

Solarstrom und sicheres Trinkwasser für Afrika - Chancen und Herausforderungen

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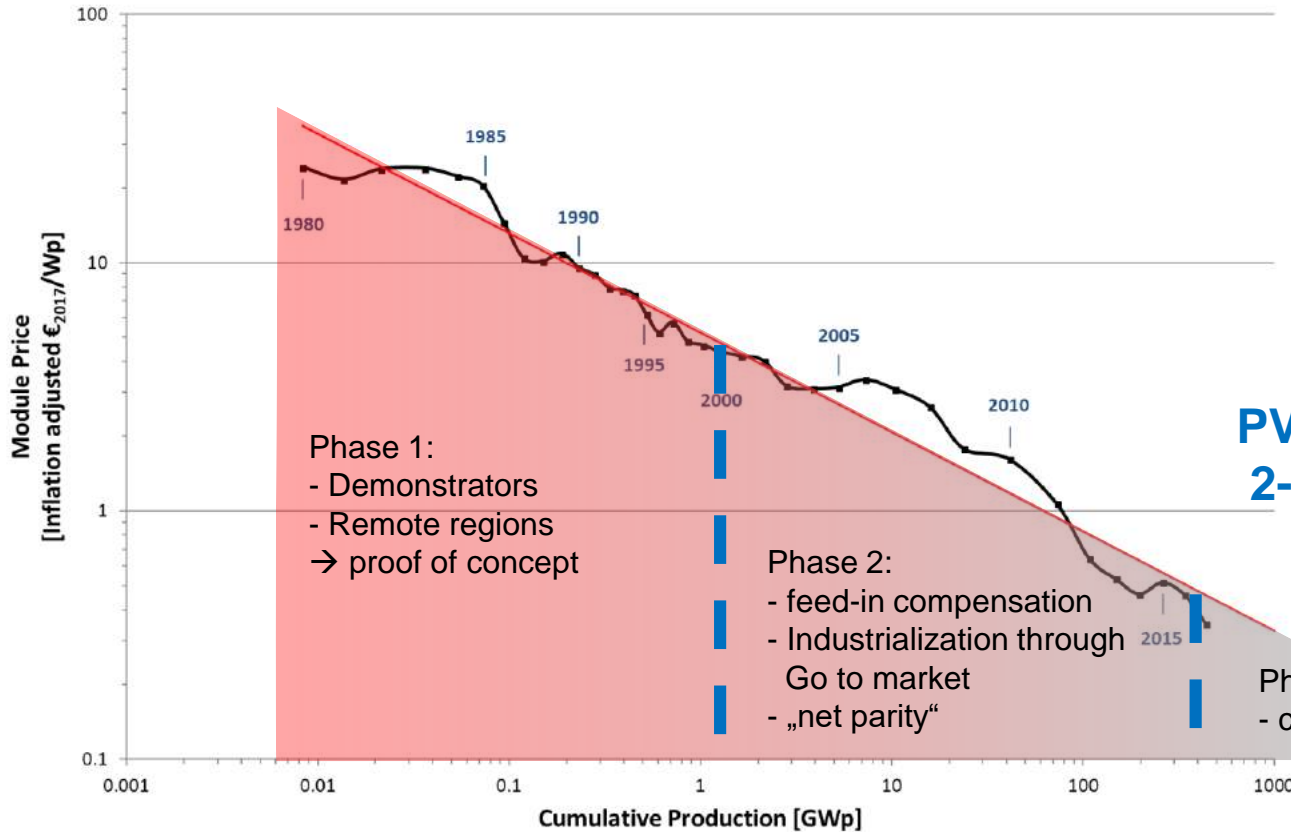
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- Motivation for this work
- PV and it's role within SDG
- Solar electricity and drinking water on a global scale
- Methods to produce safe drinking water
- Requirements for the rural population
- Project Nigeria
- Outlook

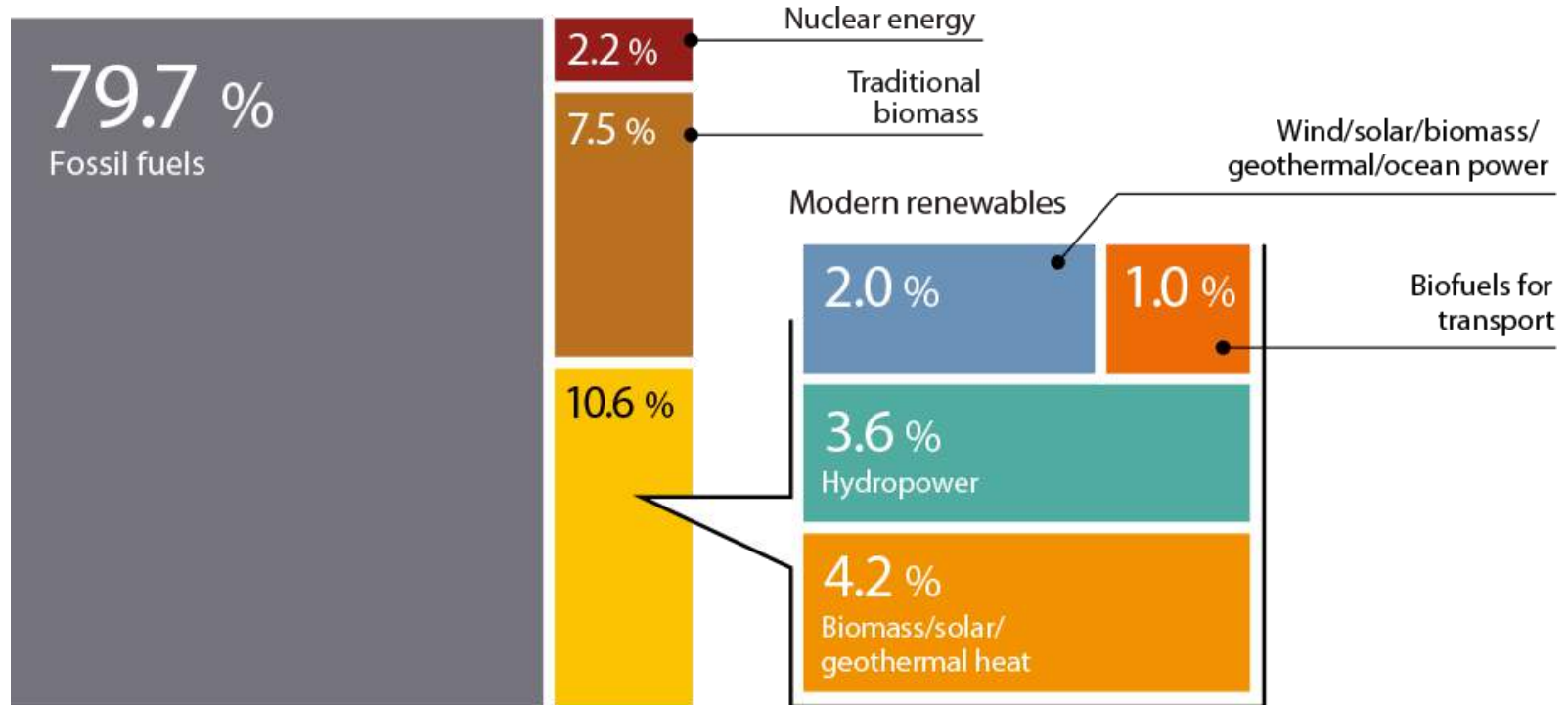


Learning rate:

Every time cumulative production doubled, the price fell by 24% in the last 36 years.

**PV is competitive
2-5 €cent/kWh**

Quelle: Fraunhofer ISE



Note: Data should not be compared with previous years because of revisions due to improved or adjusted data or methodology. Totals may not add up due to rounding.

Source: Based on OECD/IEA and IEA SHC.
See endnote 54 for this chapter.

- The Sustainable Development Goals (SDG) describe 17 goals within 169 sub-goals which were agreed upon and signed by nearly all UN-members
- These goals should be reached by 2030
- The goals are broadly defined and noncommittal
- Significant differences between countries as to achieving them
- Impact of science and technology high to achieve them



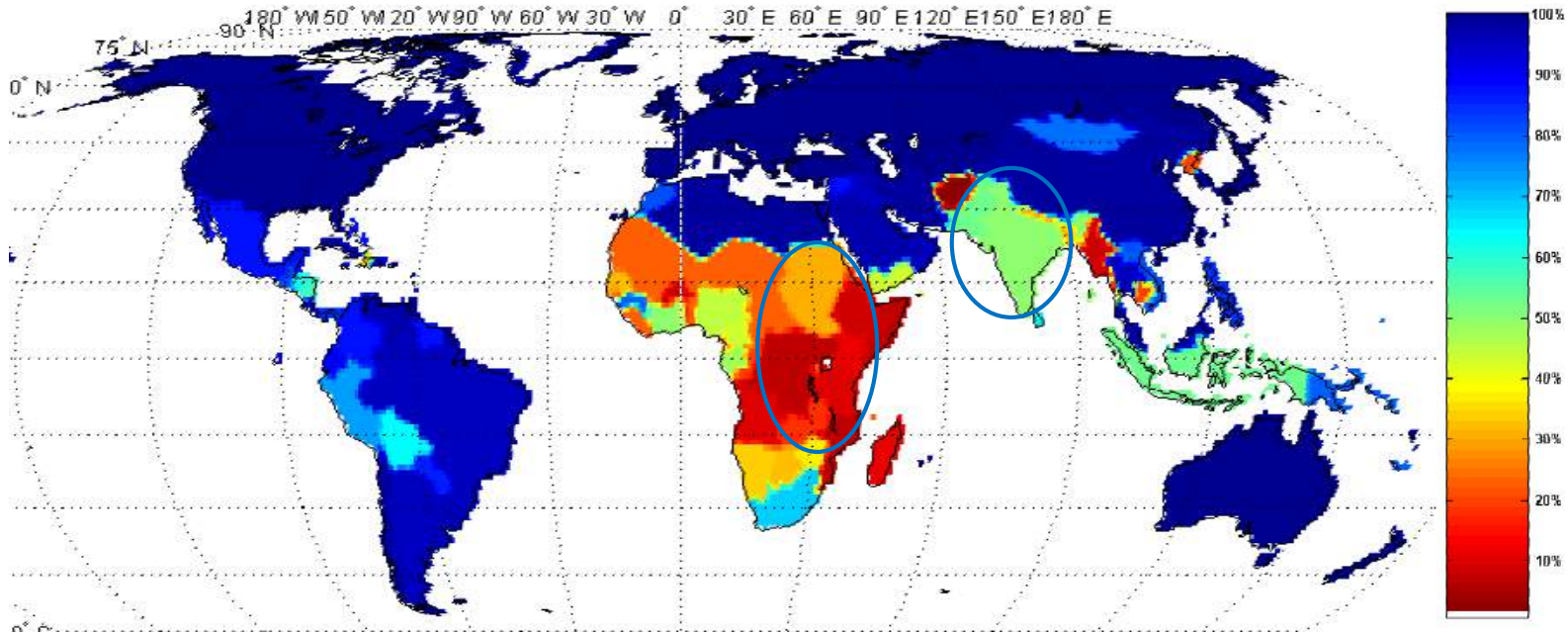
The United Nations Sustainable Development Summit for the adoption of the post-2015 development agenda and the **Sustainable Development Goals** will be held from 25 to 27 September 2015 in New York and convened as a high-level plenary meeting of the General Assembly.



PV-Technology directly meets Objective 7 and contributes as enabling technology to the achievement of Objectives 2,3, 6 and 13



Worldwide access to electricity in percent of the population

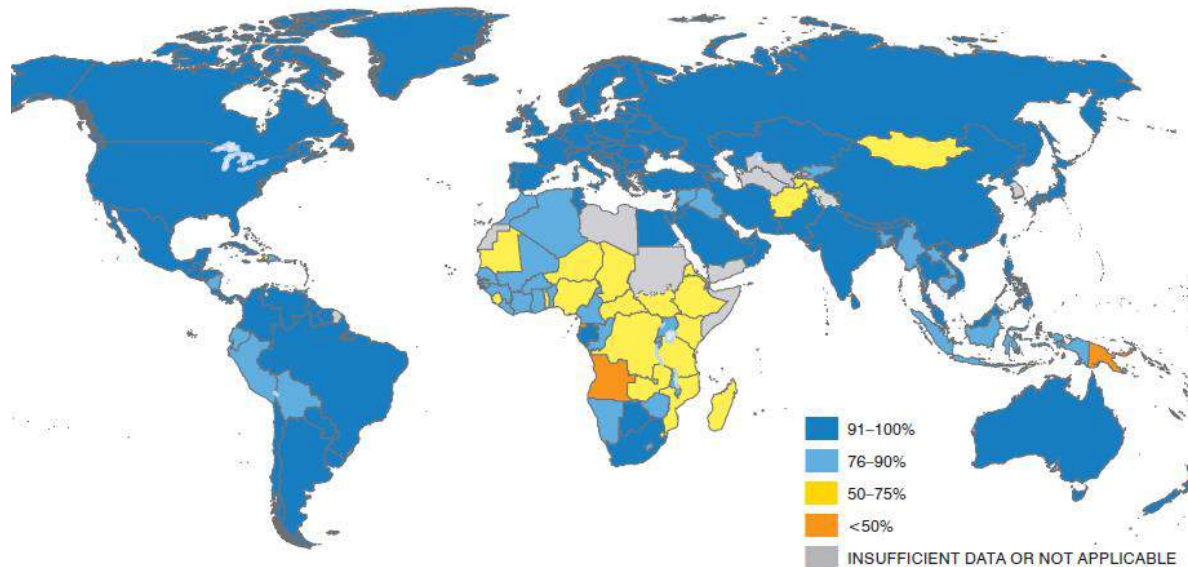


Ref.: C. Breyer, P. Adelman, Off-Grid Photovoltaic Applications in Regions of Low Electrification: High Demand, Fast Financial Amortization and Large Market Potential; 26th EUPVSEC (2011), Hamburg

Percentage of Population **without adequate access to safe drinking water** (yellow to red)

The populations without access to clean drinking water are to be found above all in sub-Saharan Africa and Southeast Asia**:

In 2019 according to WHO two billion people have to drink water contaminated with faeces



ort 2015 English“

- Sub-Saharan Africa and South-East Asia have high solar irradiation where we can employ Low-cost electricity to pump water and produce safe drinking water
- We can install autonomous systems producing up to 20.000 l/day Drinking water – enough for ca. 6.000 people
- Large impact on health, education and climate goals
- Huge market potential

Most frequently used methods

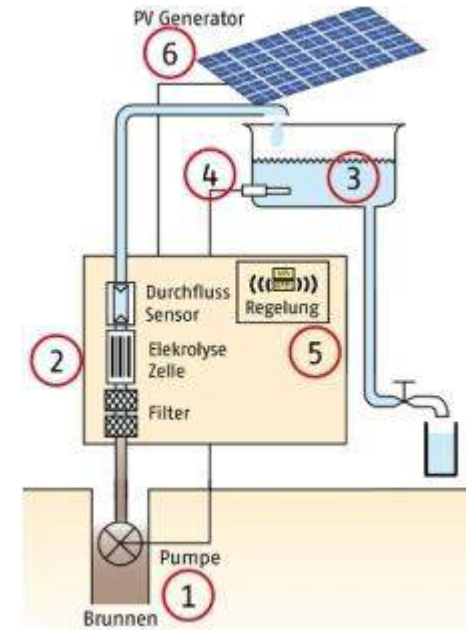
1. Boiling
 2. Ozon
 3. UV
 4. Chlordioxide
 5. Chlorine
 6. Hypochlorites NaClO , $\text{Ca}(\text{ClO})_2$
 7. Elektrolysis (+ Cl)
 8. Reverse osmosis
- Boiling not sustainable
 - Ozone production and dosing
 - Direct UV light treatment
 - Production and dosing
 - Dosage of chlorine gas
 - Dosage of liquid sodium/calcium Hypochlorite solution
 - Electrolytic production + dosing of hypochlorite solution
 - Mainly for Centralized Drinking Water Systems

- **Boiling is still widespread,
Chlorine - the No. 1 disinfectant worldwide**

- Powered by solar electricity or other RE
- Free of chemical additions
- Robust and low maintenance
- Easy to understand and operate
- Low investment
- Production of up to 20.000 l/day
- Water fulfills WHO- and national standards

Independent decentralised drinking water disinfection (Autarcon)

1. Fresh water is pumped by a submersible pump (depth up to 70m).
2. **Mechanical filtration** of water, **Production of chlorine** by electrolysis of naturally occurring dissolved salts, **Deferrisation** (optional).
3. Continuous storage of the water in a **tank**, distribution via a decentralised pipe system.
4. **Sensor** for continuous control of water quality.
5. **Controle unit** for adapting chlorine production to the measured water quality, online access to operating data.
6. **PV-Modules** for autonomous operation (batteries not mandatory)



Ref.: www.autarcon.com
SuMeWa COMPLETE

- Largest population in Africa
- More than 50% of the population have no access to electricity and safe drinking water
- The country has ca. 10.000 Primary Health Centers (PHC) where first medical treatment and advice can be obtained
- PHC's are surrounded by a wall with safety personnel, have simple buildings to house medical equipment and rooms for treatment. Size of PHC depends on the population density around them.

- We installed the first solar driven Water Disinfection system on the premises of PHC Dutsen/Abuja in January 2019
- System has ca. 5 kWp PV, ca 30% is used for pumping and disinfection, 70% stored in Lead acid batteries for charging mobile phones and other services
- Customers bring their own 20l water containers – Payment system with pre-paid cards is used for paying for water and electricity
- Data from operation continuously monitored and also transferred in realtime to Germany

- Our pilot-system will serve to evaluate the viability of a business model for selling drinking water and solar electricity. Can we reach low ROI to make the model attractive to invest in many new systems.
- Population is used to buy drinking water, often of questionable quality. Water produced by us is safe and needs to compete on the market. Importance of safe water particular for children needs to be communicated.
- If business model is successful we plan to install 5 more systems in the Abuja area.





Solar Powered Drinking Water Station
PVWater International Dutse/Abuja

- Solar electricity at the lowest cost available and the developed technology for autonomous water disinfection open the way to bring safe drinking water to millions of people world-wide
- The existing technology is not enough to make this enormous leap forward but requires the further support and determination from our societies.
- Various models exist to make universal access to safe drinking water a reality from a business perspective as well as reaching the climate goal with 100% RE.