

FOTOVOLTAIKA ZÍTŘKA

M. Ledinský Fyzikální Ústav AVČR

R. Dvořák, A. Vlk, M. Hývl, Z. Hájková, M. Hladík, A. Fejfar



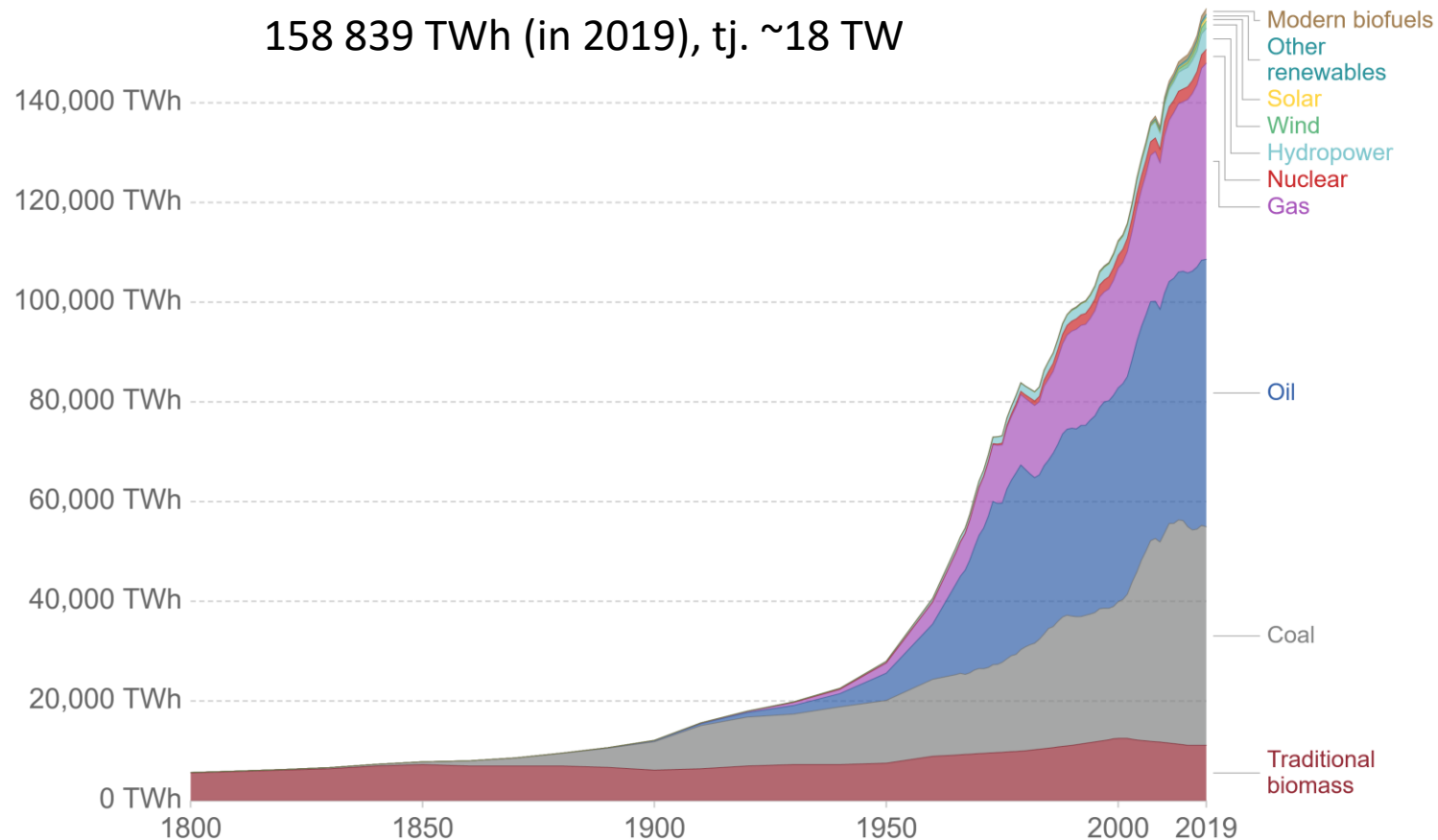
EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
Operační program Výzkum, vývoj a vzdělávání



Kolik potřebujeme energie

Global direct primary energy consumption

Direct primary energy consumption does not take account of inefficiencies in fossil fuel production.



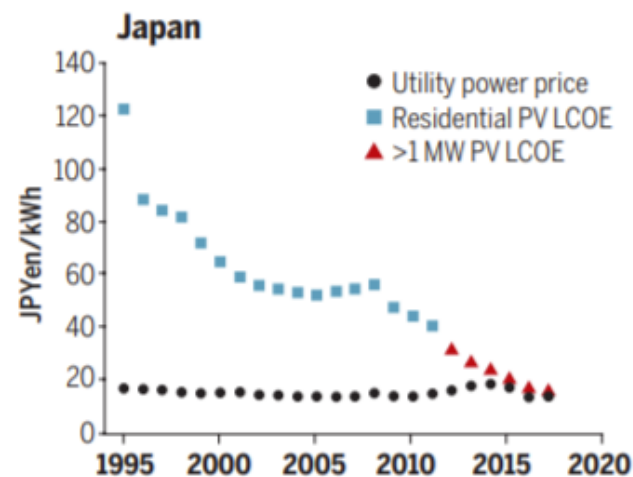
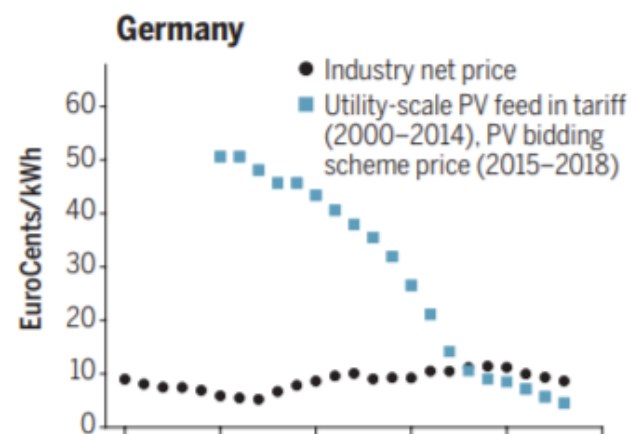
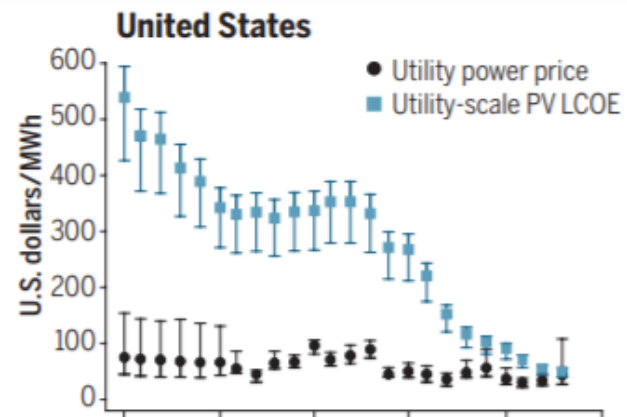
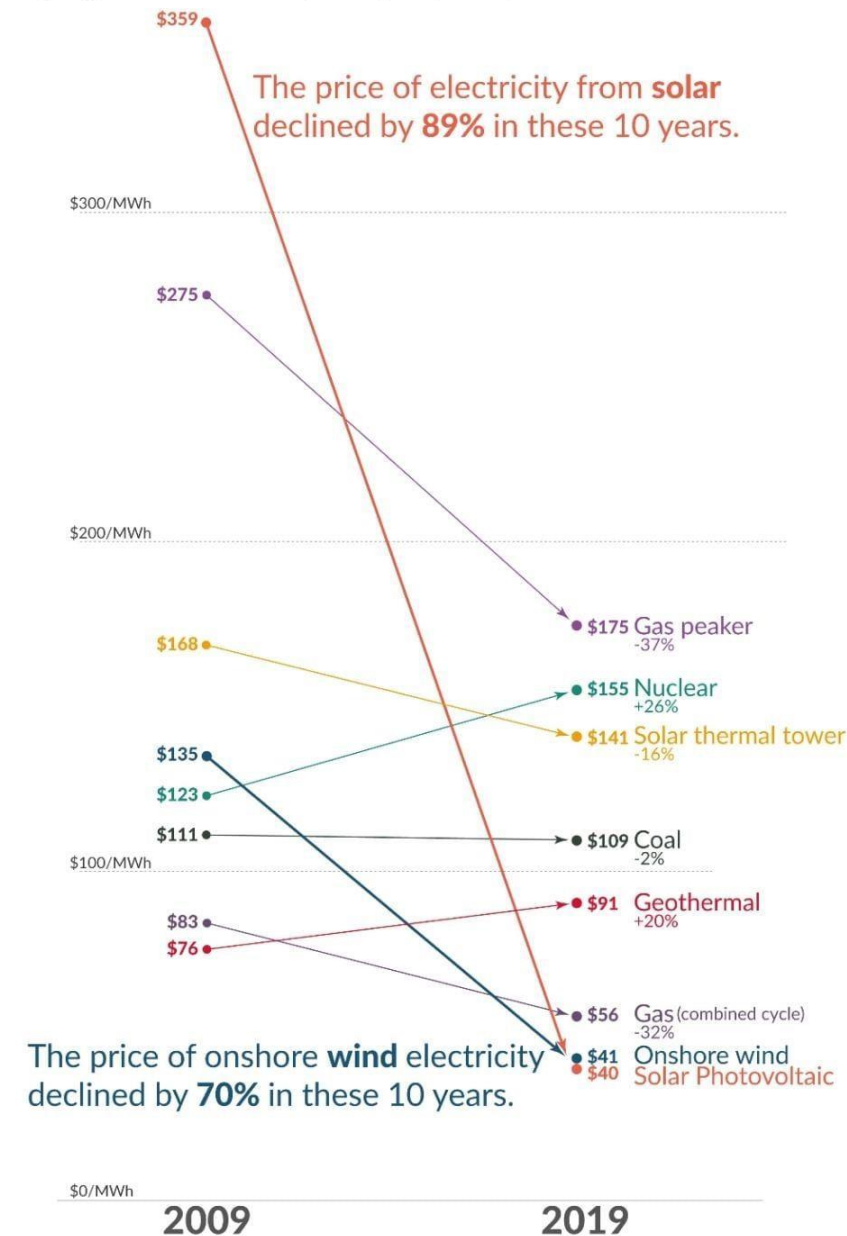
Source: Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

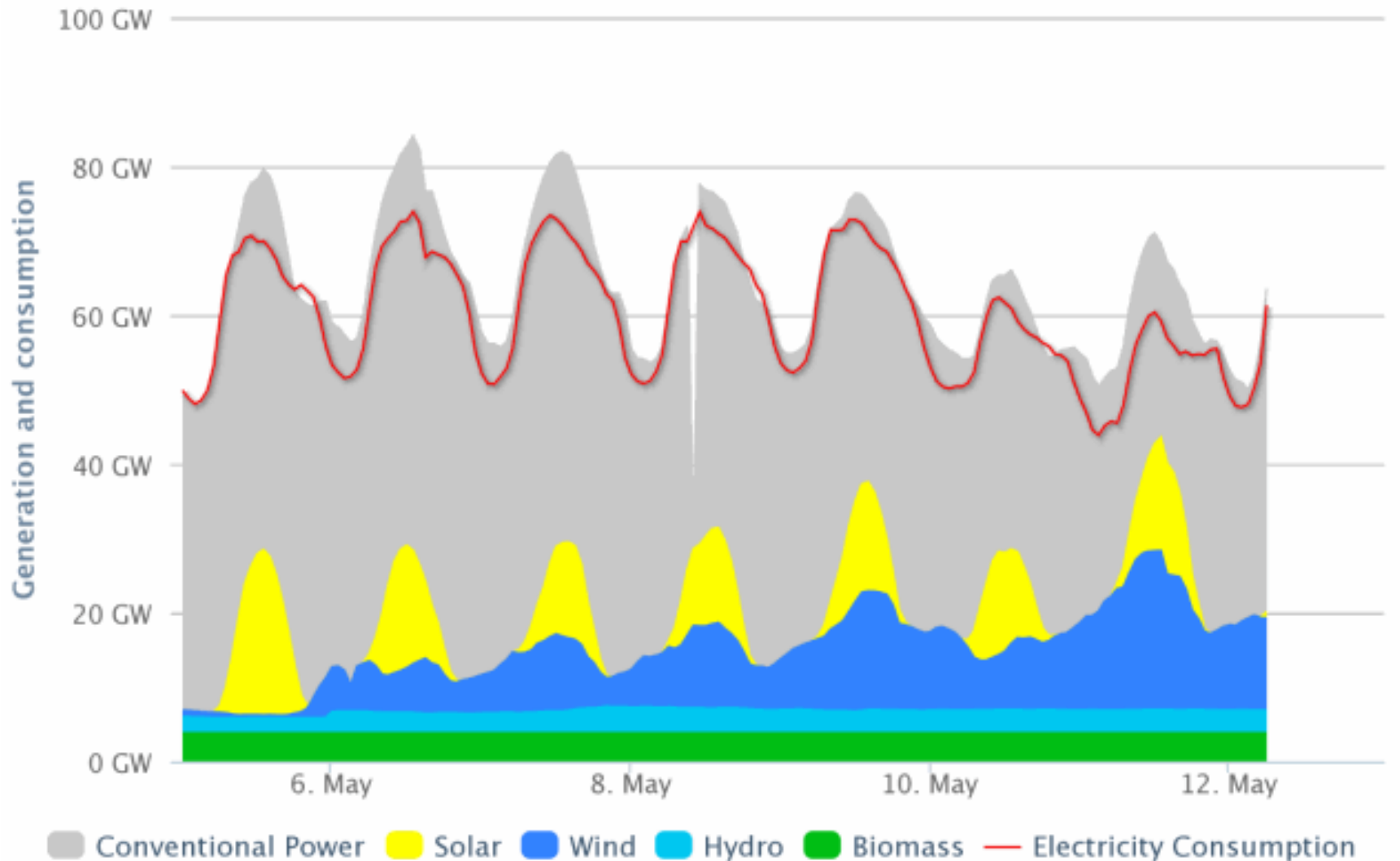
The price of electricity from new power plants

Our World
in Data

Electricity prices are expressed in 'levelized costs of energy' (LCOE). LCOE captures the cost of building the power plant itself as well as the ongoing costs for fuel and operating the power plant over its lifetime.

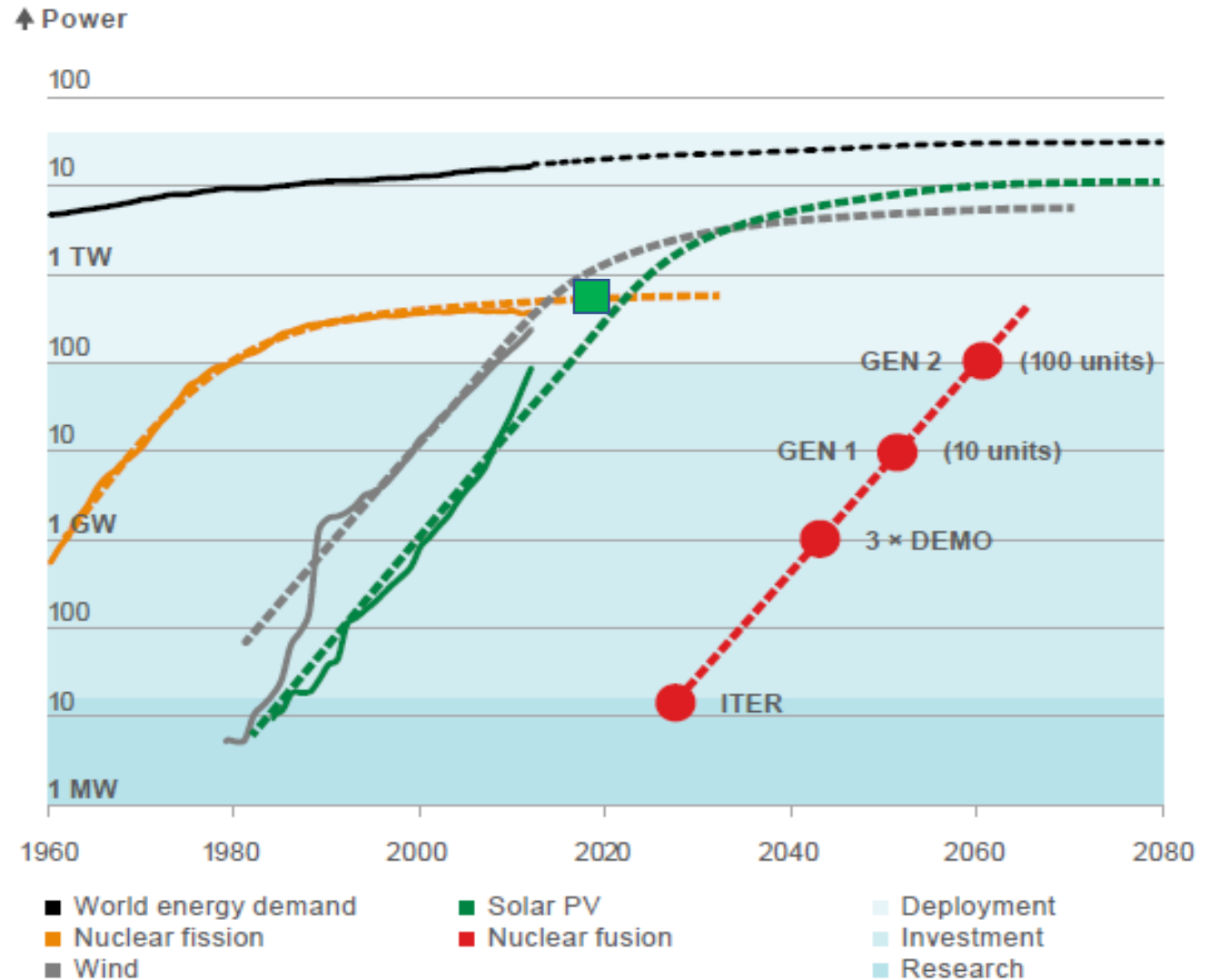


Nestálý energetický zdroj



Last Update: 12.05.2014, 08:16

Nástup nových energetických technologií



Why we have solar panels but no nuclear fusion power) by Niek Lopes Cardozo, Guido Lange and Gert Jan Kramer (NTvN 83, October 2017, page 350-354

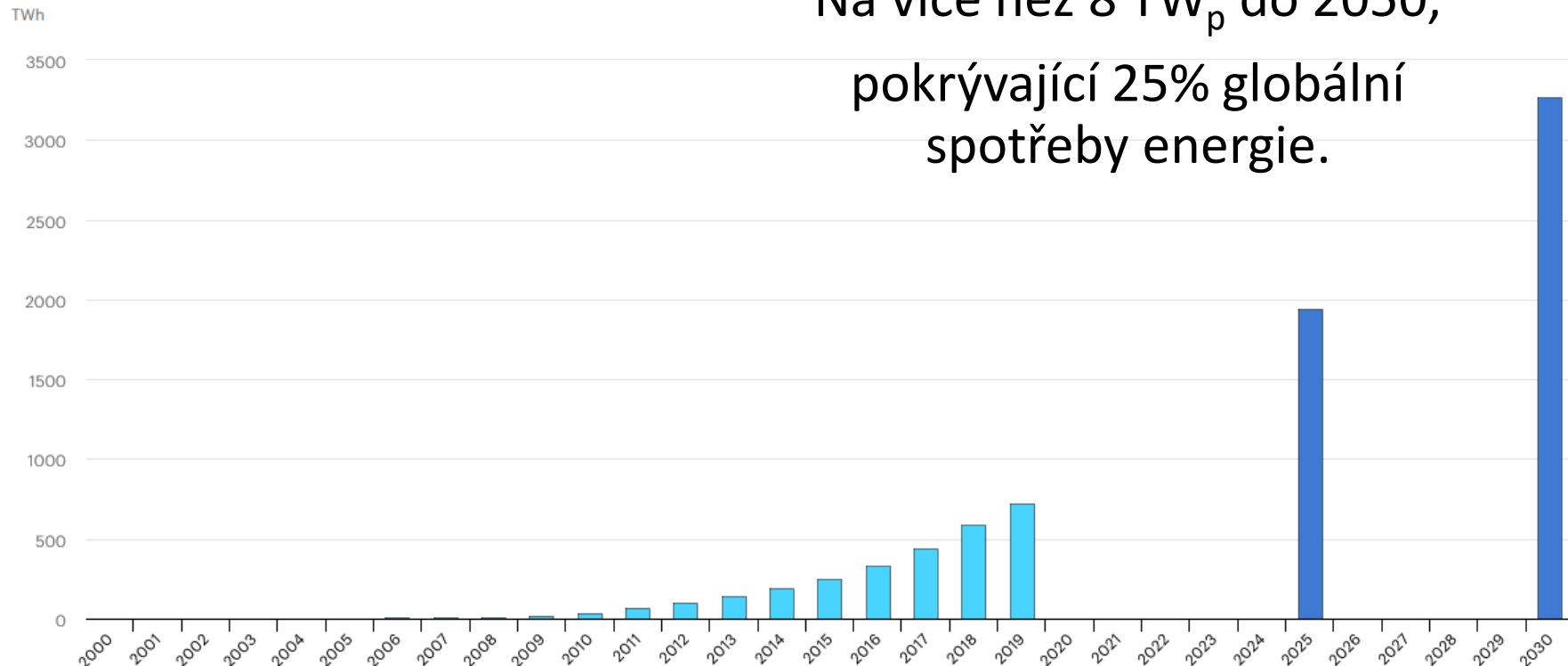
Předpověď IEA Mezinárodní energetické agentury

Solární energetika bude
podstatně růst

z 700 GW_p v 2019

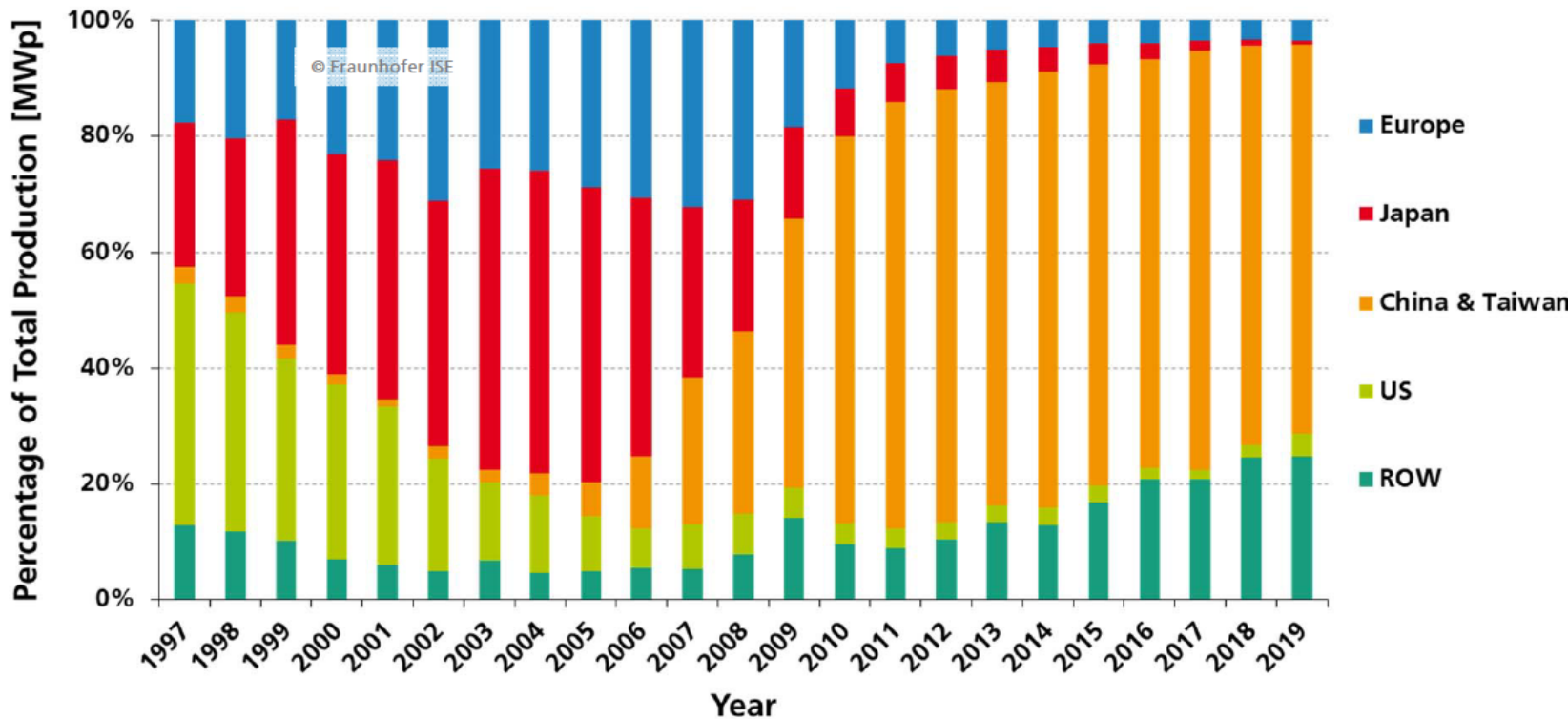
Na více než 8 TW_p do 2050,
pokrývající 25% globální
spotřeby energie.

Solar PV power generation in the Sustainable Development Scenario, 2000-2030



Rozdělení výroby ve světě

PV Module Production by Region 1997-2019 Percentage of Total MWp Produced



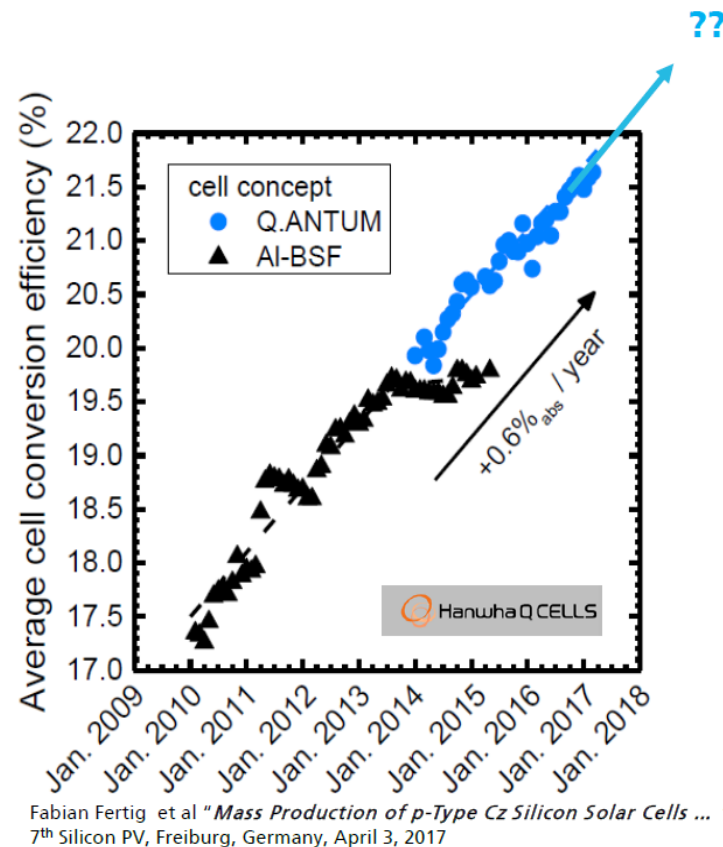
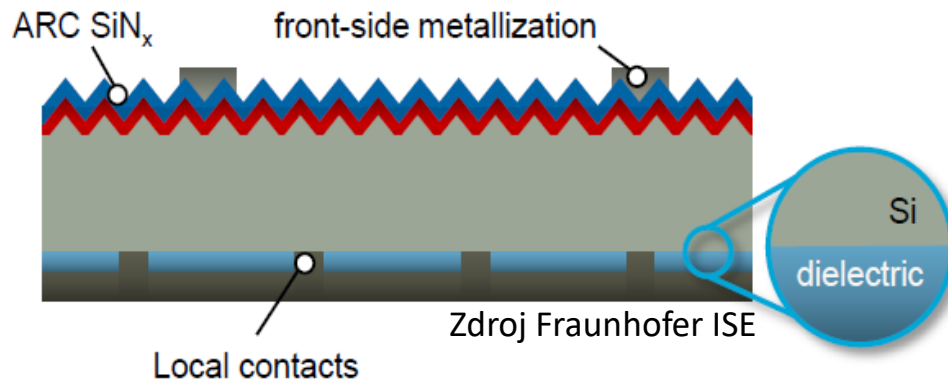
Data: Up to 2009: Navigant Consulting; since 2010: IHS Markit. Graph: PSE Projects GmbH 2020

Křemíková fotovoltaika dnes

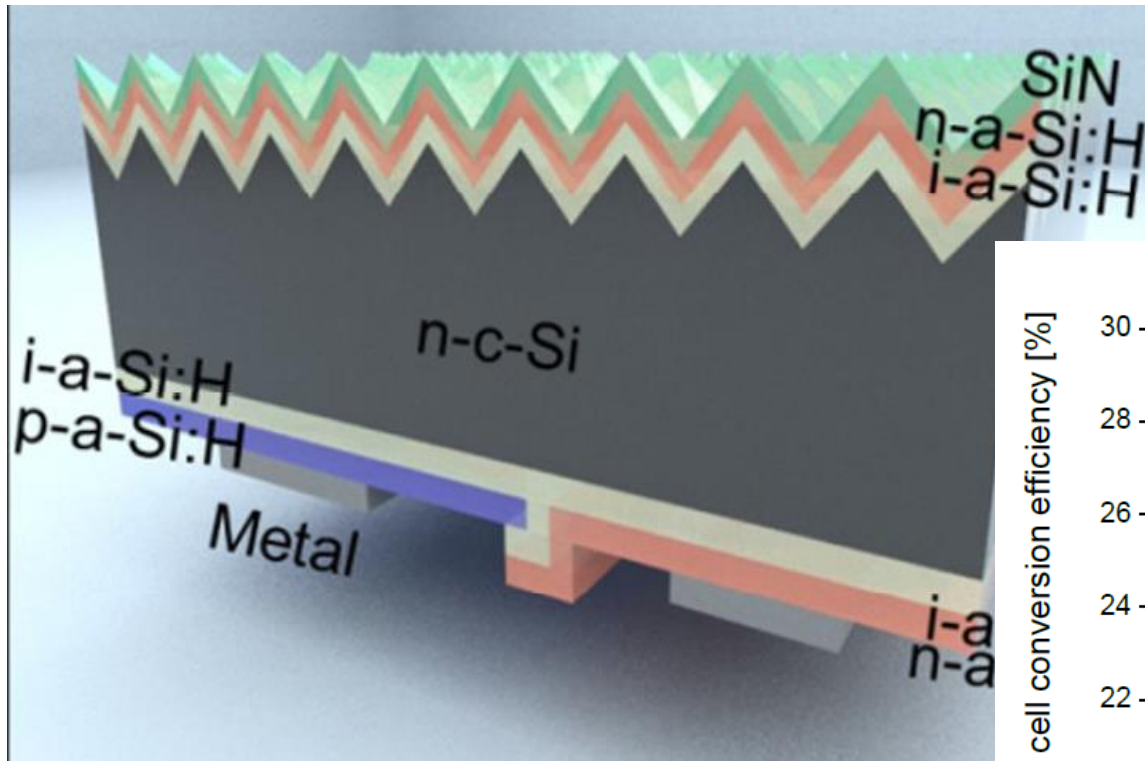
Fotovoltaická účinnost křemíkových článků roste

~ 0.6 % abs /rok

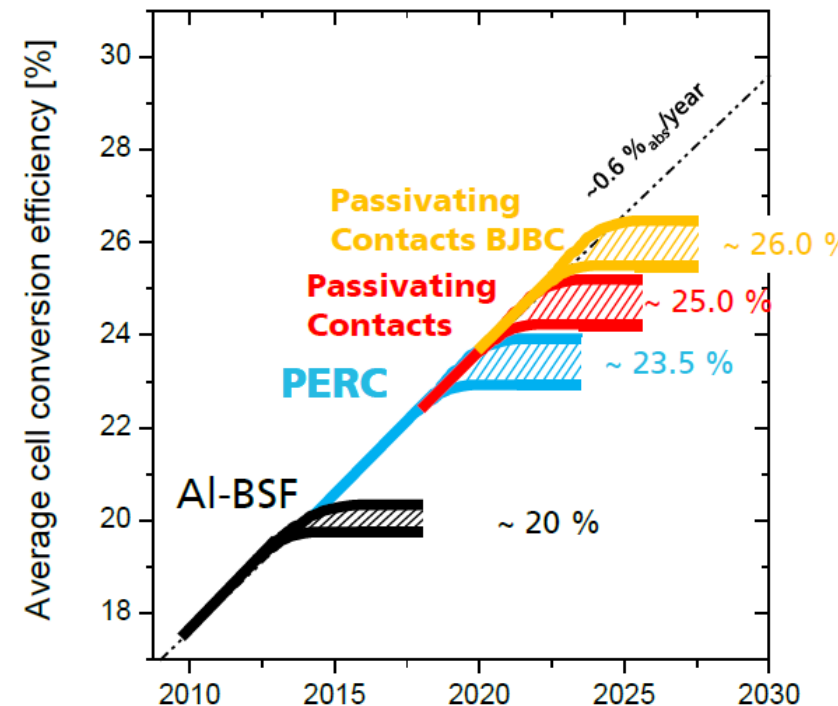
Jak dlouho to může pokračovat?



Křemíková fotovoltaika zítřka

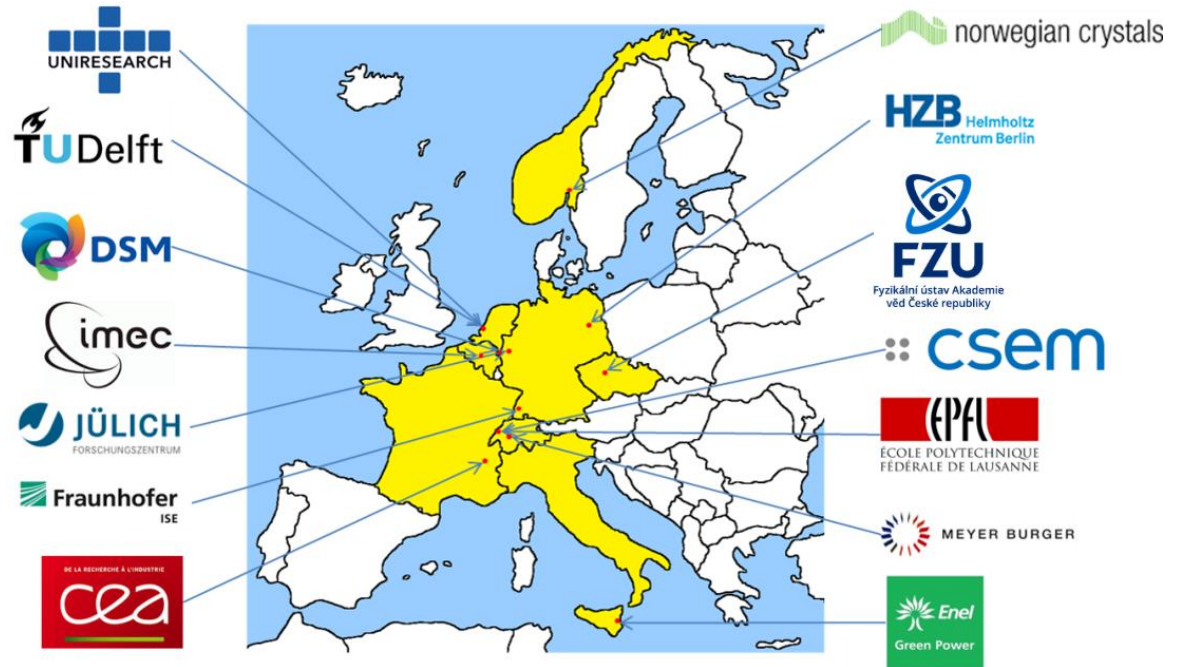


Best cell	J_{sc} [mA/cm ²]	V_{oc} [mV]	FF [%]	Eta [%]
Kaneka – 180 cm ²	42.5	740	84.7	26.6

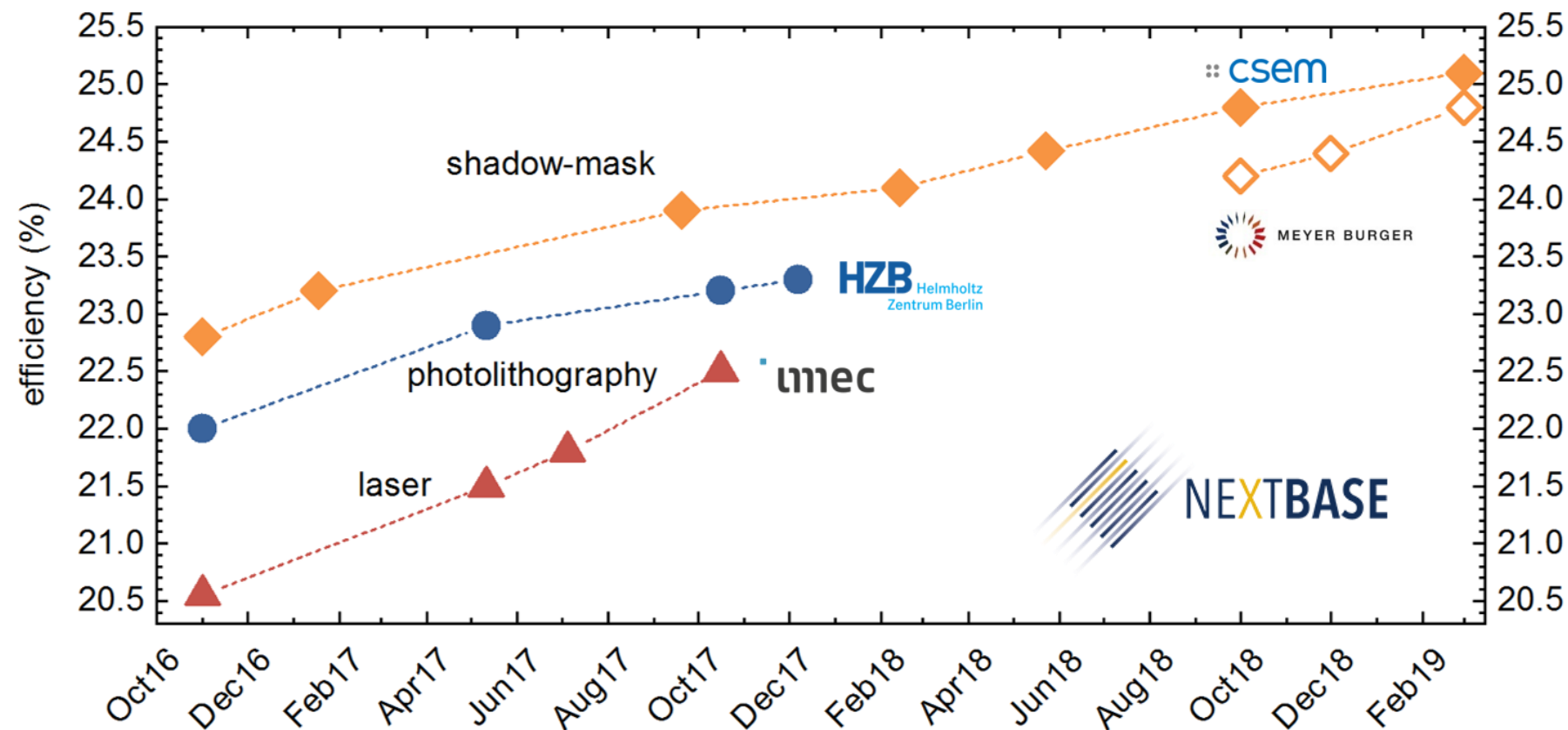


Courtesy of M. Hermle, Fraunhofer ISE

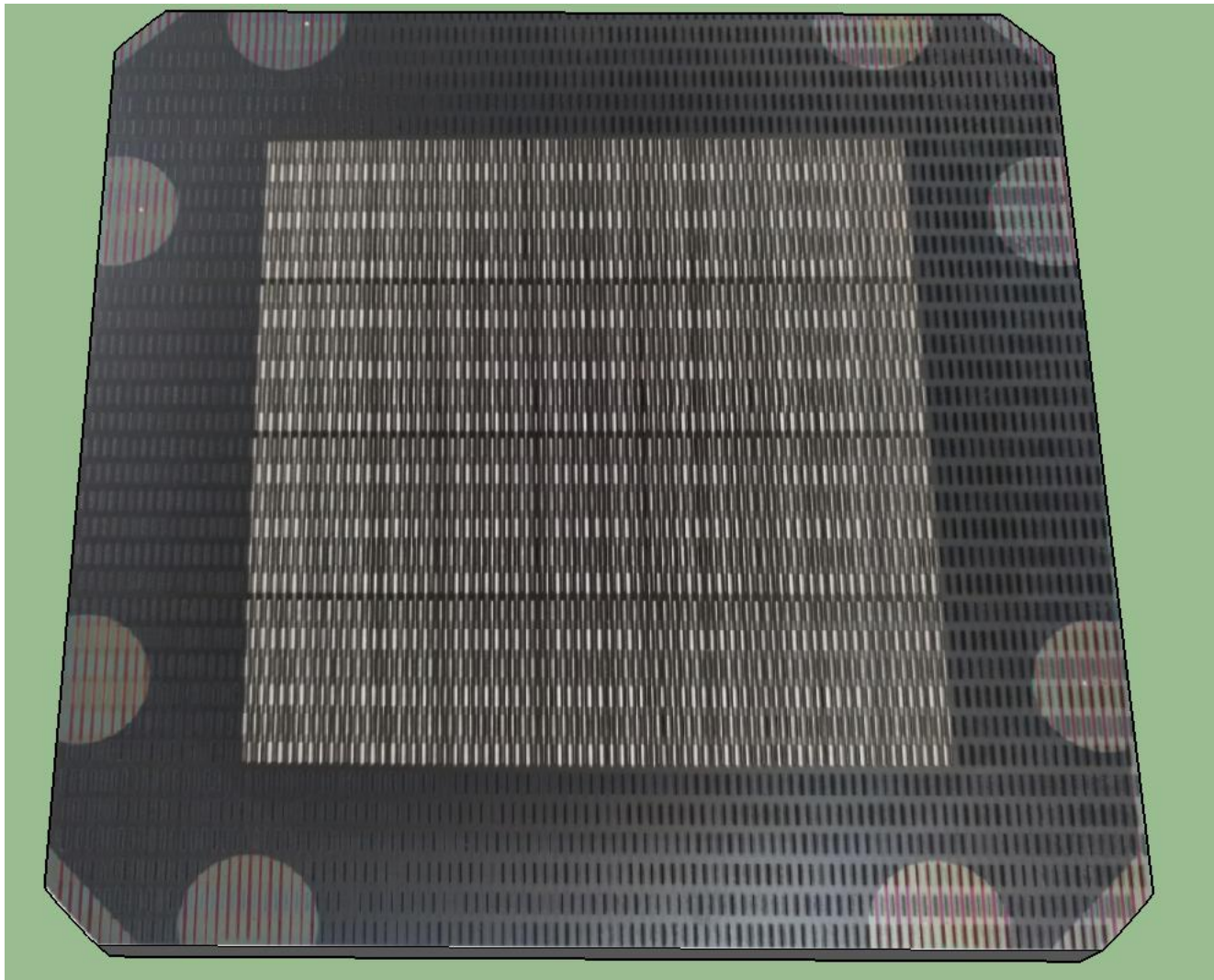
EU H2020 projekt NextBase



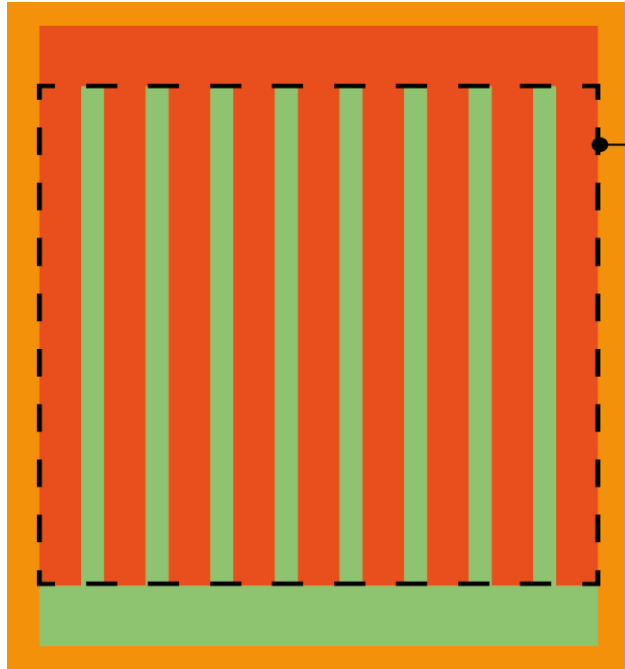
Výsledky projektu



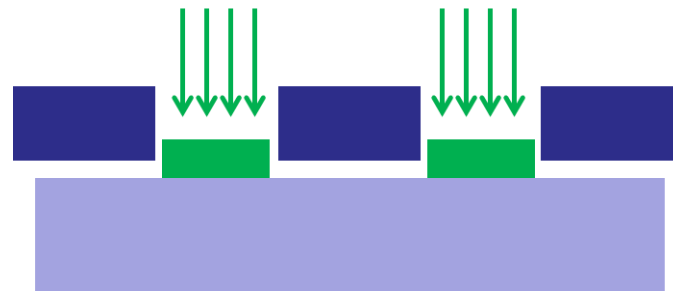
Finální solární článěk, zadní strana



Depozice přes masku kontaktu



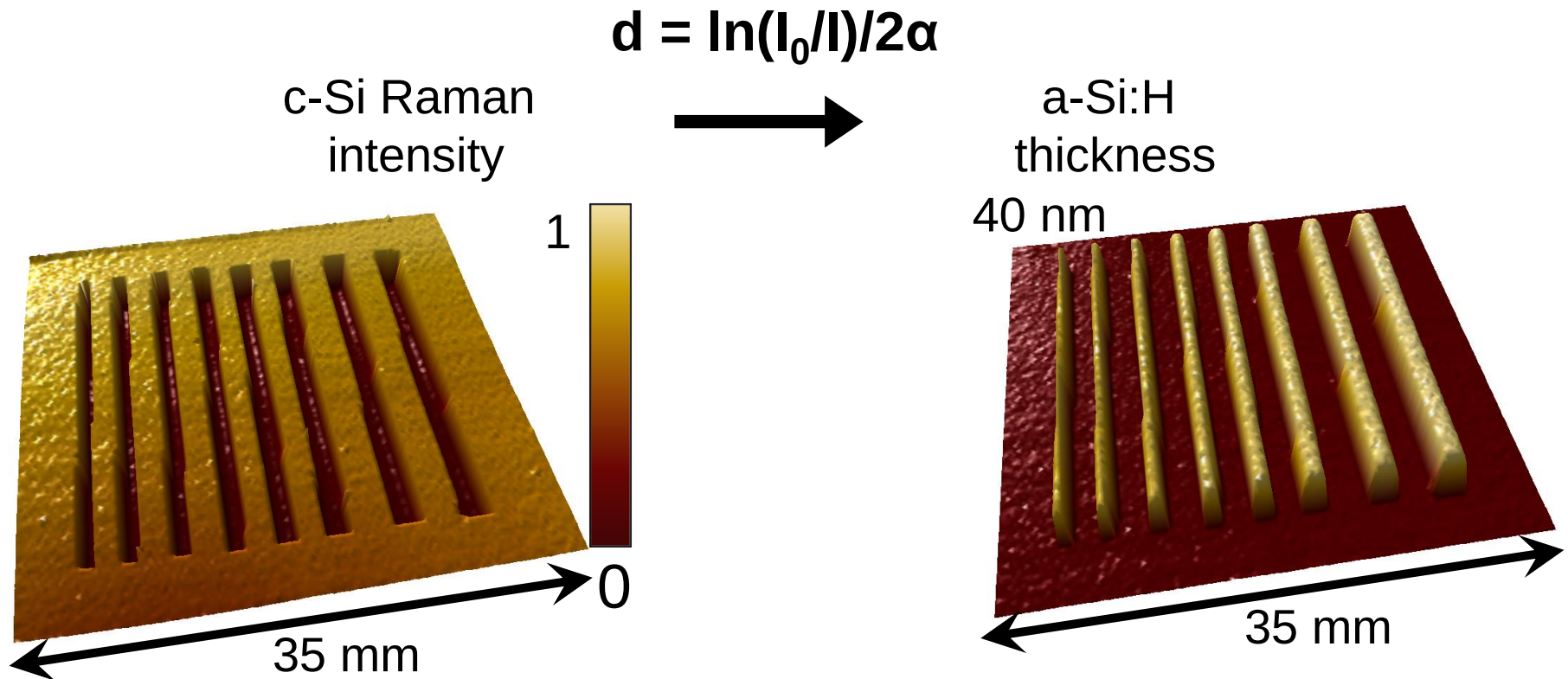
Shadow mask deposition
of doped a-Si:H combs



How to measure the thickness of a-Si:H?
How sharp are the edges of a-Si:H stripes?

M. Ledinský, B. Paviet-Salomon, A. Vetushka, J. Geissbühler, A. Tomasi, M. Despeisse, S.D. Wolf, C. Ballif, A. Fejfar, Profilometry of thin films on rough substrates by Raman spectroscopy, Scientific Reports. 6 (2016) 37859. doi:10.1038/srep37859.

Měření profilu a tloušťky vrstev

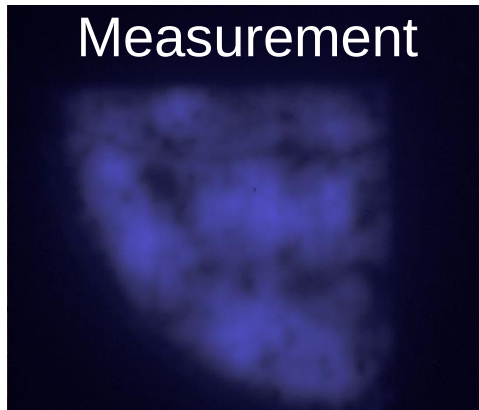


Měření trvá cca 10 hodin

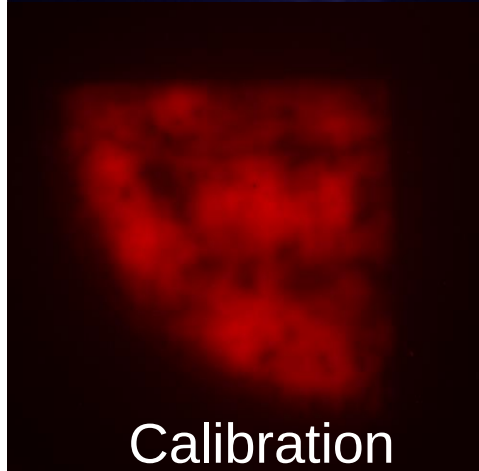
Rychlé průmyslově použitelné řešení

Blue
LED
PL

Measurement

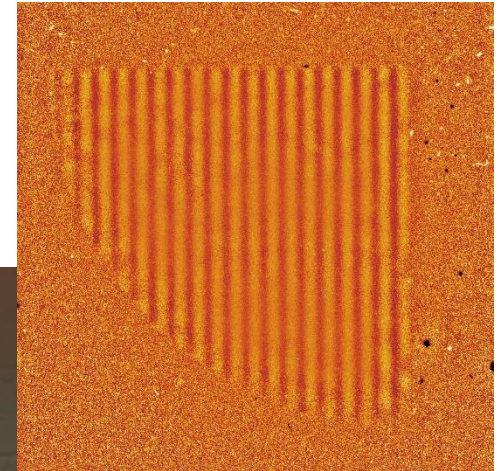
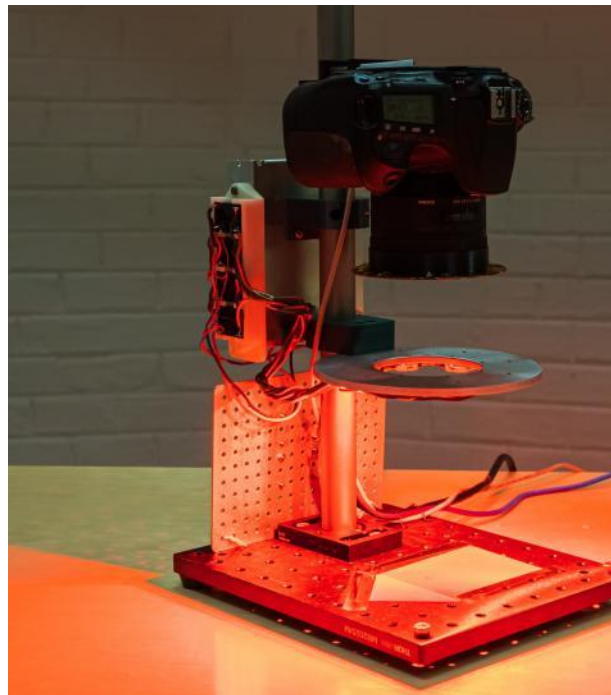


Red
LED
PL



Calibration

$$d = \ln(I_{\text{Red}} / I_{\text{Blue}}) / 2\alpha$$



Měření za
20 s

Demonstrace zařízení

Podstaný krok ke komercionizaci nápadu:



M. Ledinský and R. Dvořák: demonstrace prototype zařízení na High Efficiency Approaches in Crystalline Silicon PV workshop, 25th September 2019 v Polytech Annecy-Chambery.

Výsledek projektu II

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Meyer Burger moves to become a solar cell and module manufacturer

Through a CHF165 million capital increase, the Swiss company intends to finance the expansion of capacities for highly efficient solar cells and solar modules in Germany. Production is scheduled to start next year. The strategic partnership with REC Group has been discontinued.

JUNE 19, 2020 SANDRA ENKHARDT

MODULES & UPSTREAM MANUFACTURING GERMANY

Meyer Burger's demo cell production line in Hohenstein Ernstthal, eastern Germany. Now, the Swiss company is looking to bring GW-scale solar manufacturing back to Germany.

Image: Detlev Müller /Meyer Burger

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M. Ledinský: Fotovoltaika zítřka

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Děkuji za pozornost

