

The Importance of Physics to the Economies of Europe

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**€ 4.40
trillion**

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**> 17 million
high-skilled jobs**

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16 %

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44 %

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The European Physical Society



42 Member
Societies

Over 130,000
physicists

To promote
physics in
Europe

Informing Debate

Managing the
Transition to Open
Access Publication

EPS Statement on
research and
education
opportunities for
innovation in Horizon
Europe

Promote Diversity
and inclusiveness:
*Code of conduct for
conferences*

*Exchange of best
practices*

Vision on future
research: *Grand
Challenges* (planned
for 2021)

EPS Study - Context

We know the value of long term basic research

Policy-makers want evidence of shorter-term benefit

We must demonstrate regular contribution to society

What industrialist, looking for new cutting and welding devices, or what doctor, wanting a new surgical tool as the laser has turned out to be, would have urged the study of microwave spectroscopy?

Charles Townes: How the Laser Happened

EPS Study - Context

European Research Area
(ERA)

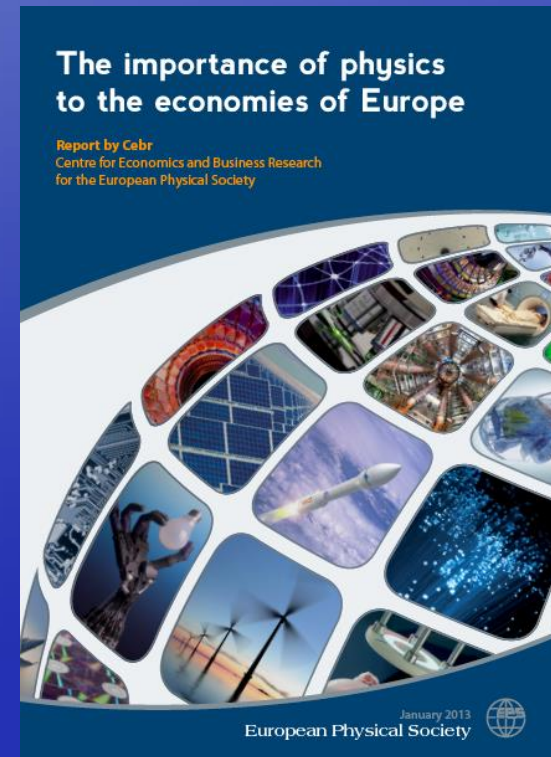
- recognises that science is important for economic development

H2020 = 80 billion

FP7 = 55 billion

FP6 = 19 billion

1st study 2013



(covered 2007-2010)

EPS Study – Basic Principles

A quantitative and objective statistical analysis

Use public domain data

Commission independent experts

Define physics based industry

EPS Study - Process

Commissioned by EPS in 2017

Centre for business research (Cebr):
independent business & economics analysts

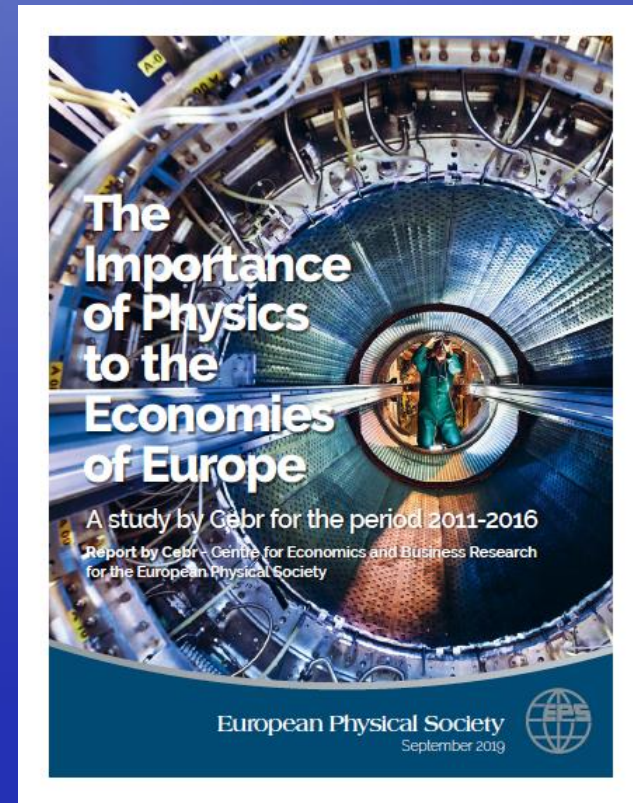
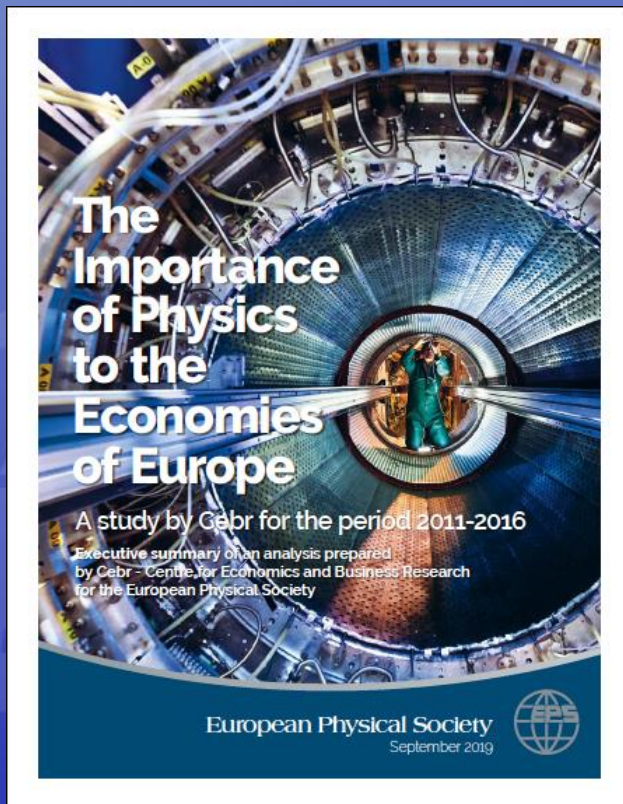
Using publically available data from Eurostat

Study covers 31 countries, EU28 countries (plus
Iceland, Norway and Switzerland) over 2011-
2016

EPS Study - Output

Executive Summary

Full Report



https://www.eps.org/page/policy_economy

EPS Study – Definition

Physics-based industries are defined as those sectors of the European economy where the use of physics – in terms of technologies and expertise – is critical to their existence.

Electrical, civil, & mechanical engineering
Energy
Information technology & communications
Design & manufacturing
Transportation
Medicine & related life-science fields
Technologies used in space

EPS Study – Data Sources

Data provided by enterprises

Eurostat's Structural Business Statistics (SBS)

NACE Rev. 2 statistics

Human Resources in Science and Technology (HRST) employment statistics of Eurostat

Other: WTO, UN, OECD...

NACE Rev. 2 Definition of physics-based activities Subset of 82 codes from total of over 700

Code	Description	Code	Description
6.1	Extraction of crude petroleum	27.12	Manufacture of electricity distribution and control apparatus
6.2	Extraction of natural gas	27.2	Manufacture of batteries and accumulators
9.1	Support activities for petroleum and natural gas extraction	26.8	Manufacture of magnetic and optical media
20.13	Manufacture of other inorganic basic chemicals	27.11	Manufacture of electric motors, generators and transformers
21.2	Manufacture of pharmaceutical preparations	27.31	Manufacture of fibre optic cables
23.44	Manufacture of other technical ceramic products	27.32	Manufacture of other electronic and electric wires and cables
24.46	Processing of nuclear fuel	27.33	Manufacture of wiring devices
25.4	Manufacture of weapons and ammunition	27.4	Manufacture of electric lighting equipment
25.99	Manufacture of other fabricated metal products n.e.c.	27.51	Manufacture of electric domestic appliances
26.11	Manufacture of electronic components	27.9	Manufacture of other electrical equipment
26.12	Manufacture of loaded electronic boards	28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
26.2	Manufacture of computers and peripheral equipment	28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)
26.3	Manufacture of communication equipment	28.25	Manufacture of non-domestic cooling and ventilation equipment

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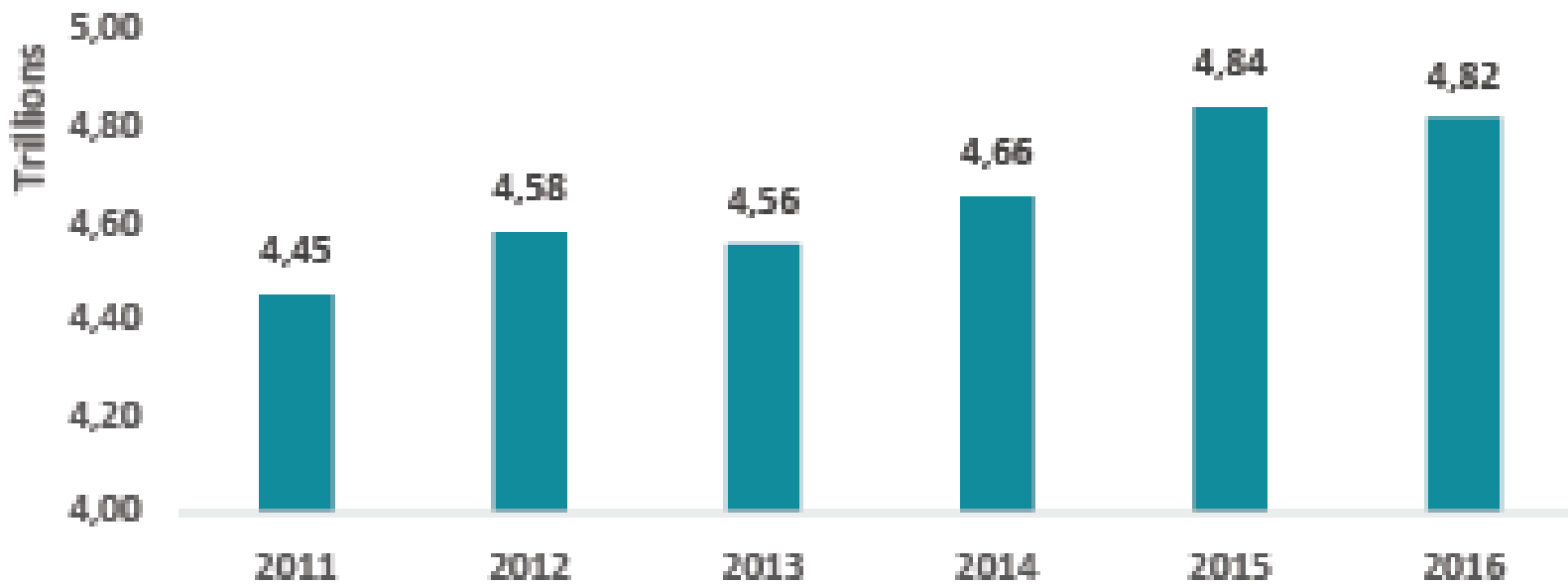
The physics-based industries contribute 44% of the total exports of the EU28 business economy

EPS Study – more than € 4.4 Trillion/y

In 2016, physics-based industries generated €4.8 trillion of turnover – 1 trillion more than in 2010, in representing over 16% of total turnover within Europe's business economy

Turnover per person employed in the physics-based sector substantially outperforms the construction and retail sectors

EPS Study – more than € 4.4 Trillion turnover

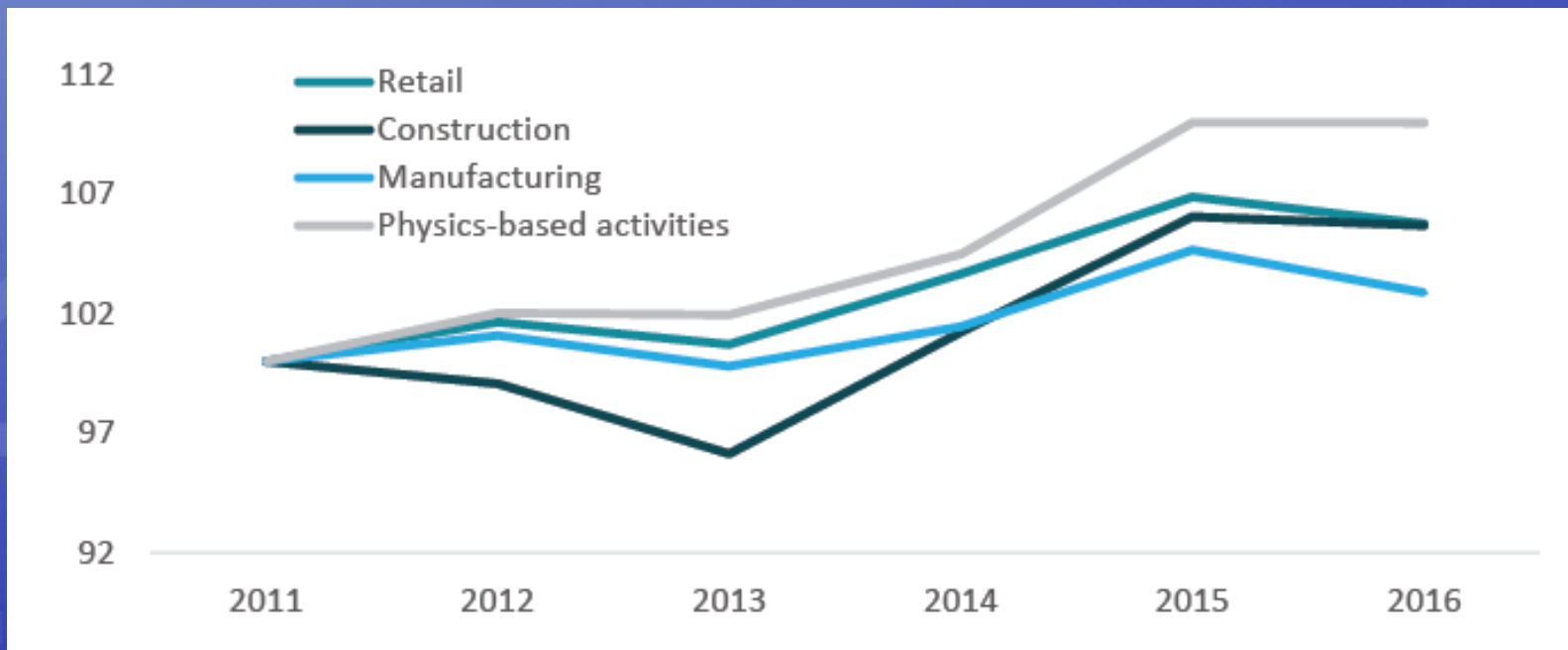


Strong growth in France, Germany, Ireland, Greece, Switzerland and U.K.

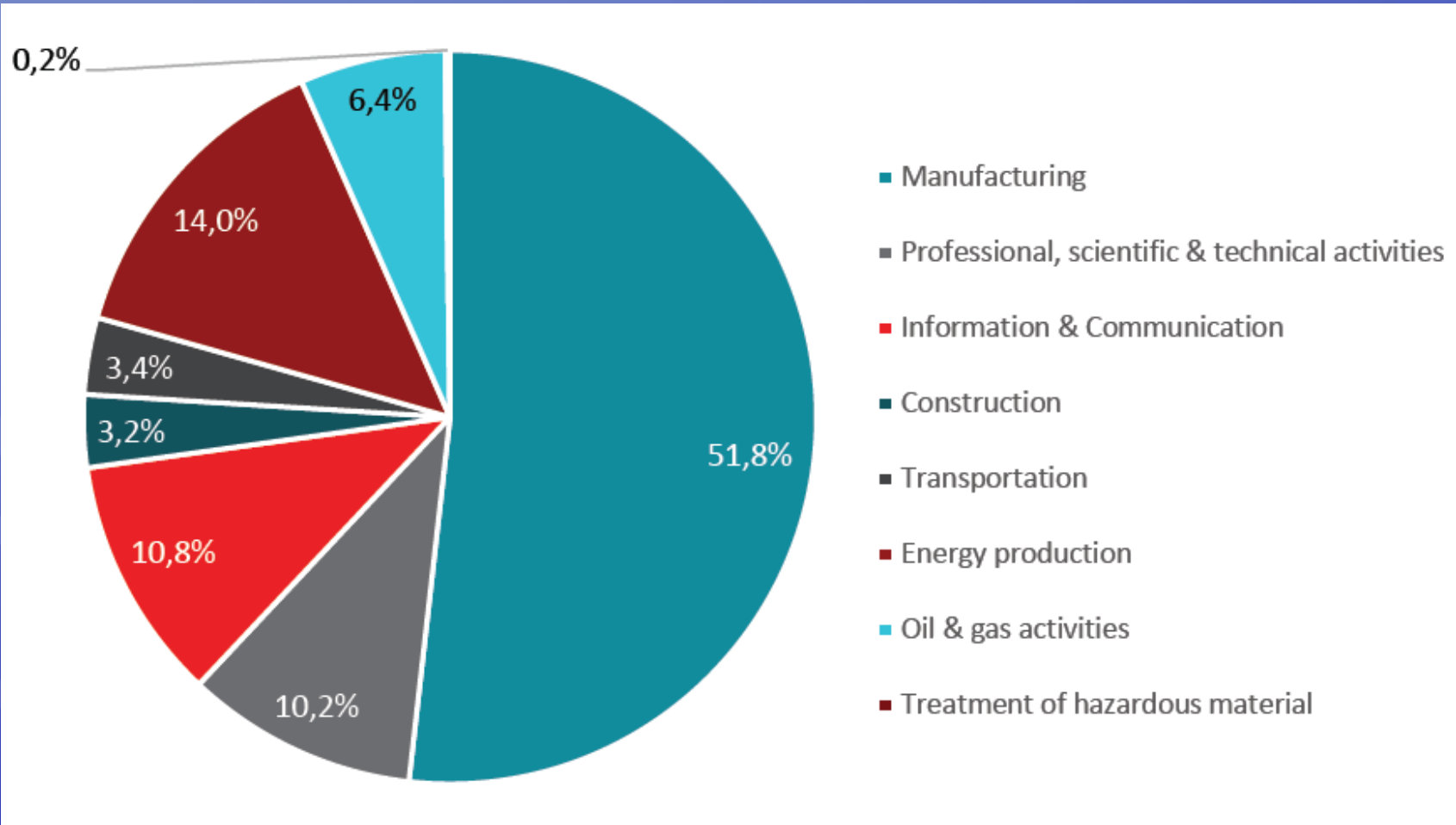
Decline in NL, Germany, U.K.¹⁵ Poland, Norway

EPS Study – physics-based industry more resilient

Physics-based turnover versus other major sectors, index (2011 = 100)



EPS Study – more than € 4.4 Trillion turnover



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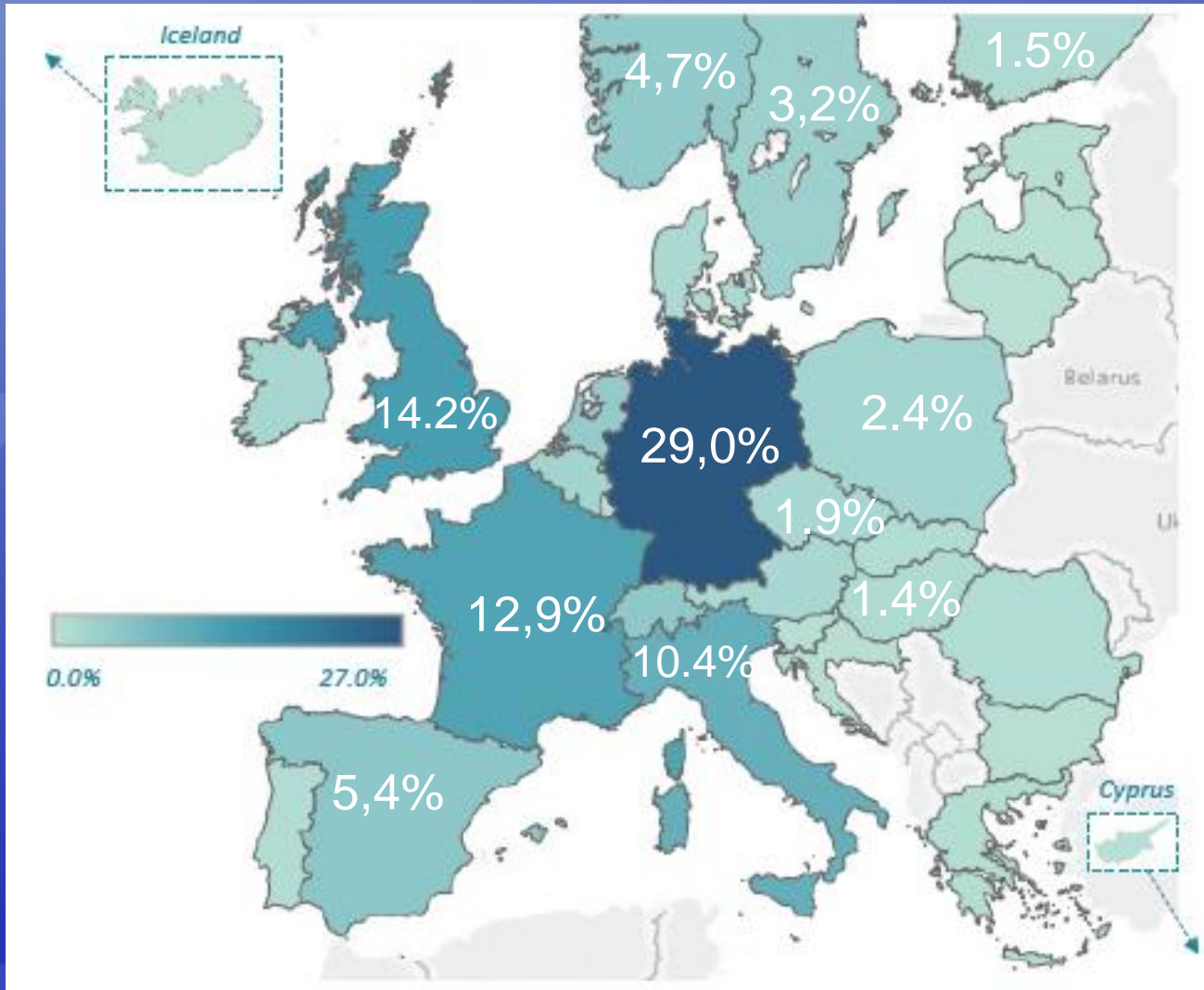
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EPS Study – % share of total turnover



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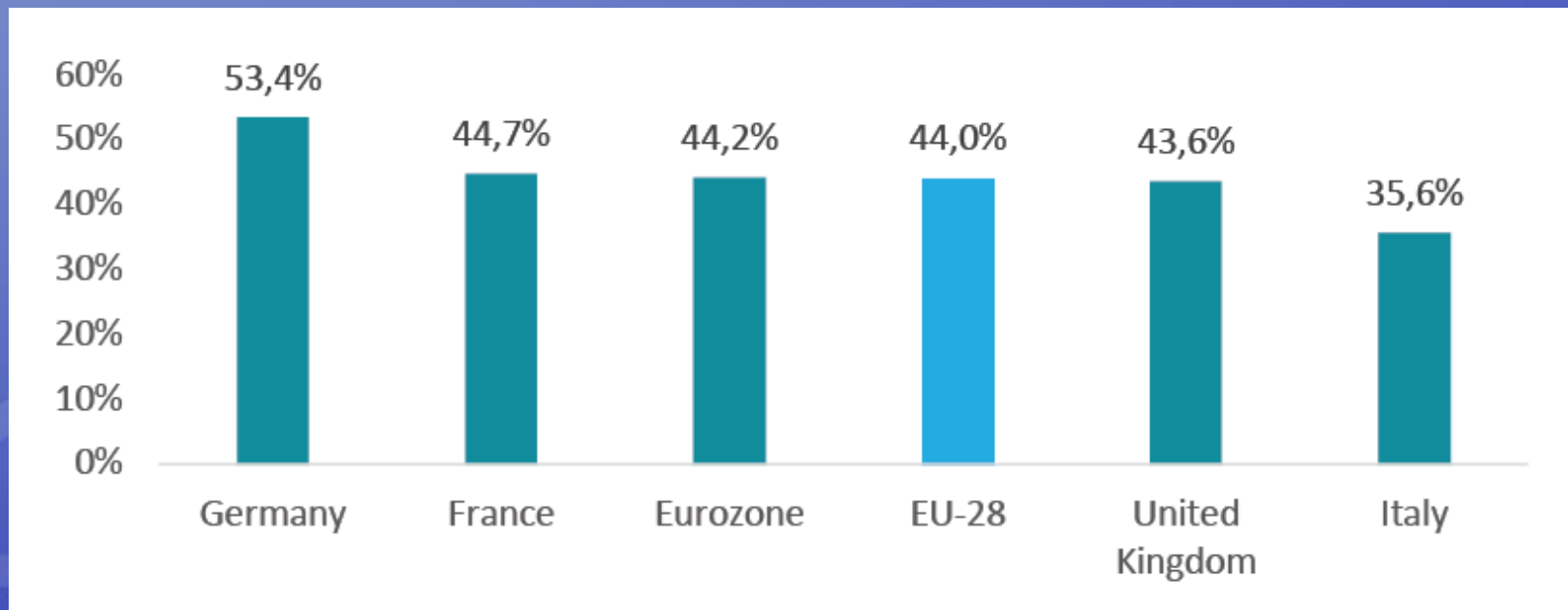
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EPS Study – Physics-based exports 44% of total exports



Physics-based exports to extra EU-28 nations as a share of each economy's total exports, aggregated 2011-2016

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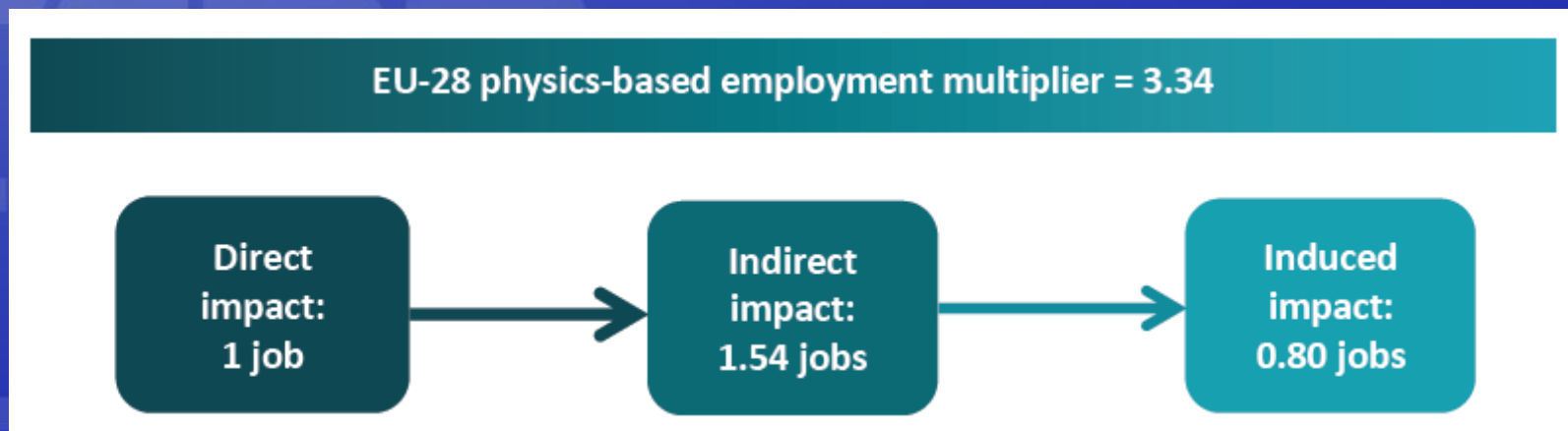
EPS Study – 17.8 Million jobs

Physics-based sector = 17.8 million jobs in 2016

12% of EU's business economy employment

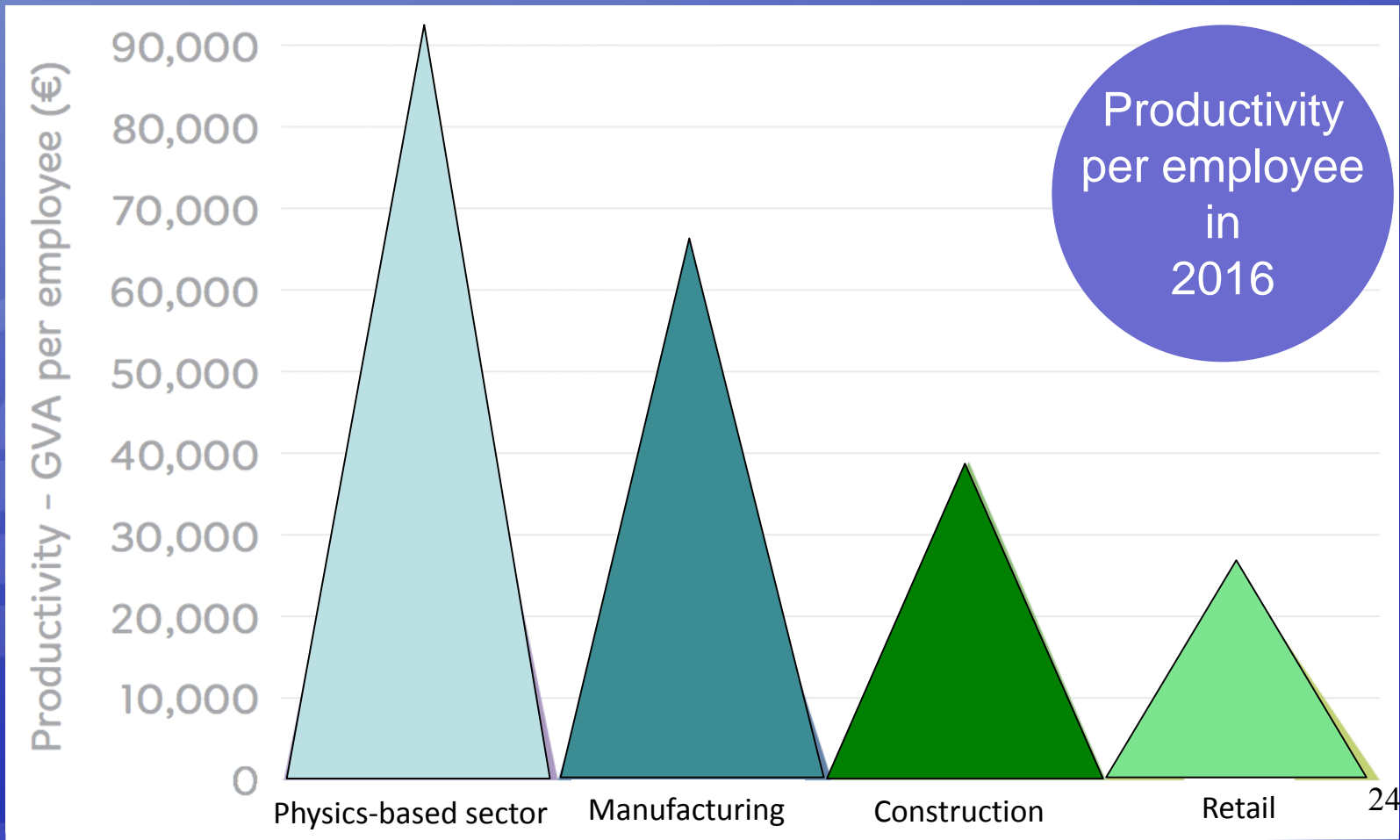
Average turnover per employee € 253,000/year

1 job created in physics-based industries = 3.34 jobs in the whole EU economy



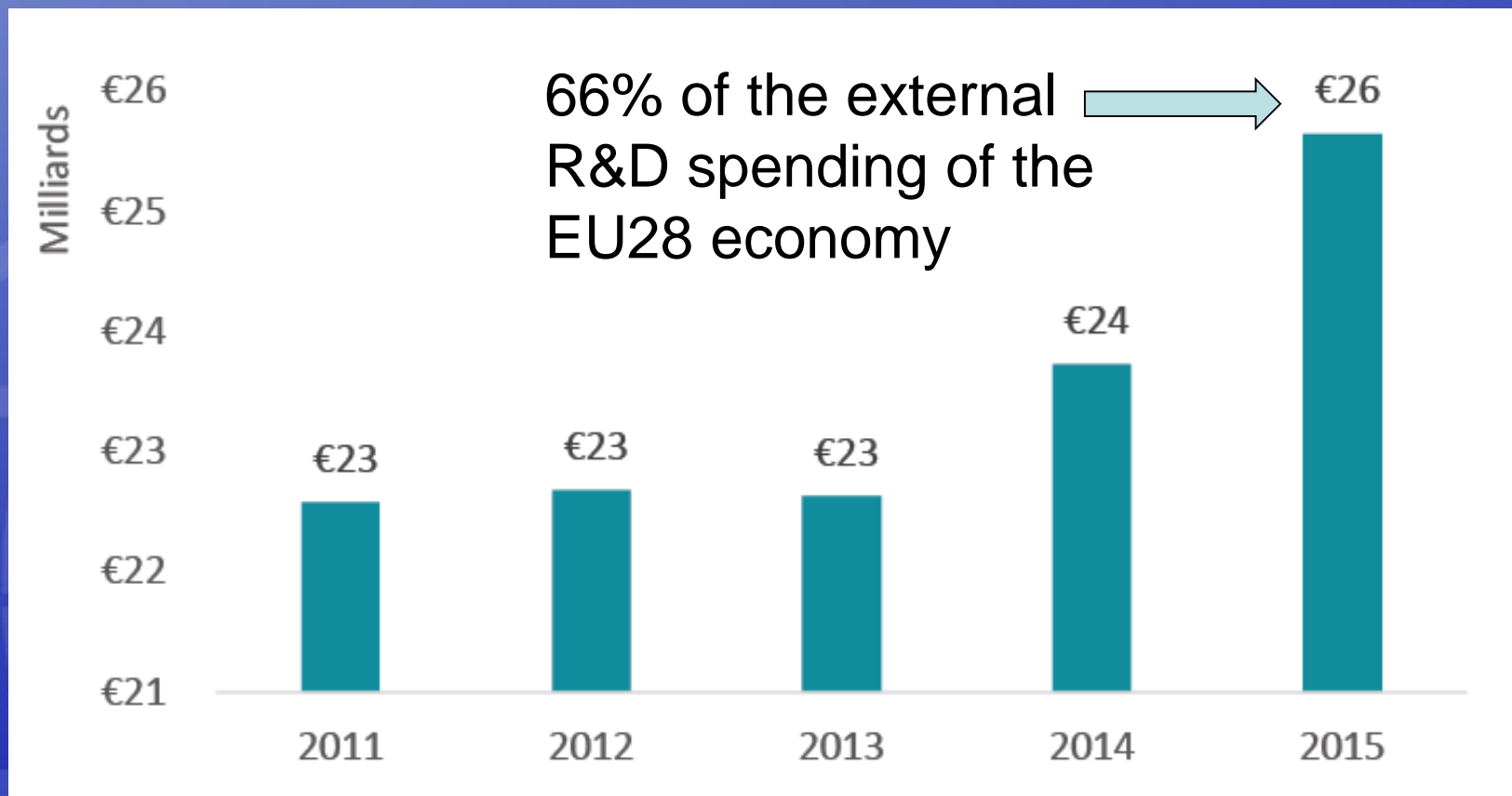
EPS Study – 91k€/employee/y

GVA = value of what is produced – value of intermediate goods and services used as inputs to produce it



EPS Study – R&D expenditure

- The European physics-based sector is highly R&D intensive BUT: 2007-2010 € 47 billion/year on scientific R&D services, now much lower !



Conclusions

Europe has a long lasting tradition in physics, science and technology

The Cebr Report commissioned by the EPS clearly highlights the importance of physics to the European economy

Will demonstrate to policy makers the current and future potential of physics and lead to continued support

R&D expenditure EU nations

- Lisbon treaty of 2000 : European governments and firms should together spend 3% of GDP annually on R&D

→ target not yet met by most !

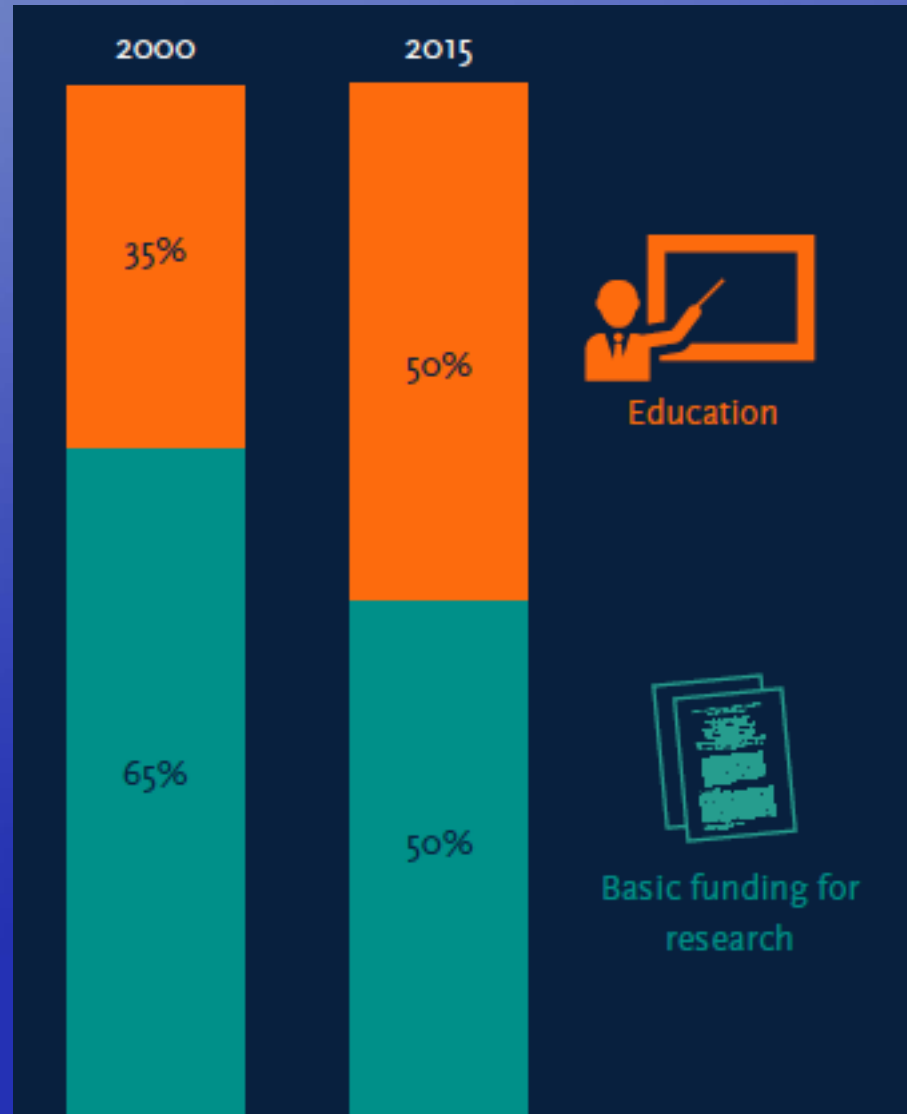
2015: Sweden, Austria, Denmark, Finland, Switzerland and Germany all invest \approx 3%. Germany 3.5% foreseen in 2025.

France 2.2%, NL 2%, U.K. 1.65%

Problem: when it comes to education, increased 'expenditure' is too often at the cost of 'investment in research'.

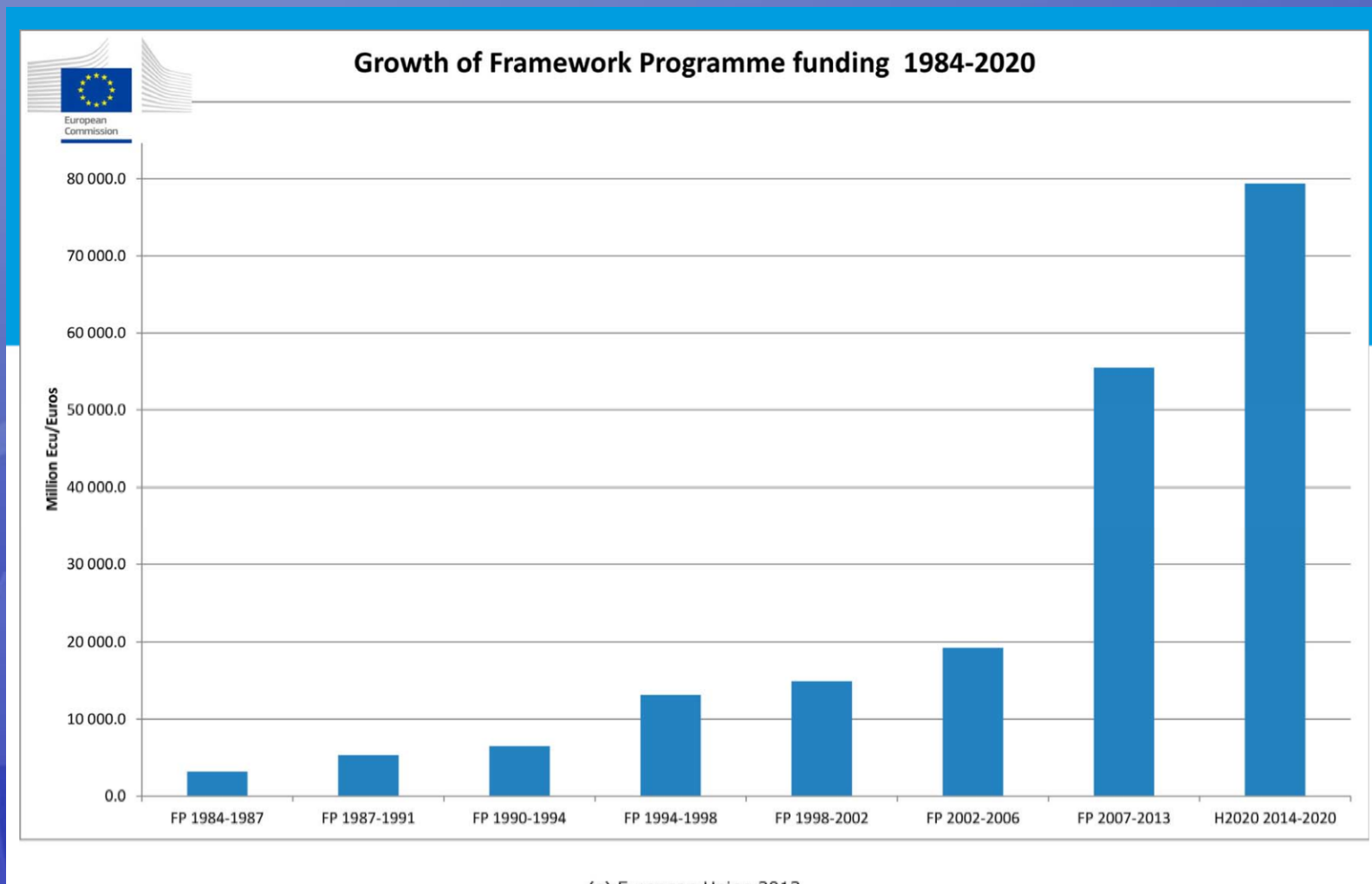
Ex. NL: 2000 - 2015, 54% more students, but direct government funding only grew by 12% → Universities have less money to invest in research.

Not sustainable for adequately educating future work force for physics-based industry!



EU Framework Programmes

Problem: increasingly accentuating economic exploitability



(c) European Union 2013

Conclusions

"Europe should become the most competitive and dynamic knowledge based economy in the world."

EU Commission, 2003

"One day, sir, you may tax it"

Michael Faraday, in reply to British Chancellor of the Exchequer Gladstone's question "What use is electricity?" (1850), *Harvest of a Quiet Eye, IoP, 1977*