Photovoltaic Technology Trends

Solar cell – building element - artwork

Laure-Emmanuelle Perret

Source: Reiser

Order of magnitude

Sun intensity1000 W/m²

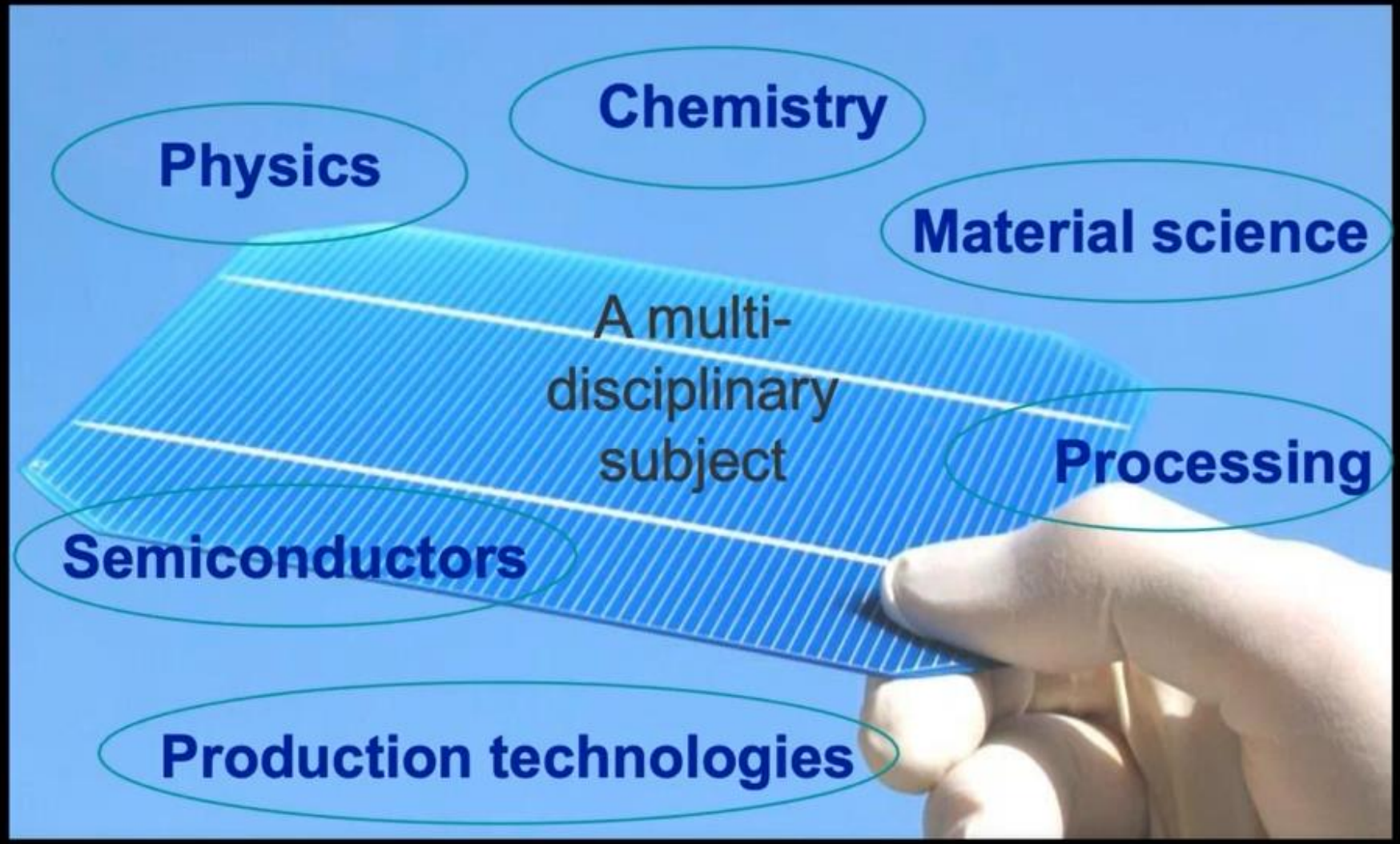
In CH~1000-1500 full hours

1000-1500 kWh/m² per year

Up to one barel (159 litres) of oil per m² par year

*1 liter gasoline ~10-11 kWh chemical energy

Photovoltaics = direct conversion of light to electricity



Potential of PV Energy: some rough estimation

With 20% efficiency module

All the electricity of USA (3.9 PWh in 2018)

All the energy of USA

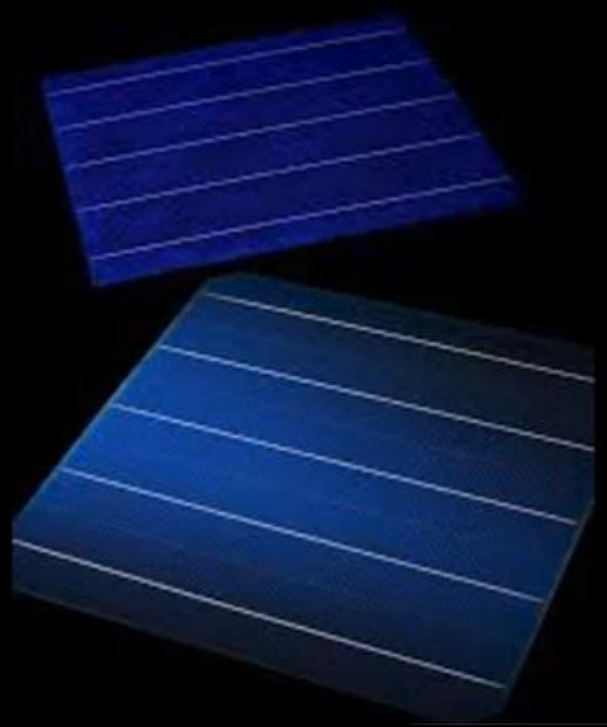
= Area of Switzerland, to scale

Introduction

Some numbers, yesterday and today

In 1998, 40 millions of solar cells produced at 25 CHF/piece

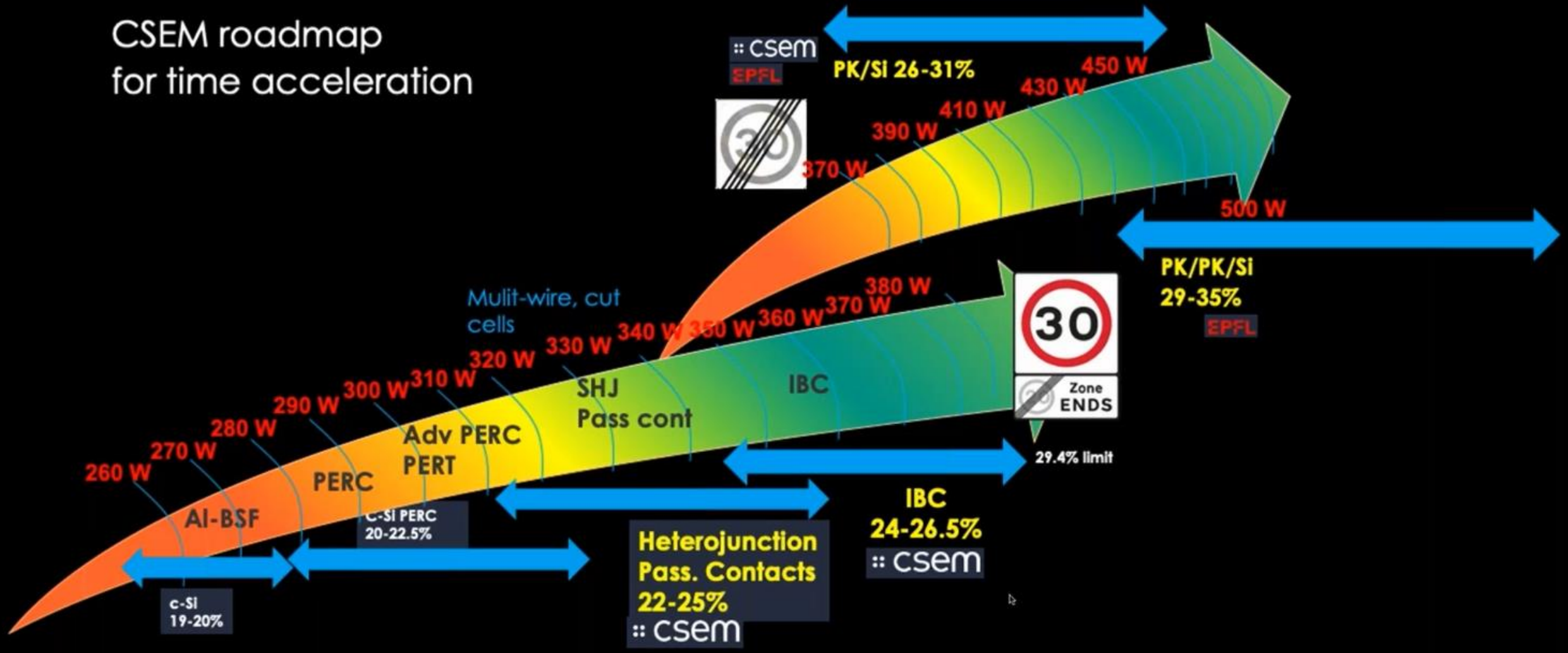
In 2017, 17 milliards of solar cells produced at 1.2 CHF /piece



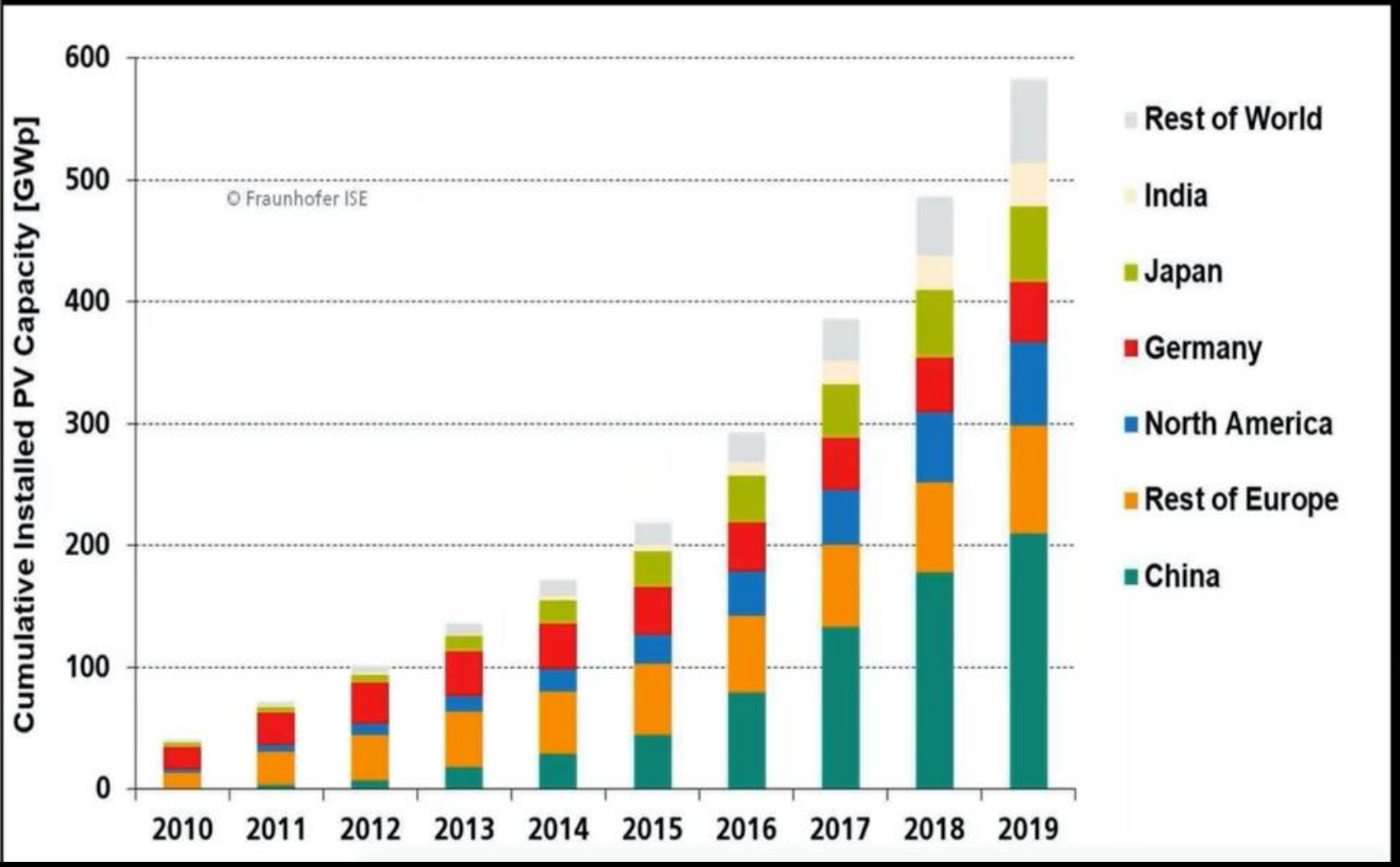
Today we buy solar cells at 0.80 CHF/piece

4.5 ct / kwh

CSEM roadmap for time acceleration



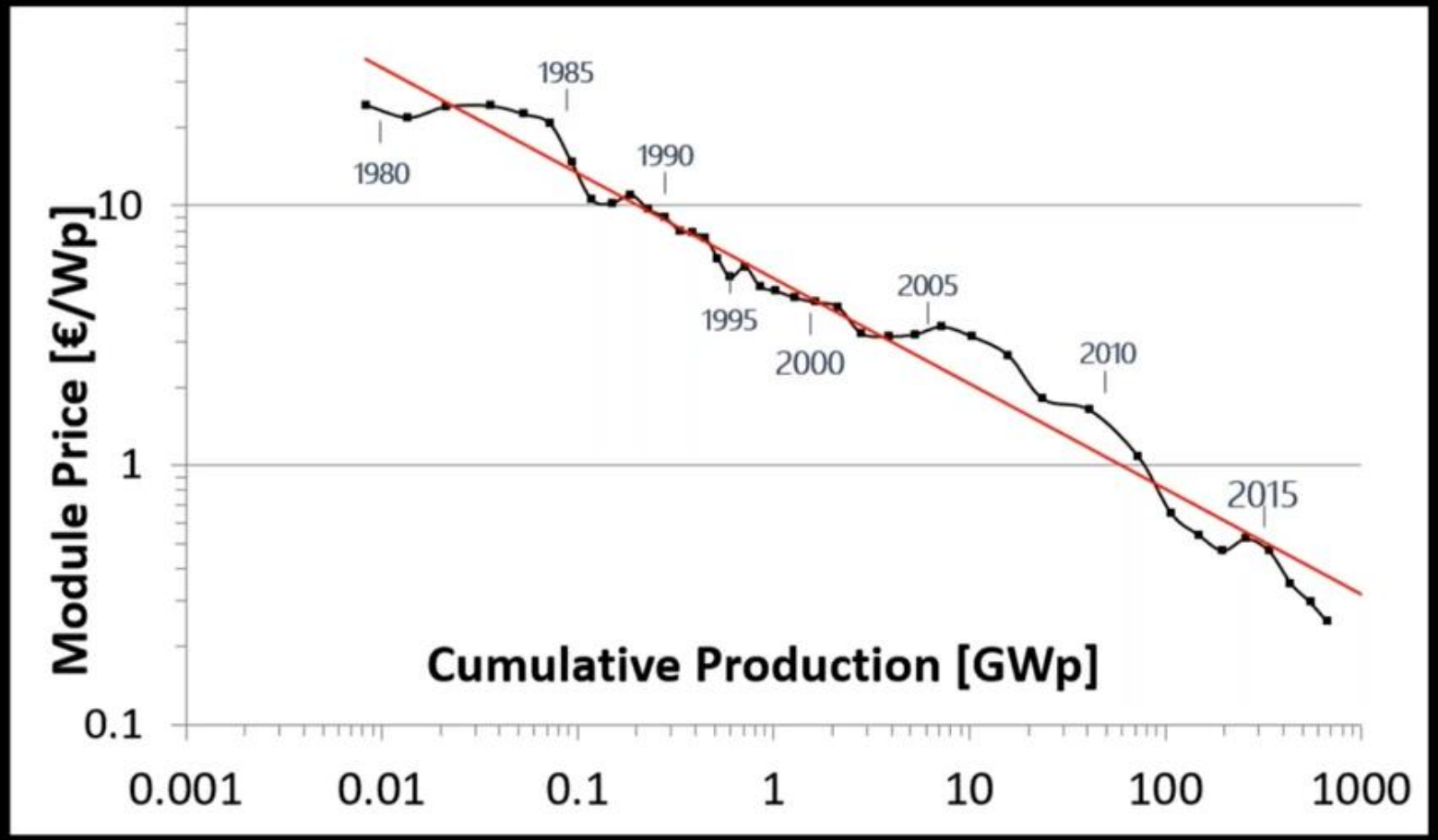
GLOBAL MARKET



- Europe as an initiator of volume installation; stagnating since 2012
- Now: Asia and USA
- End 2020 close to 750 GWp PV installed
- by 2030: expect 1-3 TWp installed (likely China, USA, India, Chile)

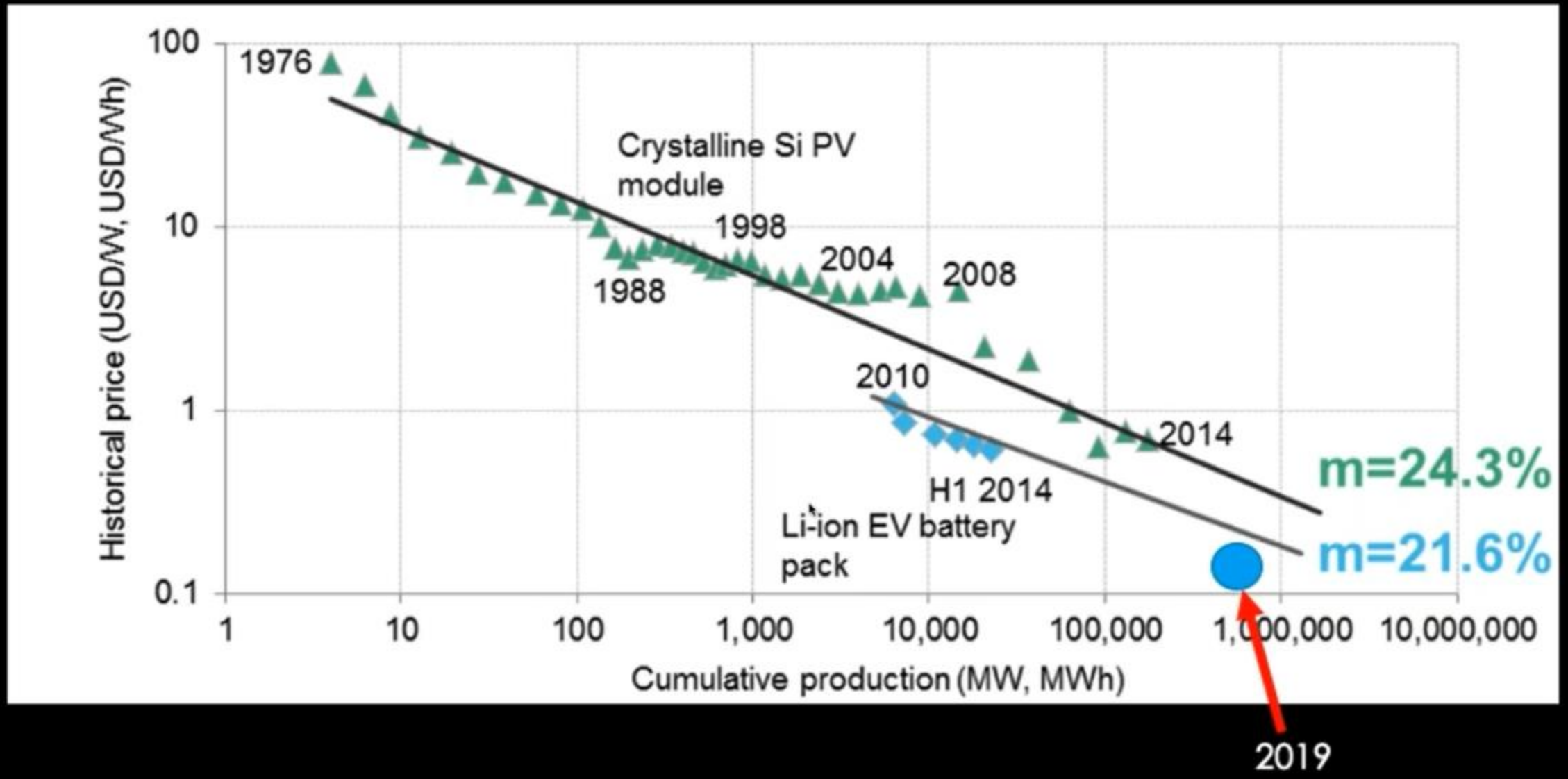
Source:
PV-Report, Fraunhofer ISE (May 2019)

Learning curve for modules, inverters, mounting and engineering



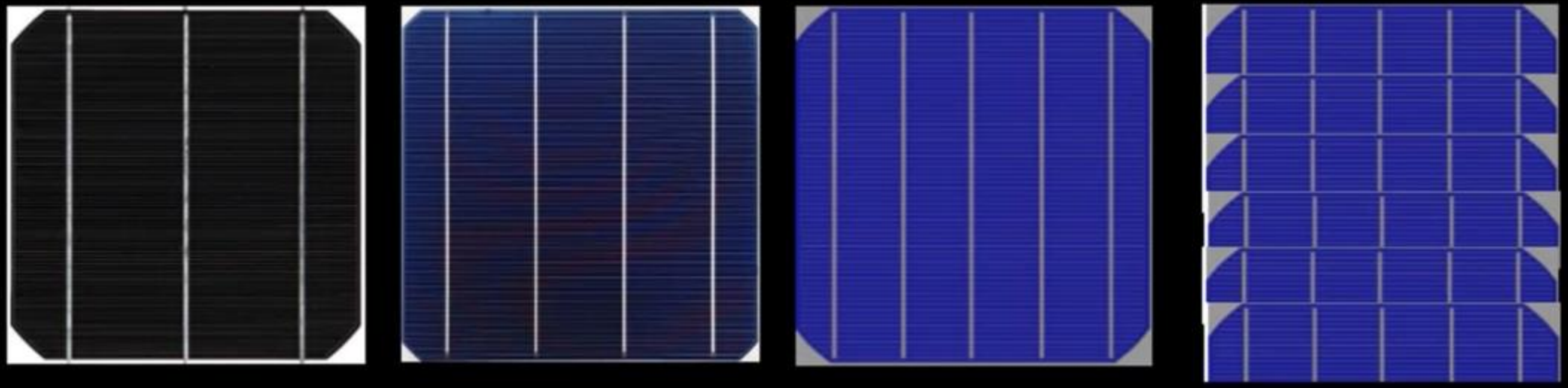
- Current standard PV module price down to 22-30 cts/Wp (~ 40-55 CHF/m²)
- In 30 years, the cost/watt decreased by a factor 30-50.
- 0.2-0.3 CHF/Watt

Battery: same learning curve as photovoltaics



Technological trends

The trends which makes PV even cheaper, and greener



- More busbars to save on the cost of screen-printed Ag lines ½ cell or shingled cells to gain space and reduce loss in ribbons

100 mg less of Ag per solar cell, 0.5% more power

Potential of PV

The cheapest source of energy

Global warming is fundamentally an energy problem

- 2/3 of greenhouse gases are emitted by oil, coal and gas combustion.
- In Switzerland, the main emitters are **transport** and **construction.**
- Today in Switzerland, the photovoltaics contribution is only of 3%.
- By increasing energy efficiency and making full use of renewable energies, Switzerland can reduce its CO_2 emissions by 85% and even more.

Major role of PV in the decarbonisation

- Increase world PV module production to 1 TW by 2030 (x10)
- → 25 TW installed by 2050
- → 30’000 TWh (2017 world electricity consumption of 22’000 TWh)

Potential in Switzerland

Switzerland is producing 3.5 % of solar énergie, we need to multiply this number by 25!

- Supress nuclear power plant
- Electrified mobility
- Electrified buildings to supress oil

Potential on our roofs: 50 TWh (= entire Swiss consumption!)

Potential on façades: 17 TWh