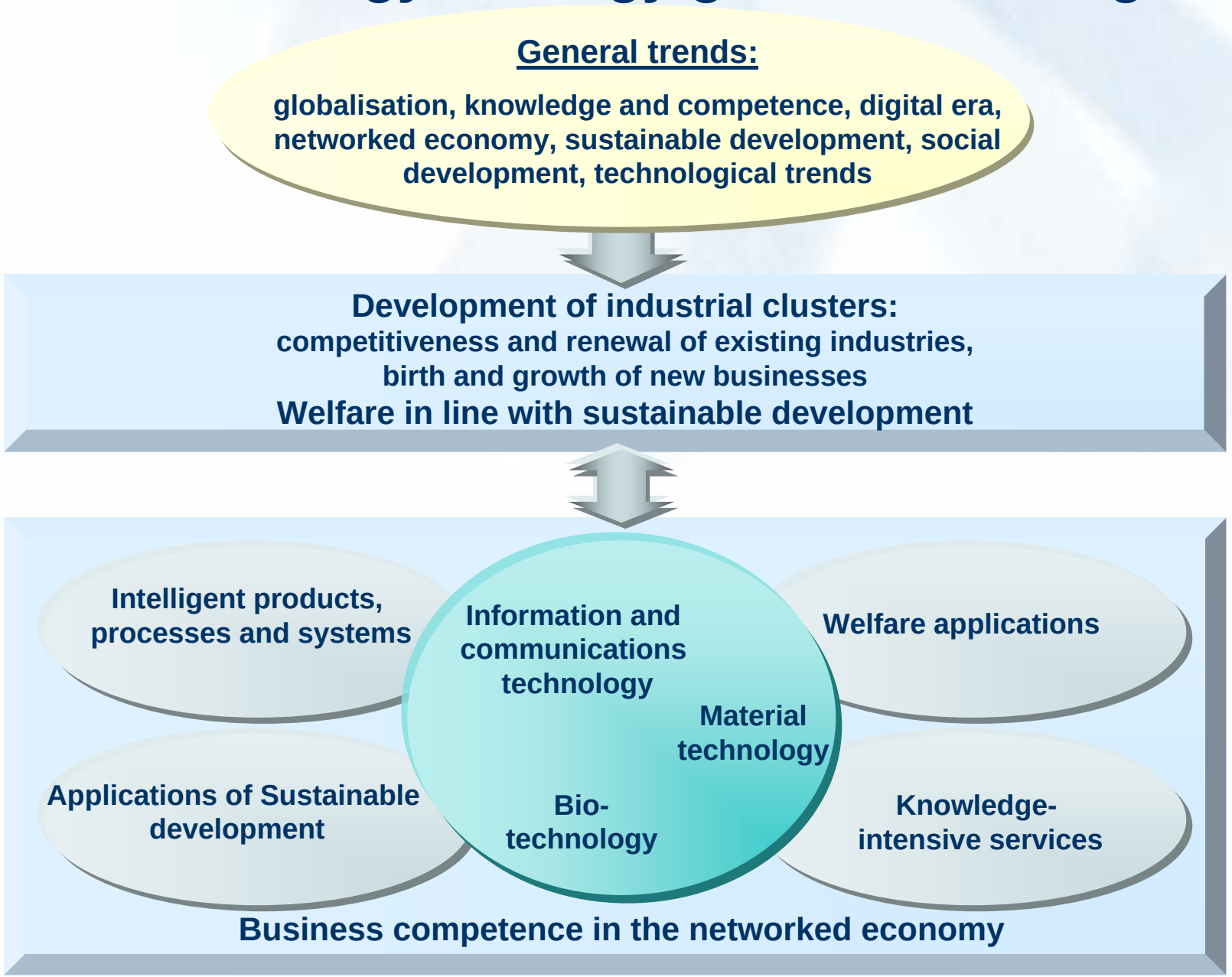
TEKES

Impact of Tekes activities



TEKES

Technology Strategy guides financing



TEKES

Technology enabling Sustainable Development

- Conclusion 1: Sustainable development is not possible without new and more eco efficient technology
  - World population growth stabilising near 10billion
  - Limited natural resources at our disposal
  - Products and services have to be produced more efficiently, resource productivity has to increase (e.g Factor 10)

- Conclusion 2:Technology alone can not create sustainable development
  - social reforms
  - economic reforms
  - environmental reforms and legistlation
  - technological reforms and innovation

TEKES

Sustainable Development
Application areas, technologies and key products

- **Energy technology**
  - Short term: Renewable energy: Bio energy, wind and solar energy
  - Long term: Hydrogen technology, Fusion energy: Unlimited fuel resource (hydrogen isotopes from sea water and lithium), no long-lived active waste or greenhouse gas emissions, safe reactor
- **Cleaning technologies**
  - Emissions, water , land
- **Energy saving products and systems**
  - Power transmission and distribution, automation, construction technology and traffic
- **Eco efficient materials**
  - Renewable, recycled and biodegradable materials
- **Eco efficient industrial processes, manufacturing and logistics**
  - Technologies reducing the birth of wastes and emissions
  - Recycling and use of waste
  - Forest, chemical, metal, food industry, metals production etc.
- **Extensive application of ICT**
  - Local distributed production and energy technology
  - Digitalised, dematerialised products and services

TEKES

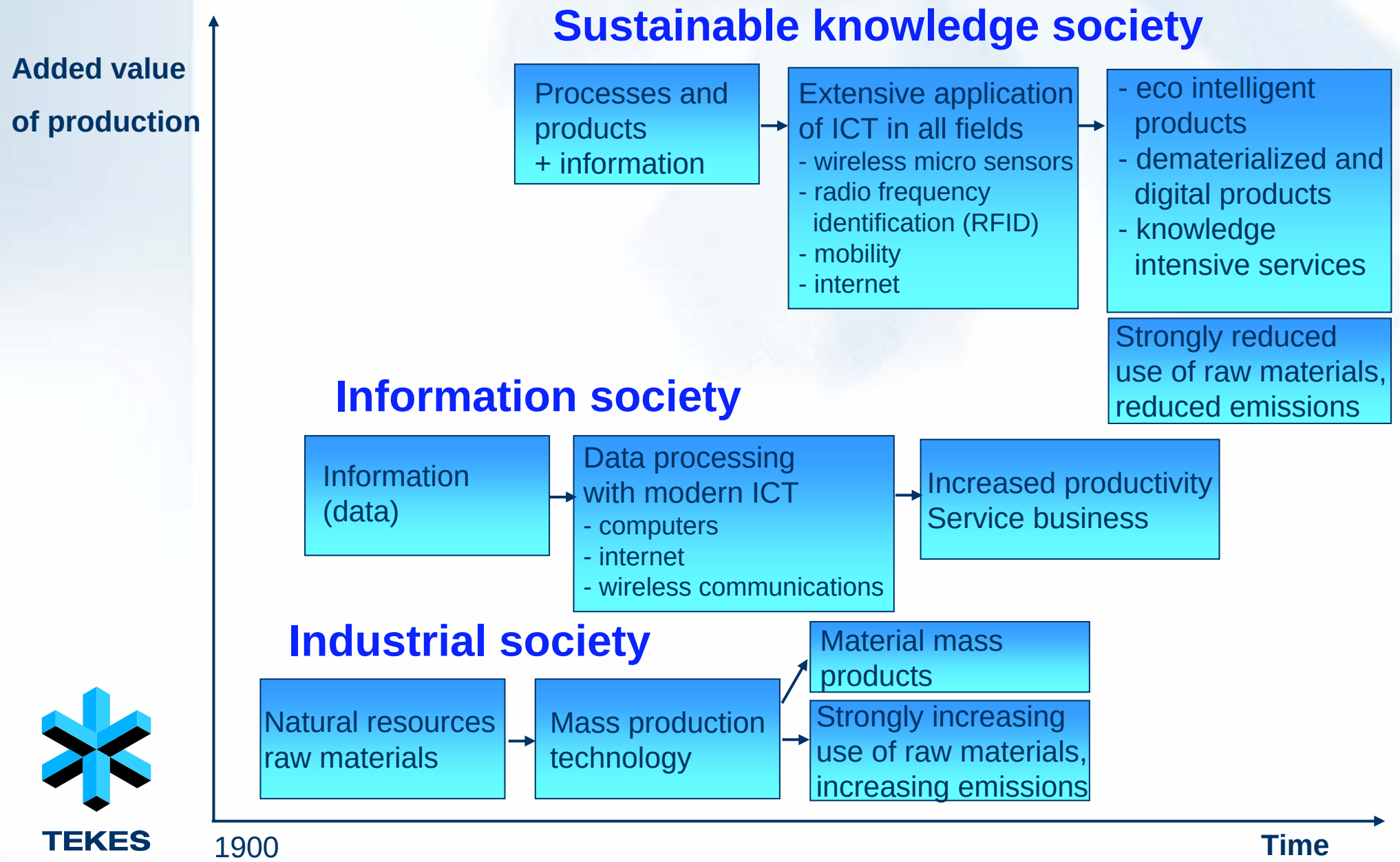
Simplified environmental Kuznetz curve

Correlation between growth and environmental detoriaration

- **Grossman G.M. and Krueger A.B: Economic growth and the environment, NBER paper 4634/1994:**
- **”No evidence that environmental quality detoriarates with economic growth. For most indicators economic growth brings an initial phase of detoriaration followed by subsequent phase of improvement. No reason to believe that this process is an automatic one.”**
- **More like a long term goal…**

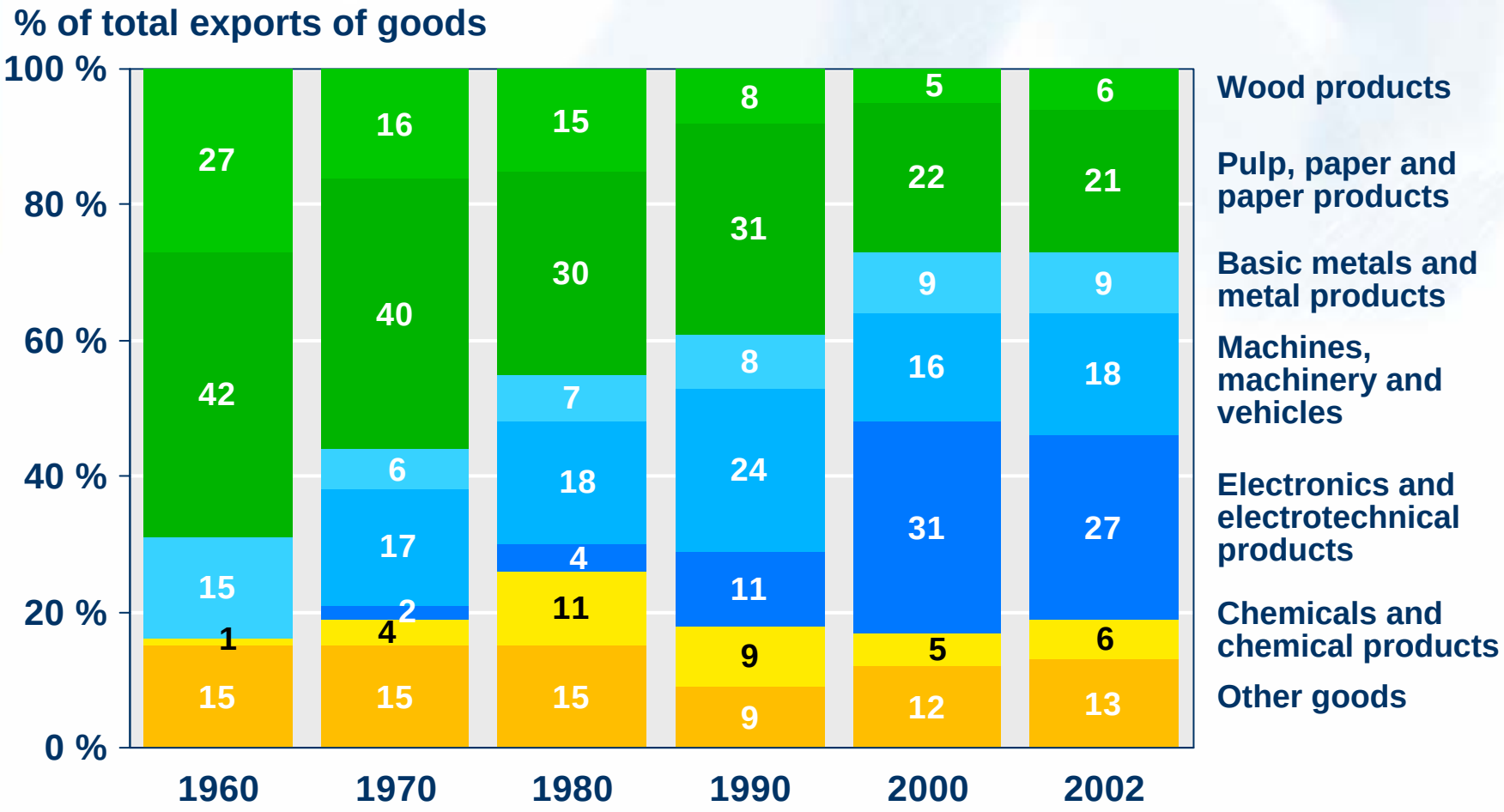
TEKES

Foundations of sustainable growth of economy



TEKES

Finnish exports of goods



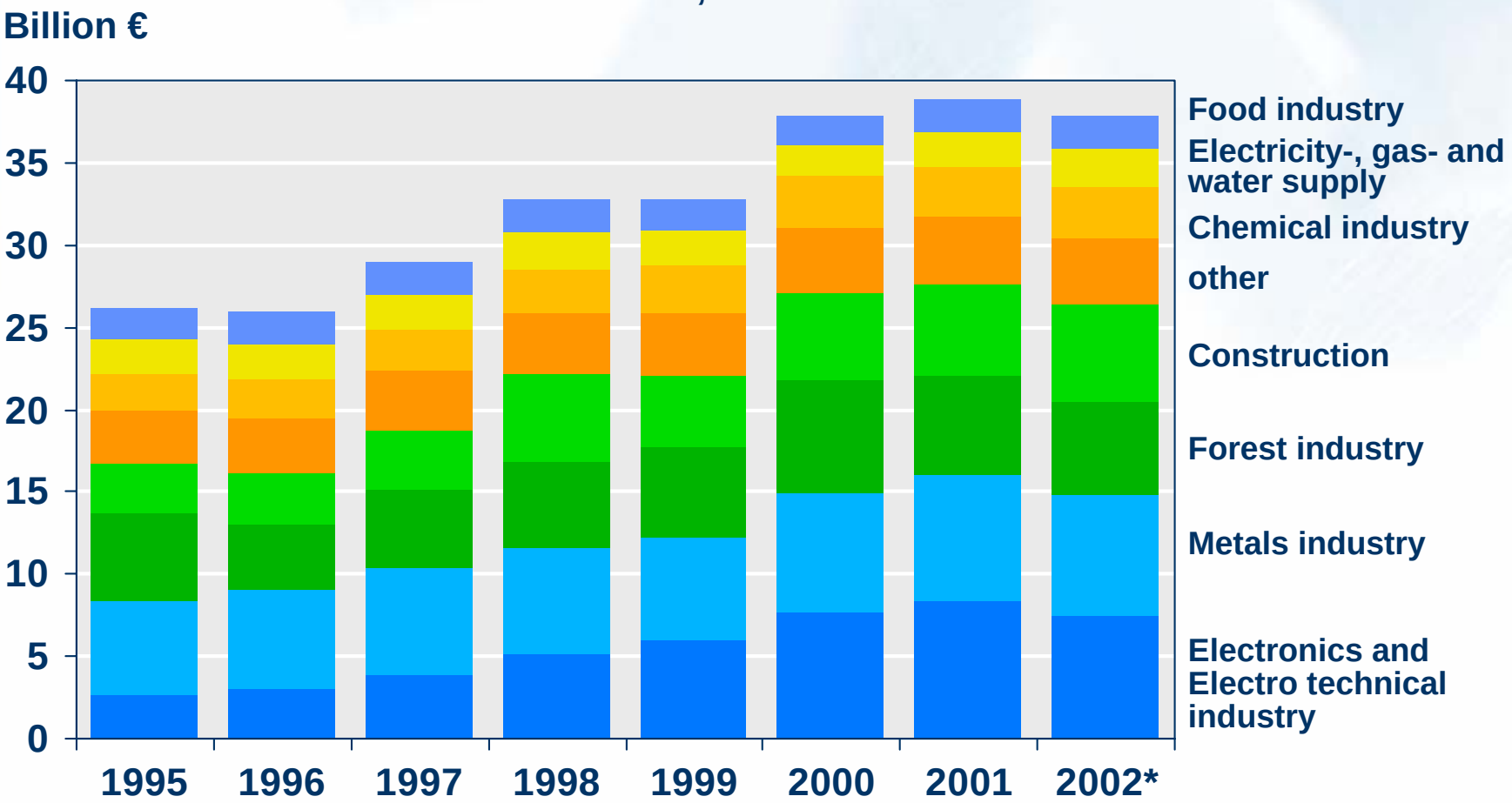
Source: National Board of Customs

TEKES

Value added in Finnish industry

Increase in added value of production

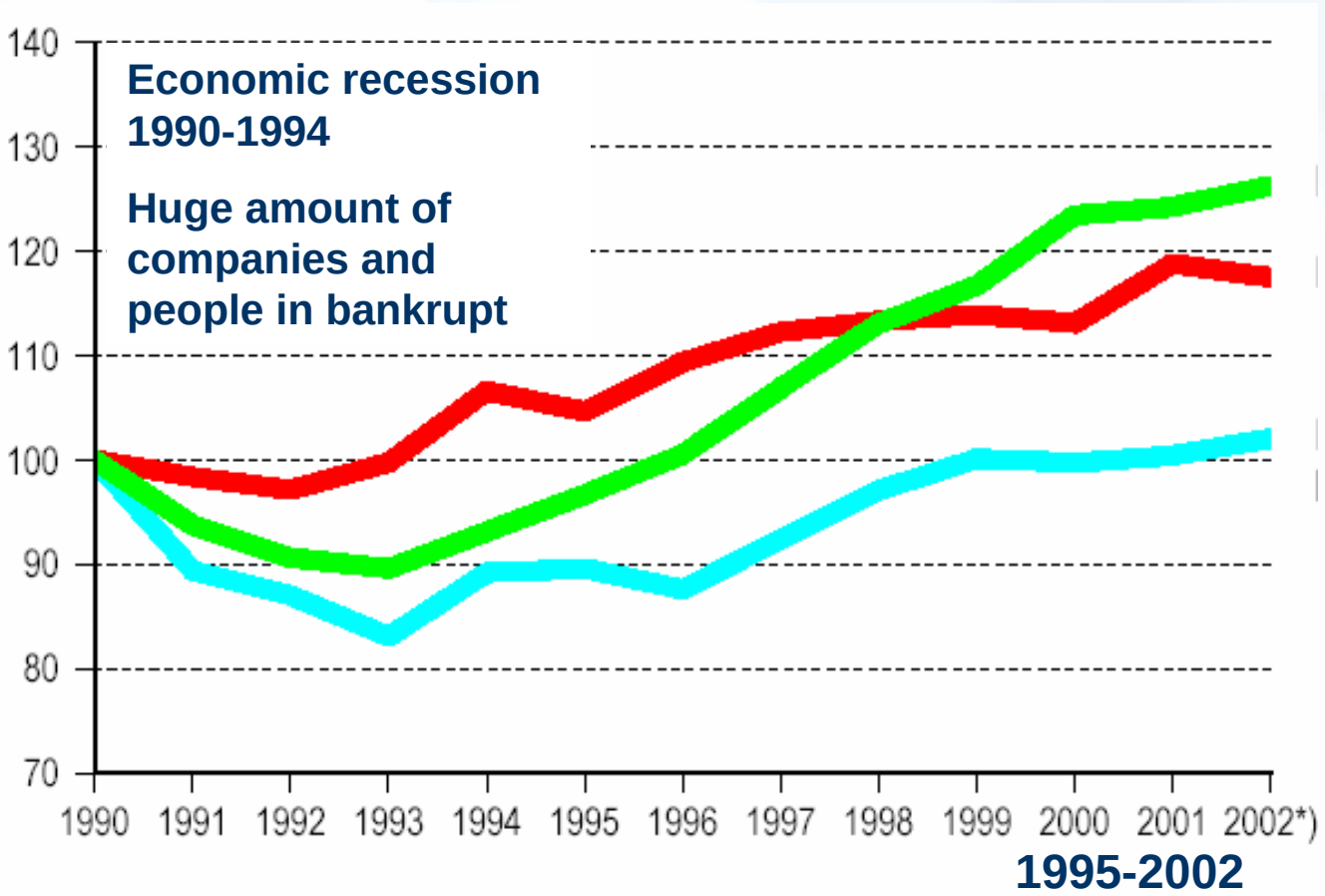
44%, 1995-2002



Source: Statistics Finland

TEKES

Trends in real GDP and the consumption of energy and materials in Finland (1990=100)



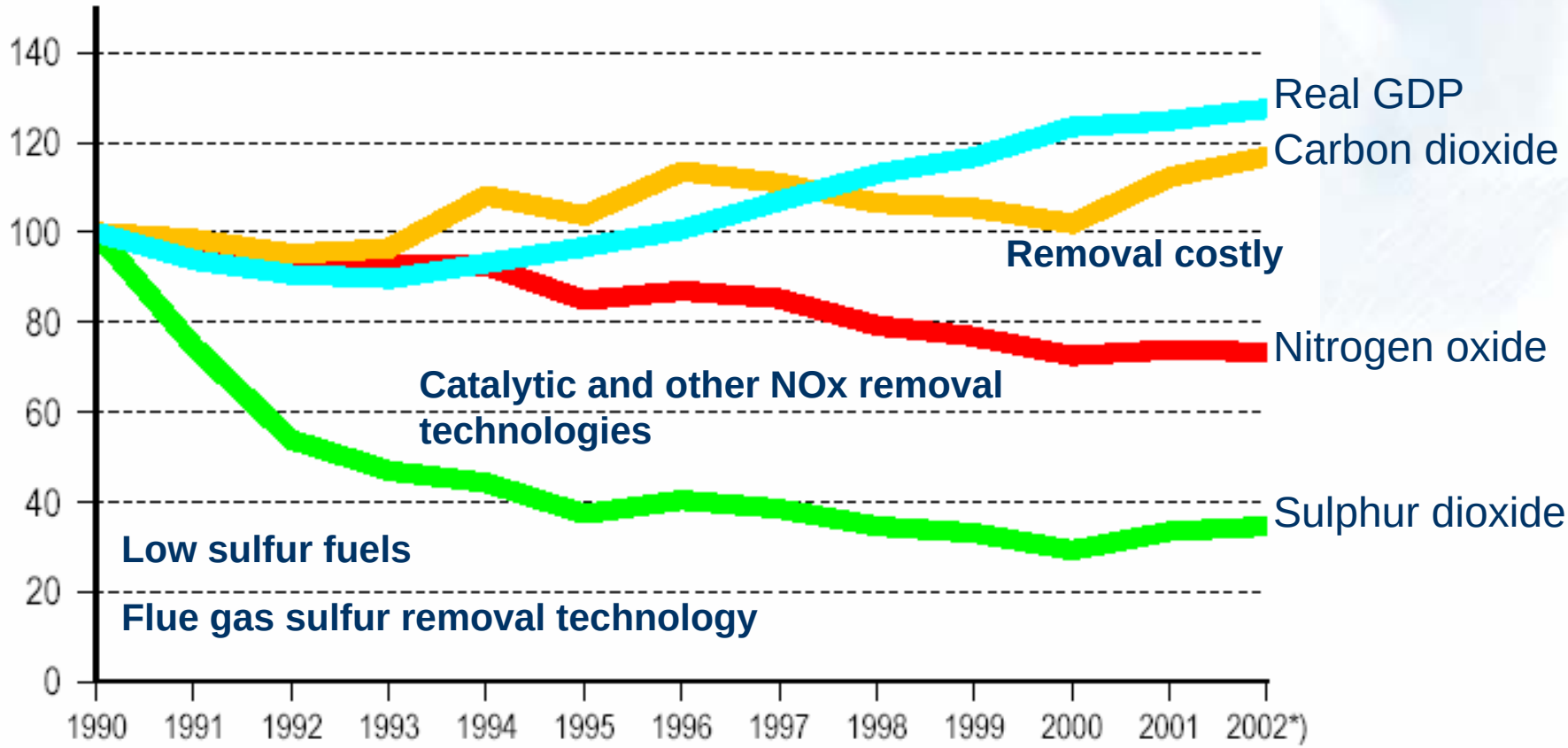
Increase in material and energy use 12-13%

Increase in value added of production 44%

Source: Statistics Finland and Tekes

TEKES

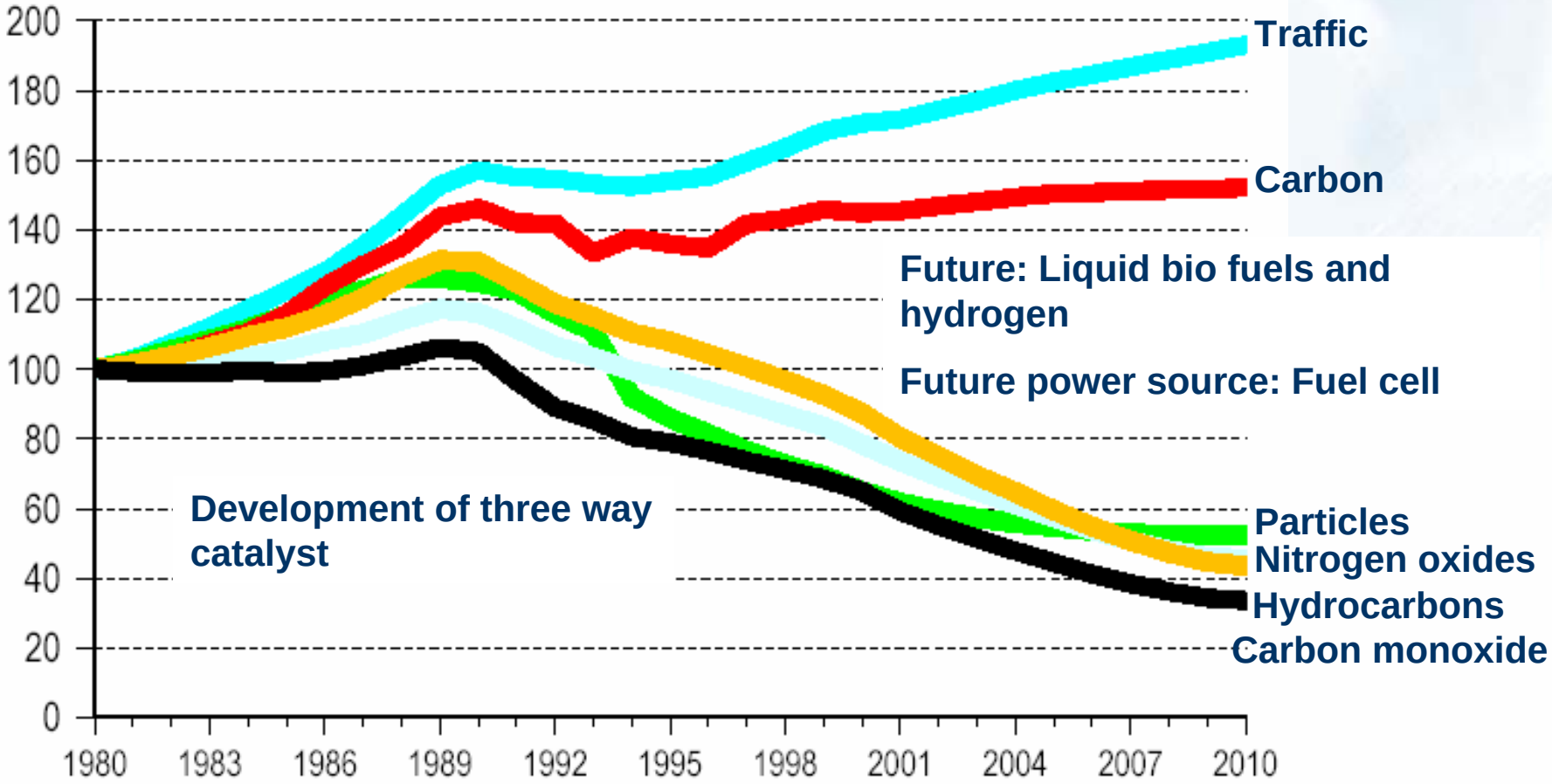
Trends in real GDP and atmospheric emissions in Finland (1990=100)



TEKES

Source: Statistics Finland and Tekes

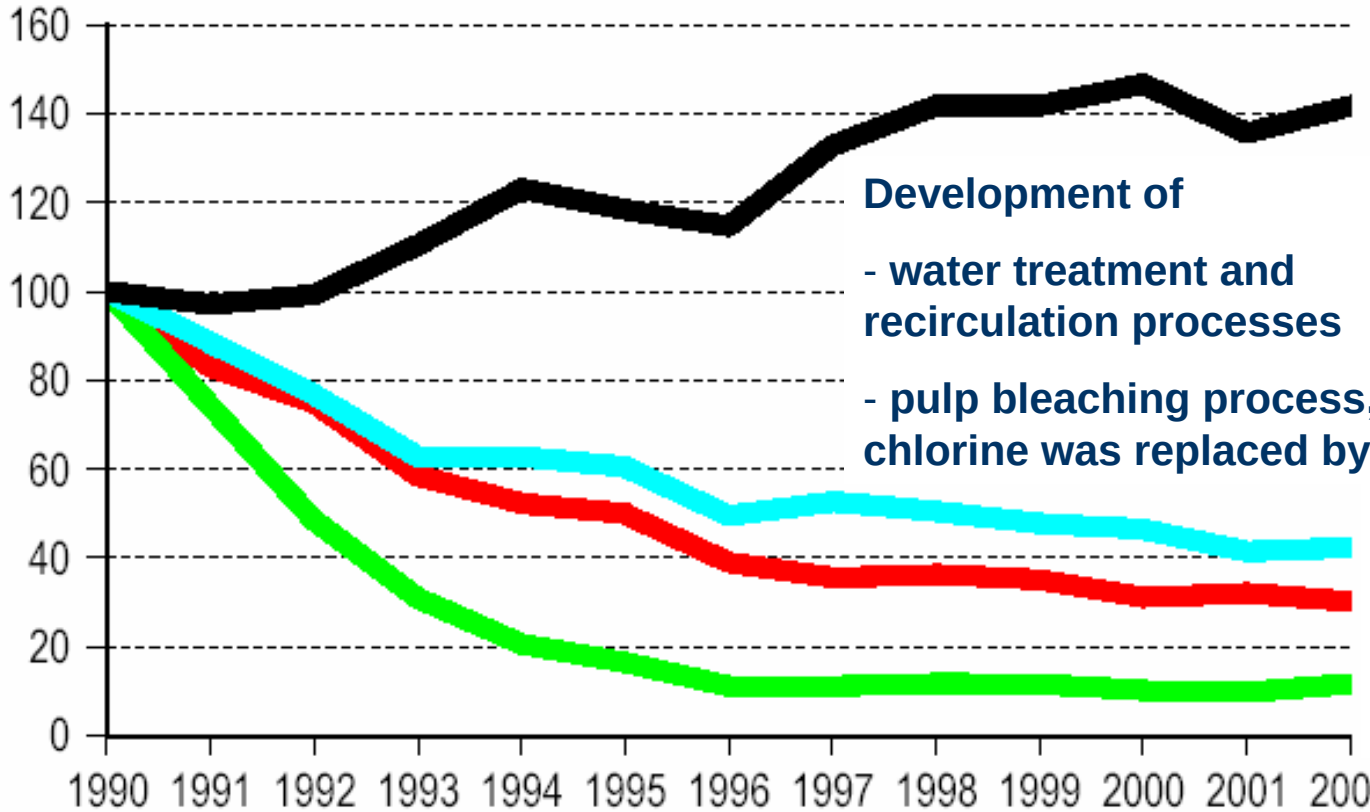
Trends in emissions from road traffic (1990=100)



TEKES

Source: Statistics of Finland and Tekes

Pulp and paper industry production and load on the rivers and lakes (1990=100)



TEKES

Statistics of Finland and Tekes

Tekes technology programmes promoting sustainable development (1/2)

Technology programme	Timing	Target	Total input M€
Renewable energy sources			
Bioenergy	1993 - 1998	Development of bio fuels	40
NEMO 2 - Advanced energy systems and technologies	1993 - 1998	Promotion of wind and solar energy use	19
Wood energy	1999 - 2003	Fuel from forest chips	35
Energy generation and transmission			
SIHTI 2 - Energy and environmental technology	1993 - 1998	Recycling and waste utilisation	22
LIEKKI 2 - Combustion and gasification technology	1993 - 1998	Development of combustion and gasification	38
TERMO - District heating and cooling	1993 - 1998	New technology to district heating	2
MODIS	1997 - 1999	Distict heat technology for near by markets	10
KESTO - Materials for energy technology	1997 - 2001	Improve competitiveness of energy technology companies	13
CODE - Modelling tools for combustion process development	1999 - 2002	Improvement of efficiency in combustion	14
TESLA - Information technology and electric power systems	1998 - 2002	Management of network and use in electric transmission grid	27
FFusion 2 - Fusion energy research programme	1999 - 2002	Development of fusion energy	17
INFRA - Construction and services	2001 - 2005	Development of building technology	25
DENSY - Distributed energy systems	2003 - 2007	Increase business opportunities	47
Use of energy in industry			
SULA 2 - Energy in steel and base metal production	1993 - 1998	Improvement of energy efficiency	22
Sustainable paper - Paper production technology	1993 - 1998	Improvement of energy and material efficiency	21

TEKES

Source: Climate change – impacts of technology policy and programmes, Jari Hiltunen

Tekes technology programmes promoting sustainable development (2/2)

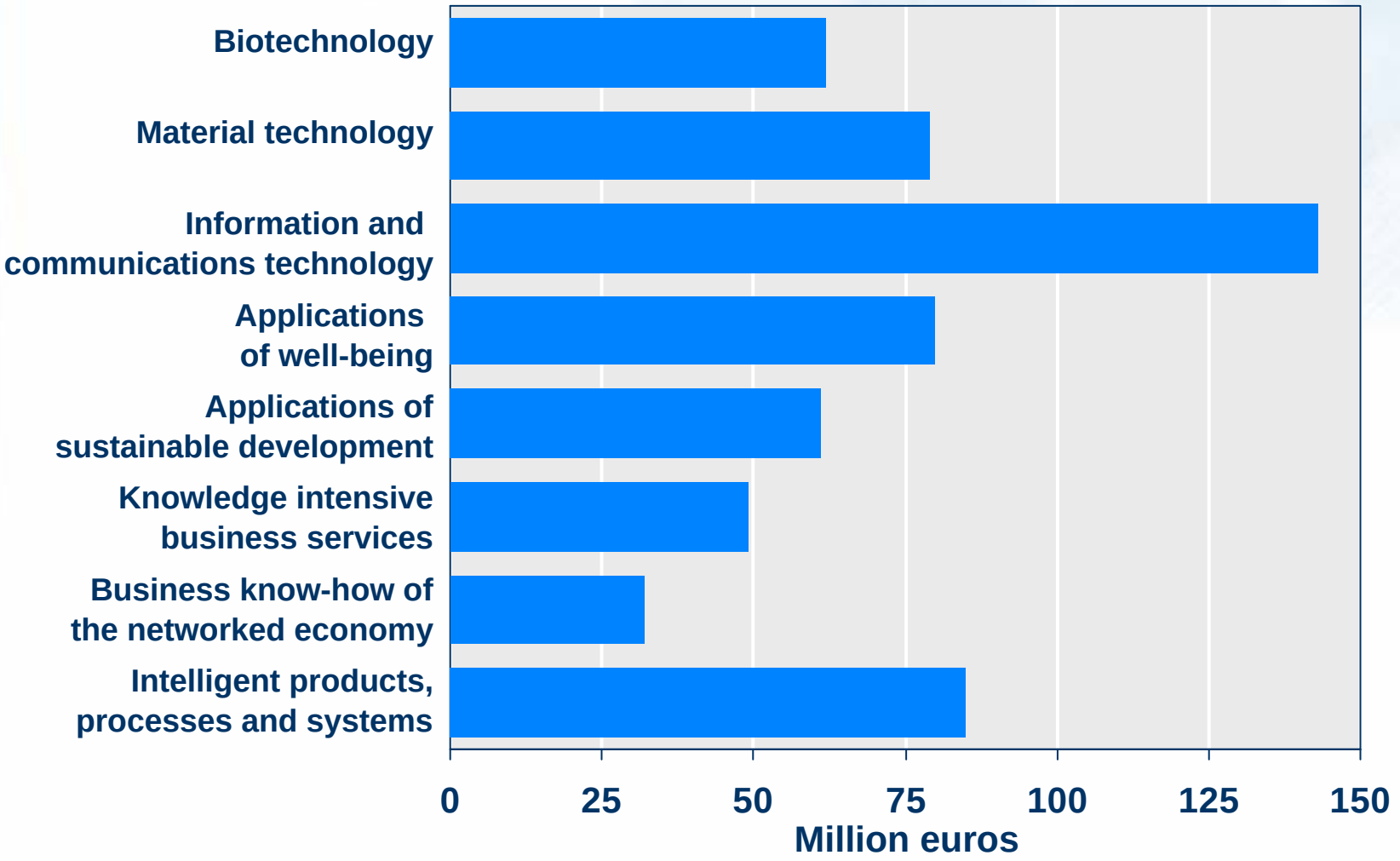
Technology programme	Timing	Target	Total input M€
Energy use in buildings			
RAKET - Energy use in buildings	1993 - 1998	Development of energy savings technologies	25
CUBE - Building services technology programme	2002 - 2006	Utilise innovations of energy technology	27
Energy use of traffic			
MOBILE - Energy and environment in transportation	1993 - 1998	Energy use in traffic and impacts to environment	17
ProMOTOR - Engine technology	1999 - 2003	Support engine R&D	46
Energy use of waste			
Waste to REF & Energy - Combustion of waste, energy production and recycling	1998 - 2001	Waste as fuels and recycling	17
Streams - Recycling technologies and waste management	2001 - 2004	Development of waste streams to business	27
Reduction of GHGs			
CLIMTECH - Technology and climate change	1999 - 2002	The possibilities to reduce GHGs	5
Reduction of emissions			
FINE - Fine particles - tecnology, environment and health	2002 - 2005	Decrease and control fine particle releases and impacts on people, climate and environment	26

Total: 542M€

Source: Climate change – impacts of technology policy and programmes, Jari Hiltunen

TEKES

Tekes funding as targeted to technology strategy 2003



Each project may be targeted to several areas.

TEKES

Sustainable development as a source of technological innovations and business

Motivation

- Existing environmental problems
- Values: Customers and markets are becoming increasingly aware of issues related the environment, health, safety and energy generation
- Increasing regulation, legislation and international agreements (Kioto)
- Combating climate change is becoming a major factor guiding development and has to be dealt with by legislation and international treaties.

Prospects for Business

- Increasing demand and market growth for technological application reducing the environmental problems
- Technological solution for mitigation of climate change
- Business opportunities will also be created in the service sector.

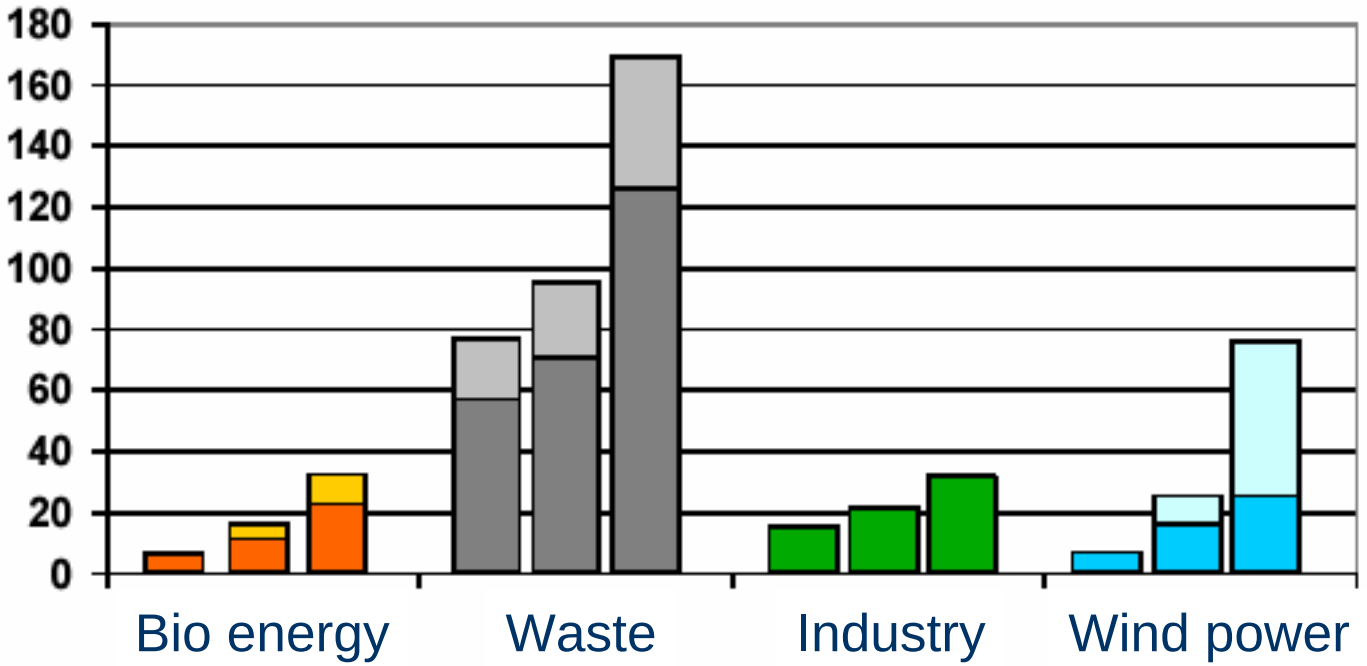
Generality

- Environmental technologies will have an impact on almost all products, production processes and operations.

TEKES

Global market potential in four areas of climate cluster

Market size, billion euros
2000/2002 (waste 2005), 2010, 2020



TEKES

Source: Study on Mitigation of climate change technology, JP Consulting (Europe)

CLIMBUS technology programme

Business Opportunities in the Mitigation of Climate Change, 2004-2008

Basis:

- Changes in markets due to international climate policy

Basics:

- 5 year programme (2004-2008), Start in April 2004, Budget 70 M€

Focus:

- Technologies and business services which are driven by climate policy
- Business services, Clean energy and fuels, Process and system solutions, Technology Road-Maps and Technology forecasting

Aim:

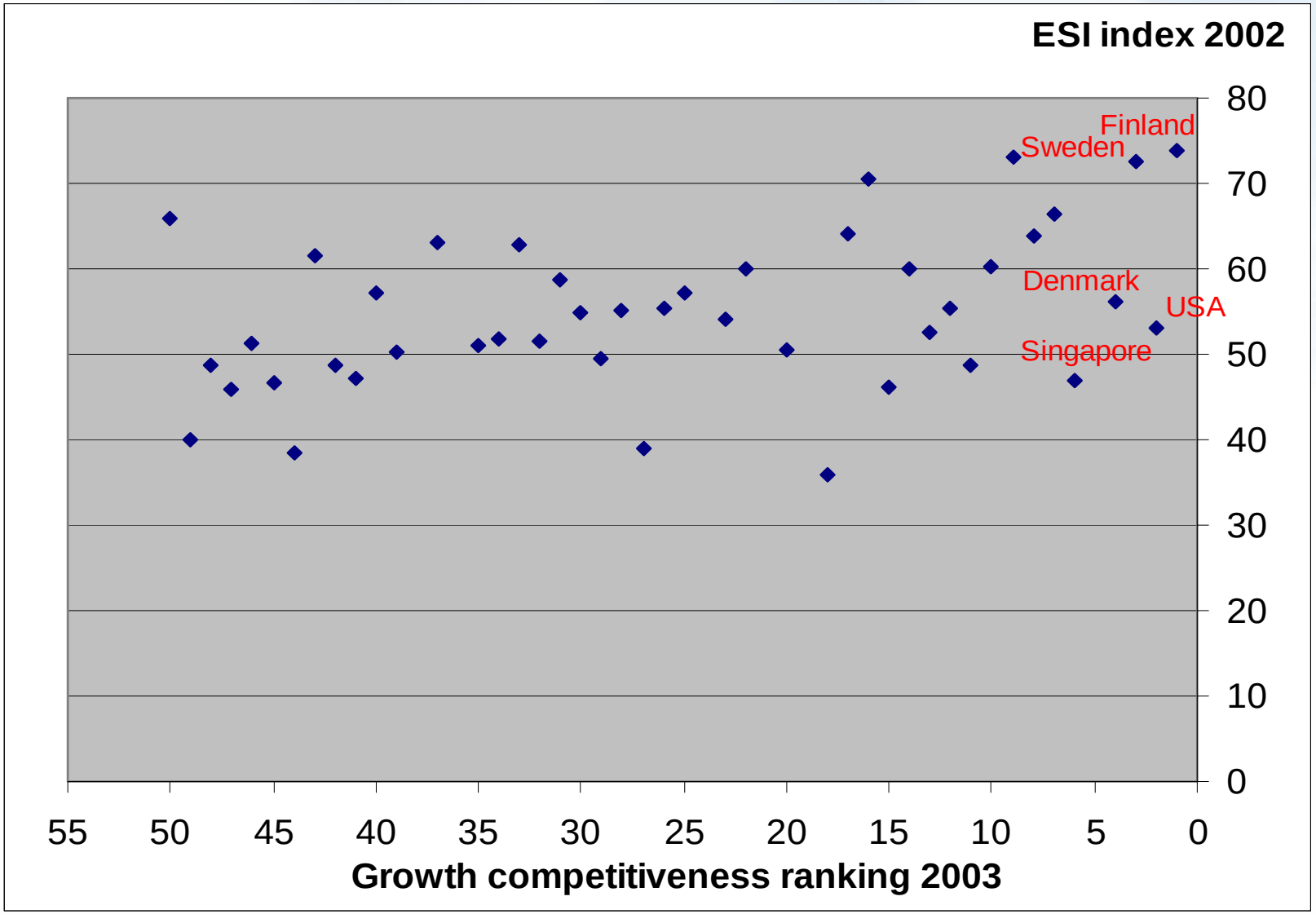
- The growth of Finnish business and creation of new enterprises to global climate markets both in medium (<2010) and long term (>2010)

Characteristics:

- Focus on company R&D activities
- Strong communication activities to support the realisation of results
- Internalisation services for companies and research organisations
- Networking with other technology and policy programmes

TEKES

Environmental Sustainability Index (ESI) and growth competitiveness



Source: World Economic Forum (WEF)

TEKES