



Welcome to ME2085

Transformation in Energy

Systems and Industries

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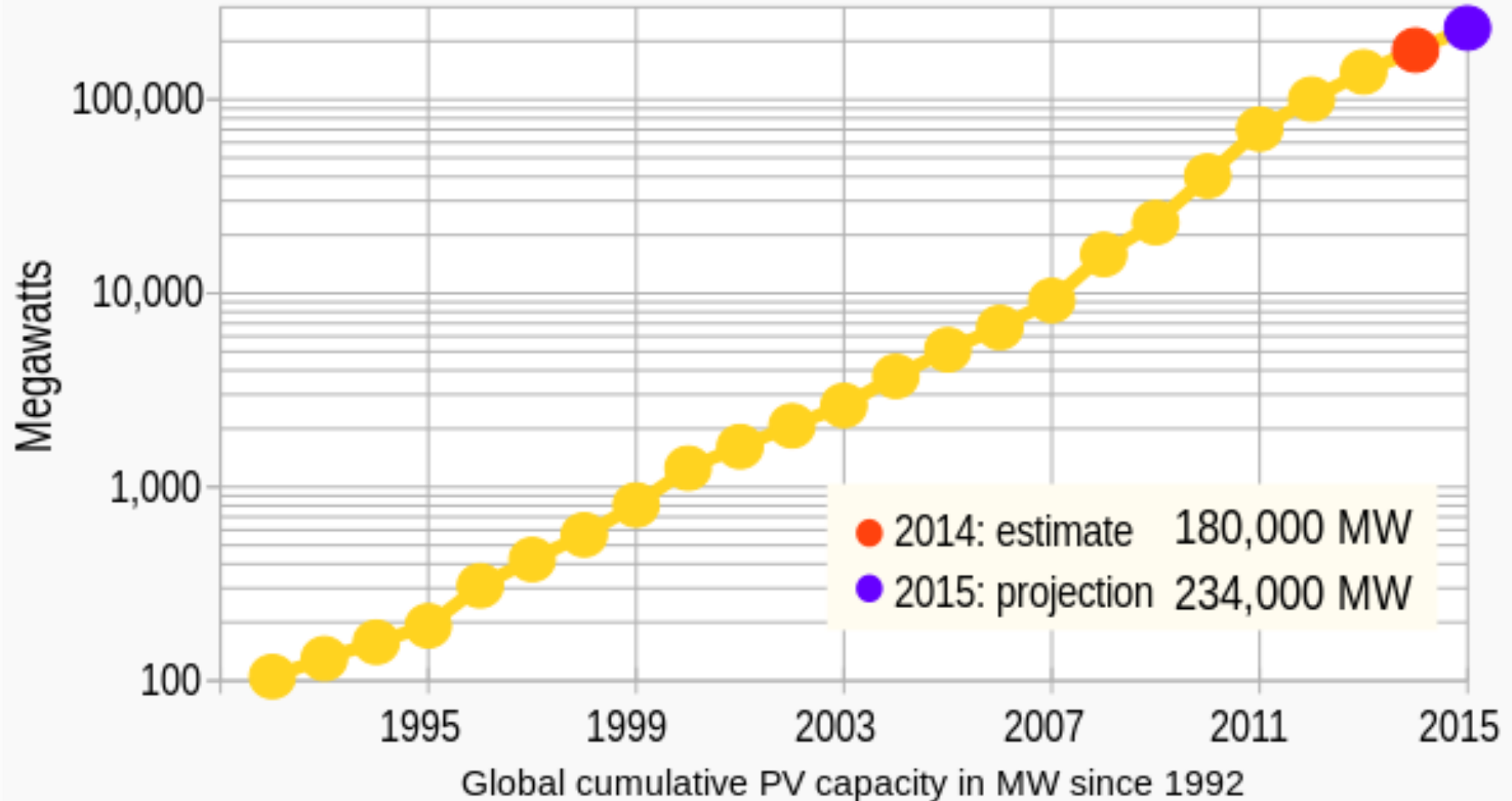
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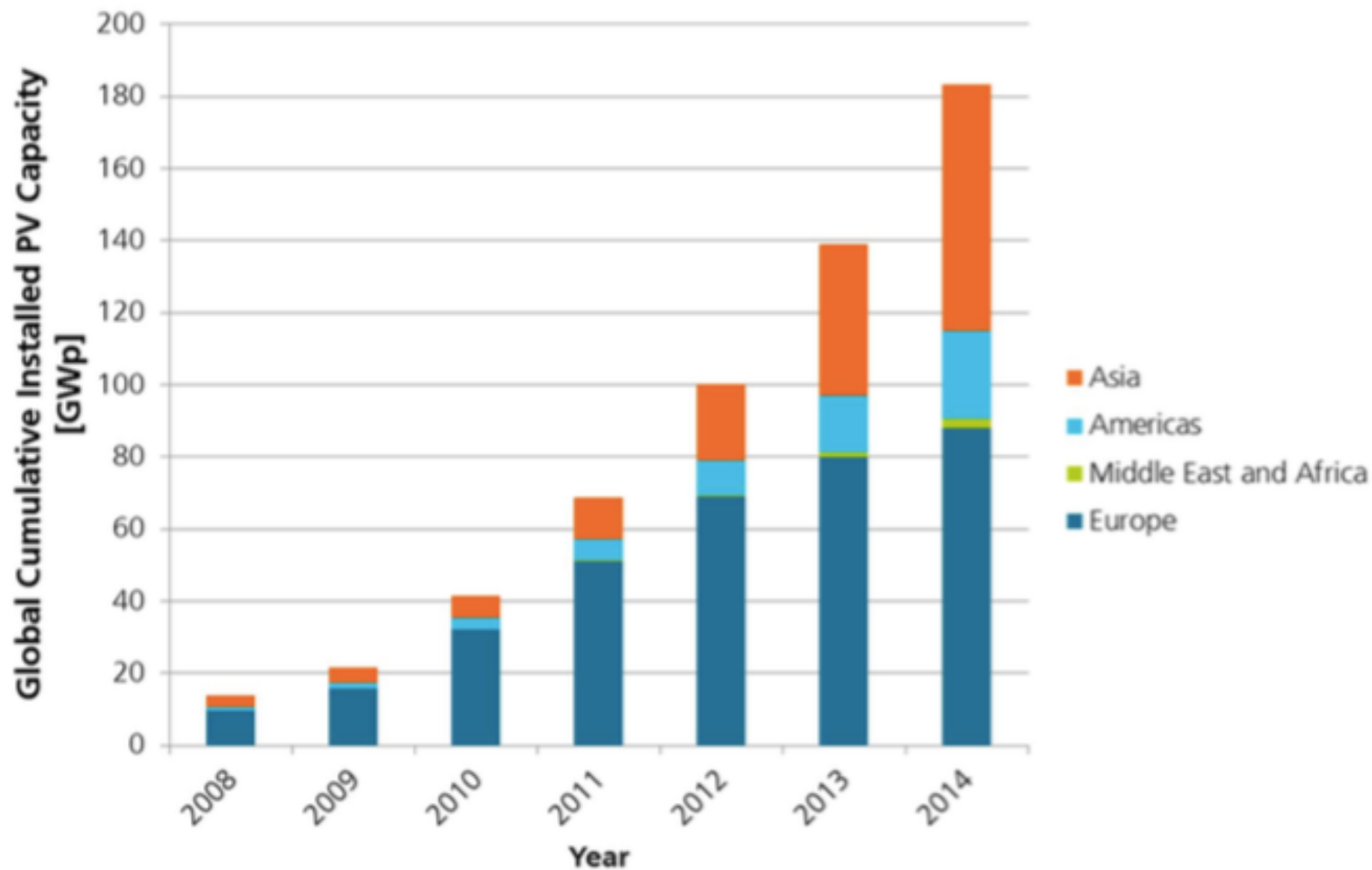


Global cumulative PV capacity

- log diagram



Fraunhofer Photovoltaics report 2015

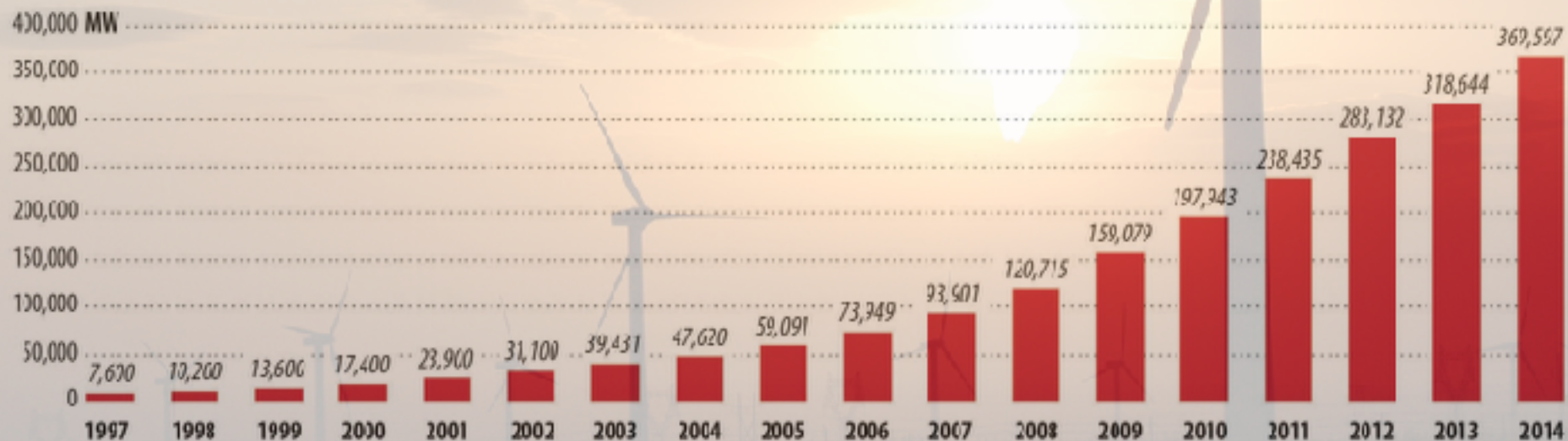


GLOBAL ANNUAL INSTALLED WIND CAPACITY 1997-2014



Source: GWEC

GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 1997-2014



Source: GWEC

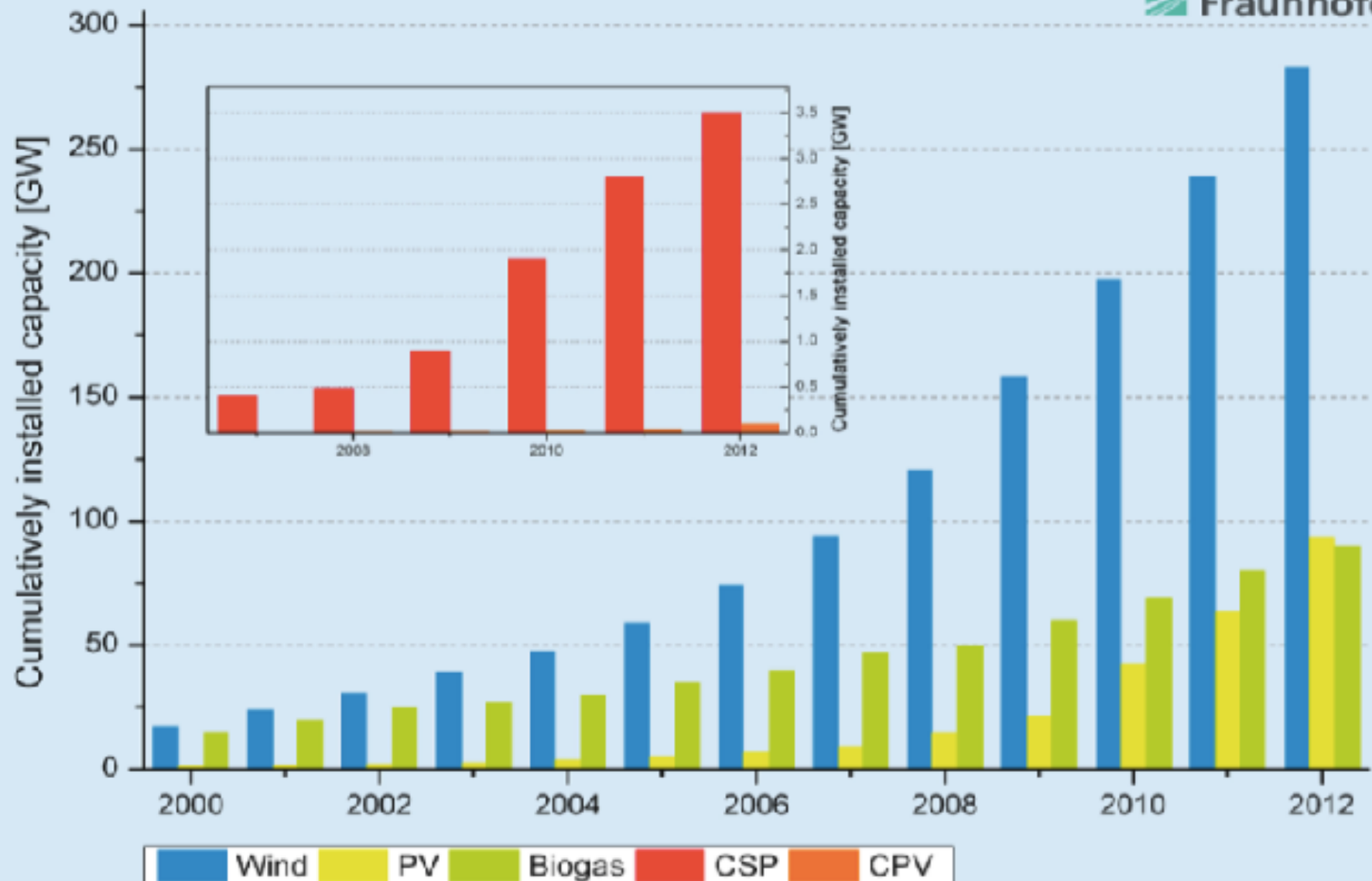
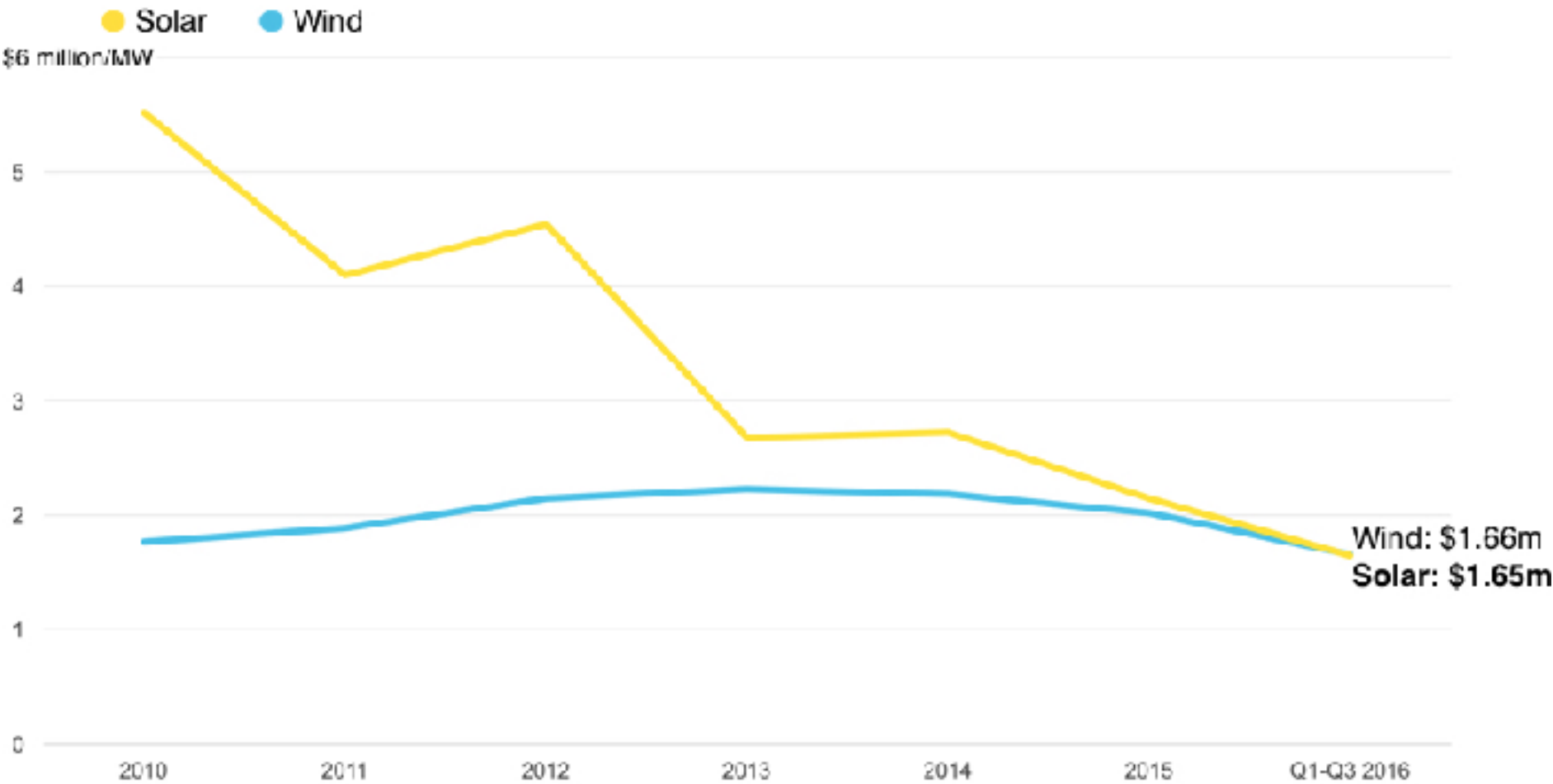
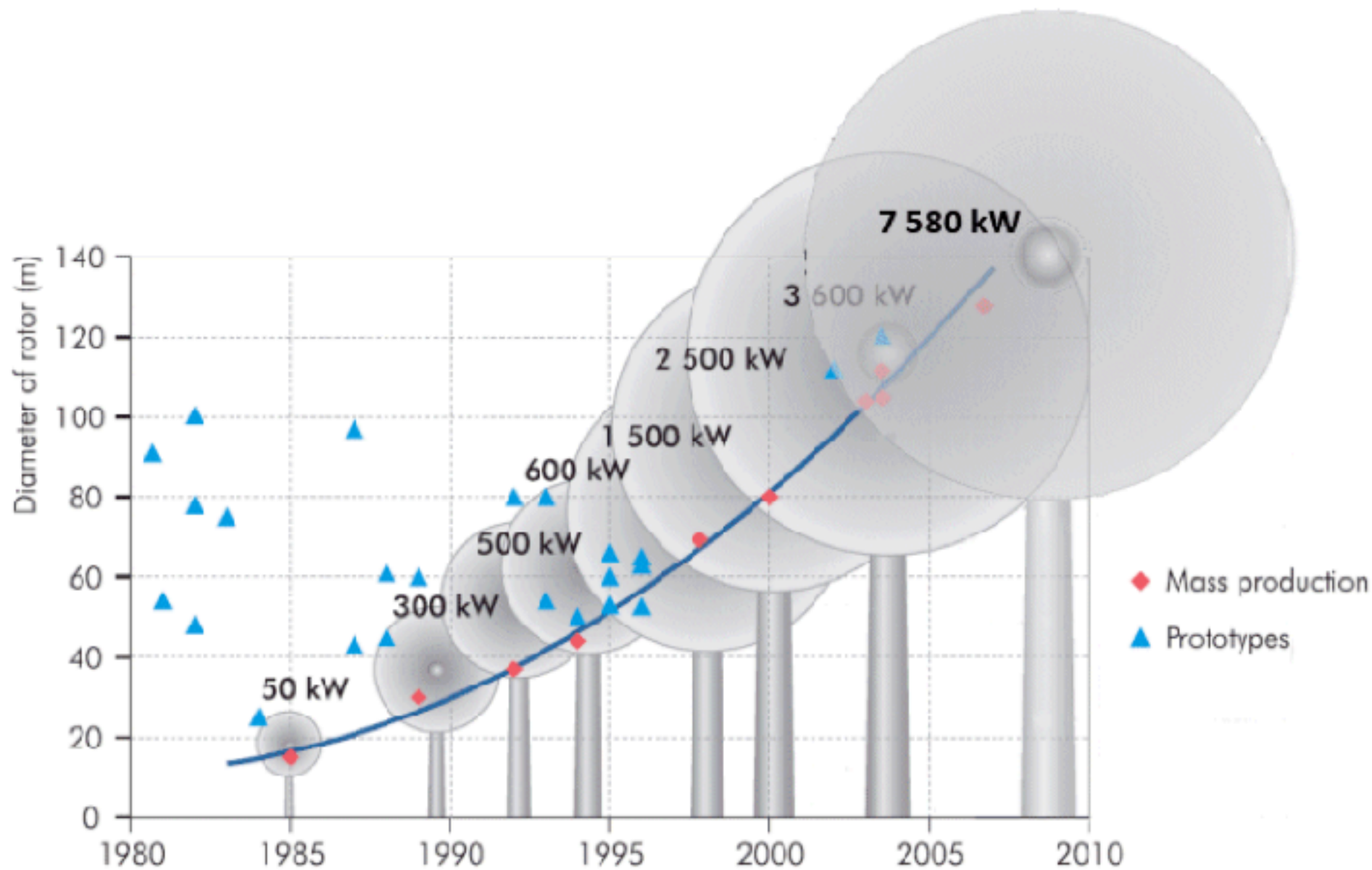


Figure 5: Global cumulatively installed capacity 2000-2012 of PV, CSP, wind power and CPV according to Fraunhofer ISE, GWEC 2013, Sarasin 2011, EPIA 2013.


Solar Surprise: Prices Fall Below Wind

A turning point for renewables in lower-income countries





Source: International Energy Agency (IEA)

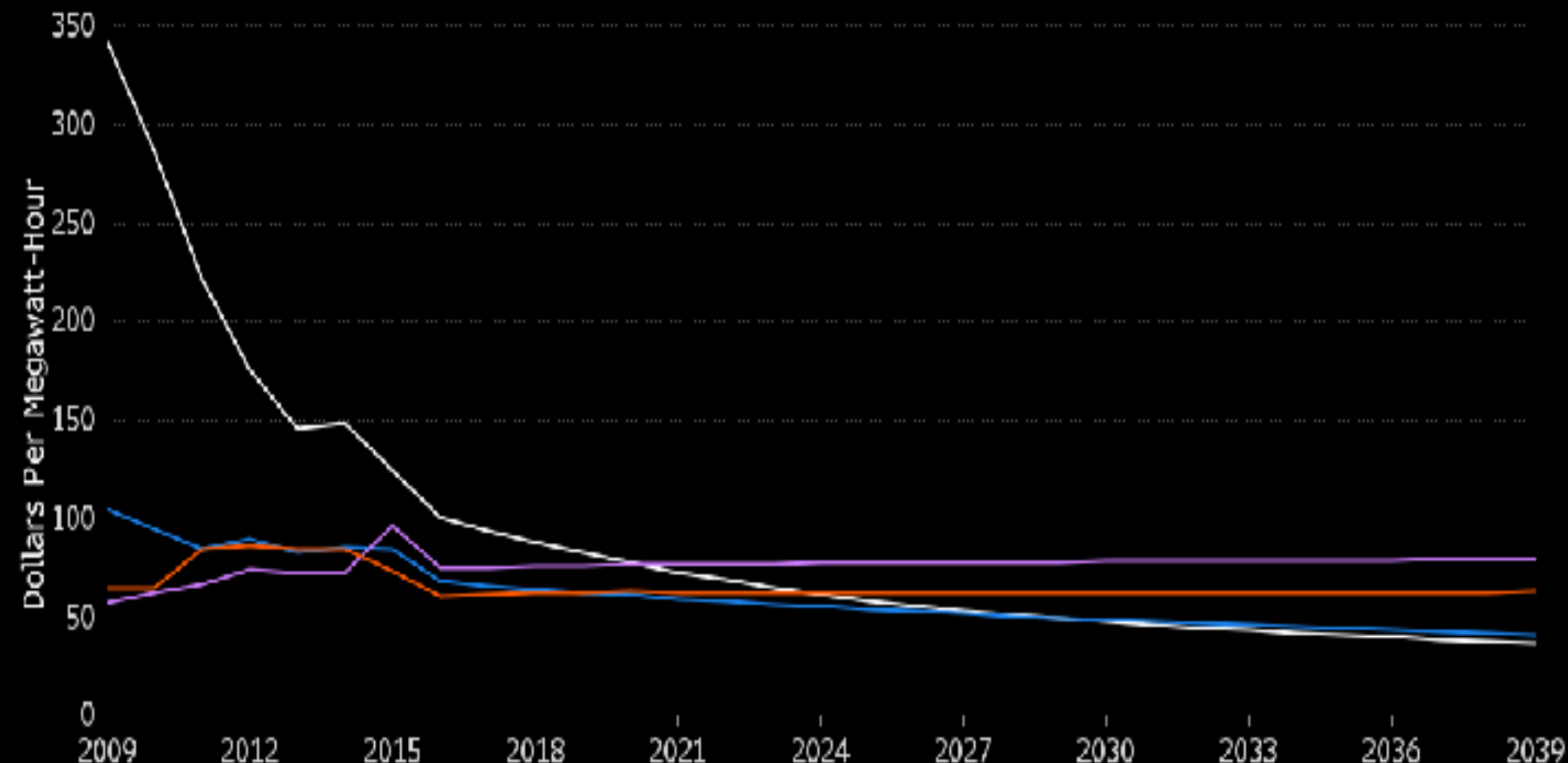


**Cumulative Green Electricity Capacity
>
Cumulative Coal Electricity Capacity**

- **Financial Times** (<https://www.ft.com/content/09a1f984-9a1d-11e6-8f9b-70e3cabccfae>) ⁹

Solar May Beat Coal in A Decade

■ Solar ■ Wind ■ CCGT ■ Coal



Source: Bloomberg New Energy Finance

Note: Price in real 2016 dollars

Challenges for Energy Industries





"The rapid growth of intermittent wind and solar [...] poses challenges for power system operators in some markets."

"...while onshore wind and solar growth was in line with what was needed to meet the Paris climate agreement's goal to stop global temperatures rising more than 2C [last year], renewables had to be used a lot more for heat and transport if the accord's aims were to be met."

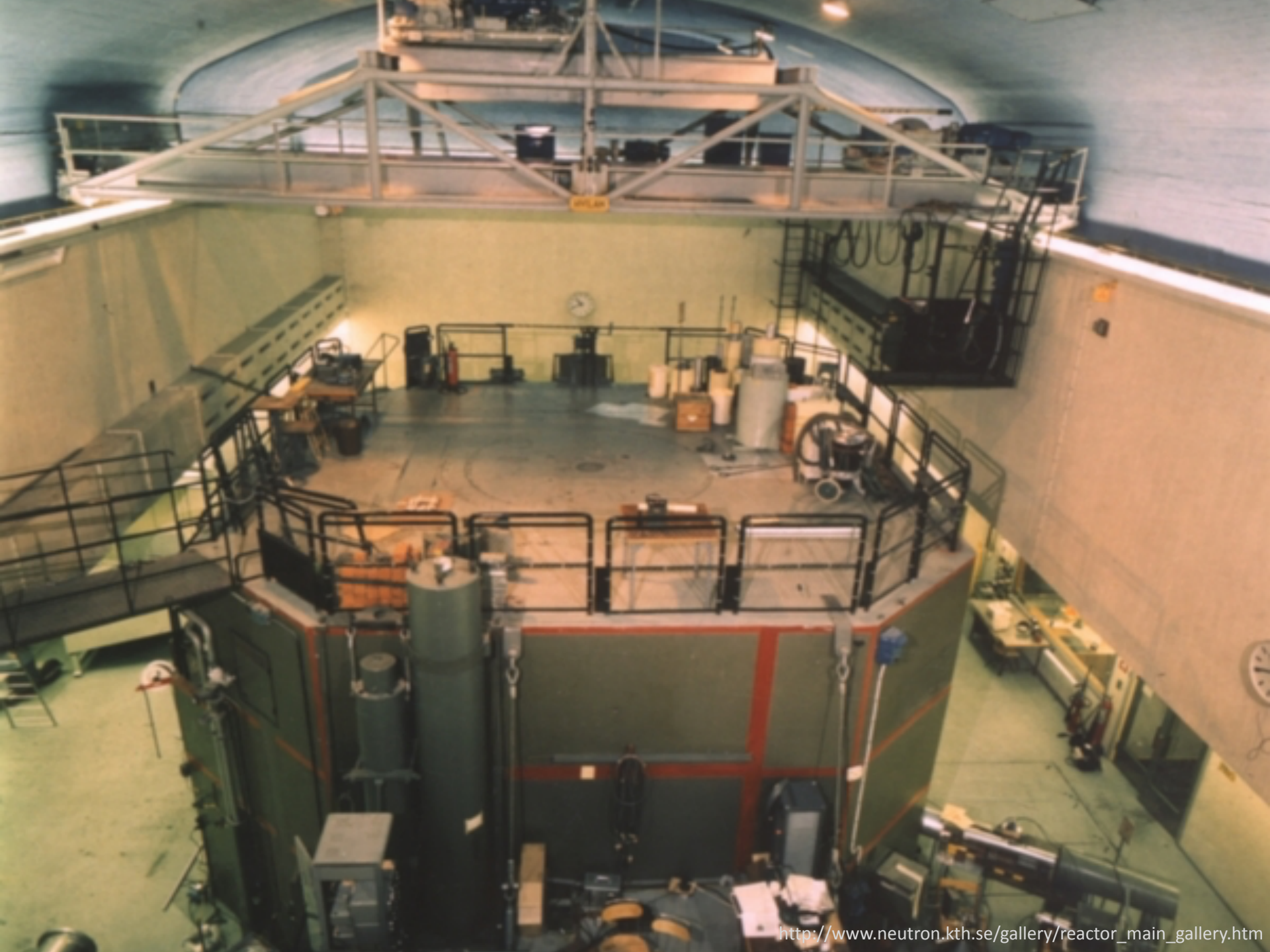
- **Financial Times** (<https://www.ft.com/content/09a1f984-9a1d-11e6-8f9b-70e3cabccfae>)

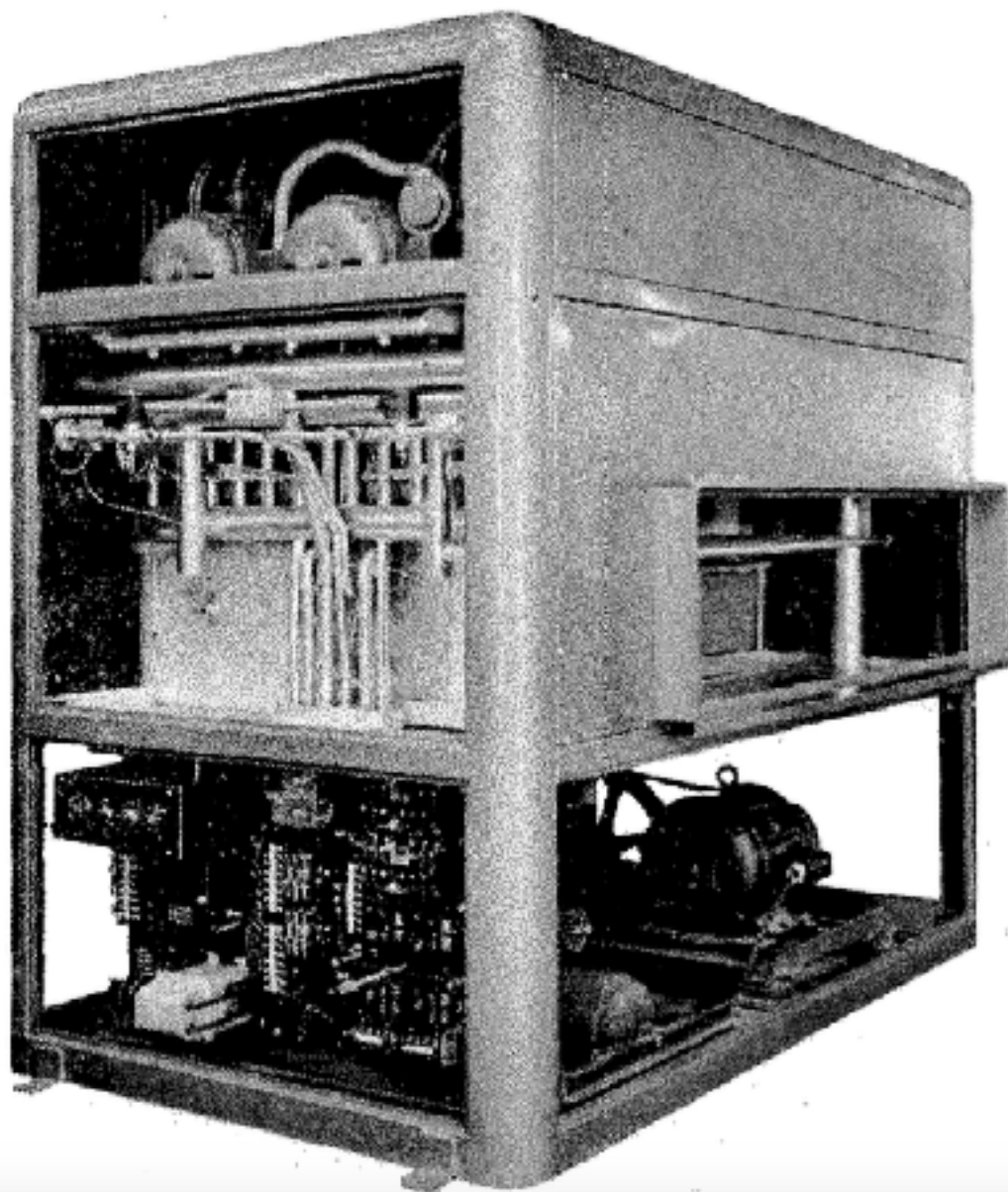
<http://www.worldenergy.org/wp-content/uploads/2013/07/Shale-gas-report.jpg>











Typical air-actuated heat pump — Drayer-Hanson's 5 hp "Airtopia". Panels have been removed to show refrigerant headers, blower motors, electrical panel and motor compressor assembly. The large opening at right, center, is outside air inlet.

A 1948 heat pump

The new energy landscape
is putting pressure on energy systems
and energy industries
to undergo rapid and
transformative change

Managers are needed
that understand
both **technical** *and* **social** aspects
to manage change in energy systems and
energy industries

TEACHING OBJECTIVES

- Understand **causes behind** transformations of the energy system and industries (TESI)
- Understand **consequences from transformations** from ethical, political, economic, and societal aspects of TESI
- Evaluate and apply **theoretical concepts from industrial dynamics** and **evolutionary economics** to TESI
- Conduct scientific based **analysis of strategies and policies** concerning TESI
- Formulate **change management approaches** for TESI based on data from various sources
- **Present scientific results** concerning TESI orally and in writing

THIS COURSE'S TEACHING APPROACH

Blended learning

- Both in class and online lectures
- A Group Project that runs throughout the course
- Readings/viewings (texts and/or online films) before class – see Schedule in Course PM
- In class discussions, application of concepts for problem-solving
- 4 Online tests and in-class mandatory assignments

EXAMINATION

TEN1 = 2 credits

- written exam 4 credits – grade A-F
- we will go through many of the exam question during lectures

SEM 1 = 4 credits

- project work, grade A-F

THE GROUP PROJECT

"New Business Models for Energy
Companies in a 100%
renewable energy system"

- *You choose your business area*

Project work details

See Course PM on Canvas

OTHER MANDATORY TASKS

- 4 Online tests (See Canvas)
- Mandatory exercises in class (also mandatory to participate at guest lectures)

CANVAS

- We will use the online tool Canvas
- <https://kth.instructure.com/>
- To access Canvas you must
 - Be admitted to the course
 - Be registered to the course
- Do it, do it naow!

Schedule

2017-01-17: In class lecture

2017-01-20: Online lecture

Online Test 1: Deadline 18:00 Jan. 20

2017-01-24: In class lecture

2017-01-26: Online lecture

Online Test 2: Deadline 18:00 Jan. 26

2017-01-31: In class lecture

2017-02-02: Online lecture

Online Test 3: Deadline 18:00 Feb. 2

2017-02-06: Online lecture

2017-02-09: Online lecture

Online Test 4: Deadline 18:00 Feb. 9

2017-02-13: In class lecture

2017-02-14: In class lecture

2017-02-16: Extra time-slot (no lecture or exercise)

2017-02-20: Online lecture

2017-02-21: In class lecture

2017-02-21: Submit report draft

2017-02-24: Room booked for project work/
own studies

2017-02-25: Submit written feedback

2017-02-28: Seminar

2017-03-02: Room booked for project work/
own studies

2017-03-06: Room booked for project work/
own studies

2017-03-06: Submit final report

2017-03-13: Exam

CONCERNING THE SCHEDULE

- See Course PM on Canvas for details
- We will skip the time-slot at 2016-02-16 and instead have the seminar at 2017-02-28
- All in-class lectures are mandatory! Especially the ones with guest lectures
- See Canvas and www.kth.se/schema for updates

LITERATURE

- See **Course PM** for list of readings
 - **Course PM** is uploaded to Canvas
- Main course literature book: 'A Dynamic Mind' (Blomkvist & Johansson, 2016)
 - Available to buy (150SEK) at the Indek Student office at the Sing-sing building, Lindstedtsvägen 30

REMEMBER!

- The web registration period for spring semester and courses study period 3 is from January 9 until January 19, 2017.
- Register for the exam ca 3 weeks before the exam
- The date 16/2 is cancelled

NEXT TIME

- Online lectures on Energy systems and systems thinking, found at Canvas (available on Canvas this Thursday)
- An online quiz/test with deadline 18:00 Jan. 20



A tall, white wind turbine with three blades stands on a vibrant green field. The sky is a clear, bright blue. The turbine's blades are white with red and blue markings near the tips. The overall scene is bright and clear, suggesting a sunny day.

UNTIL NEXT TIME

- **Read the Course PM!**
- **Read The Economist (2013) - How to lose half a trillion euros (available online)**
- **Get acquainted with the statistics reports from Energimyndigheten and Fraunhofer ISE**

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