A·S·E Applied Solar Expertise

Global energy justice and the Paris climate goal – what must be done?

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GCRNRE, Valencia

Content

Today's inequity of global energy distribution → migration!

Paris climate goal → catastrophic consequences if not reached!

Future energy needs @ energy justice & <1.5°C

Consequences for regional energy needs

Investment for fossil and PV plus storage

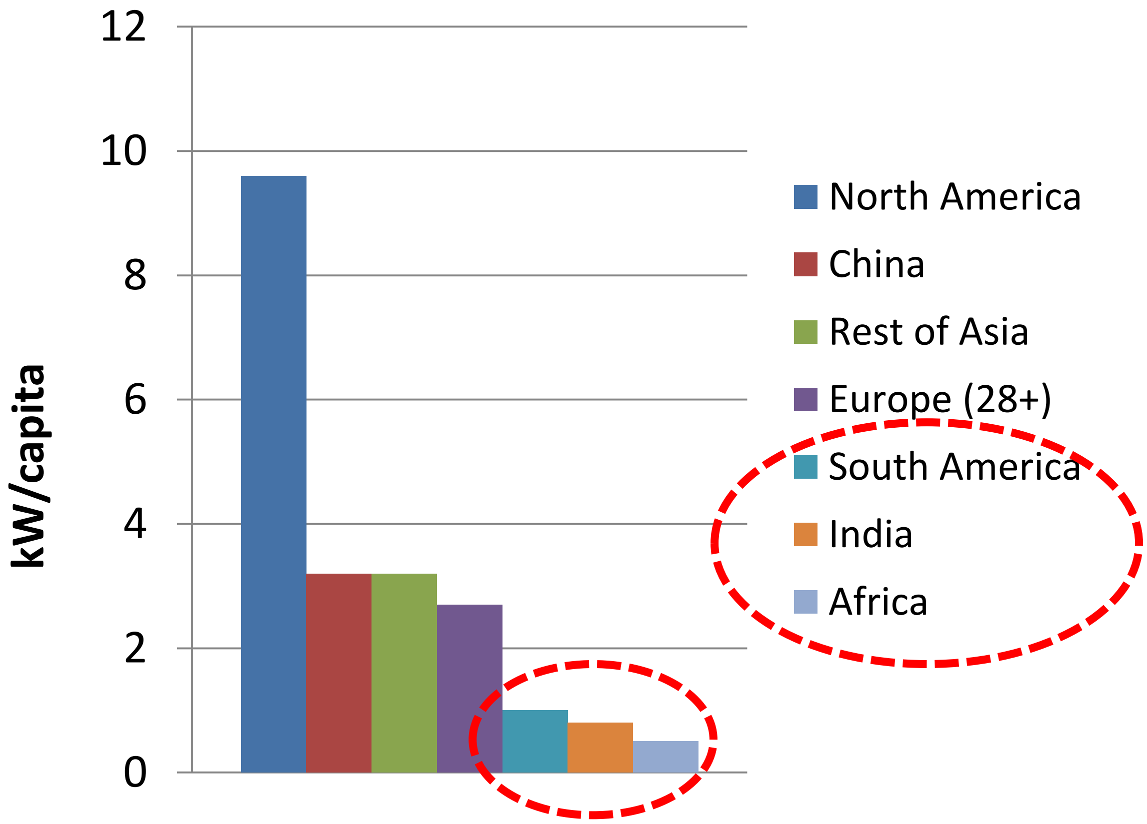
Available financial resources

Example Mali project in Africa and lessons learned

Necessary boundary conditiones & potential financing model

Global energy justice … ?

Inequity of global energy distribution

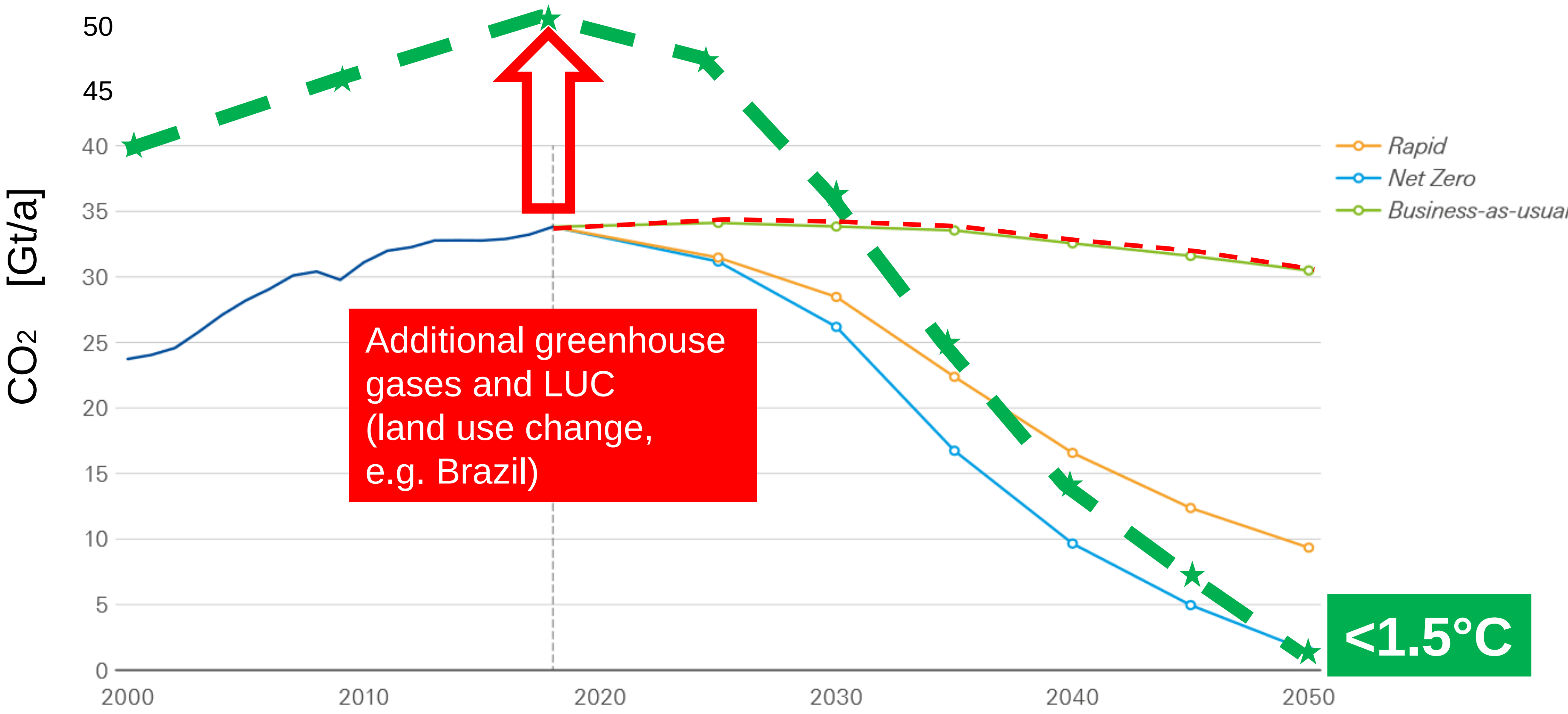


Consequences are increasing migration:

- migrants from Africa living 2020
  # in Europe ~11m
  # in Middle East ~ 5m
  # in US ~ 3m
  World bank expects 86m by 2050 (…+67m in 25a!)

- migrants from South America living 2018
  in US ~22.4m
  Only in 2021 >2m migrated to US

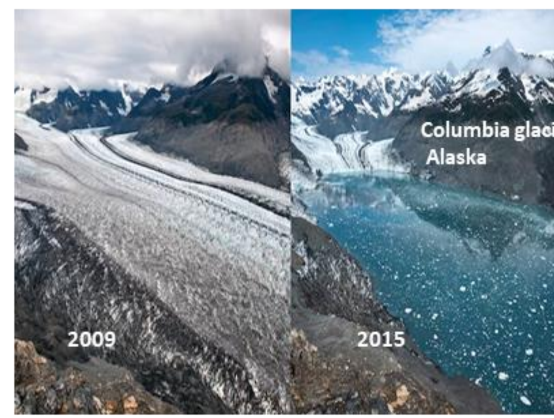
Paris agreement: scenario for the necessary CO_2 - development



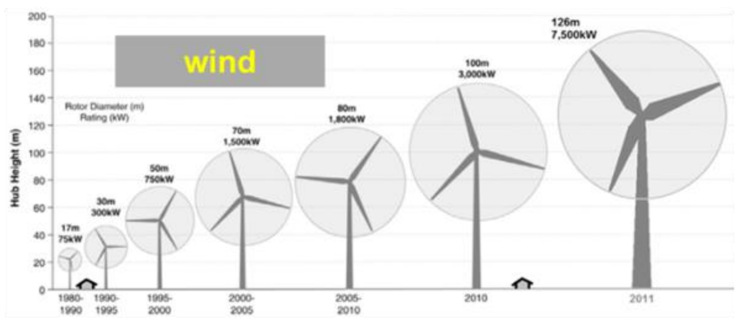
Source: BP energy outlook, 2020; green dotted line by Winfried Hoffmann

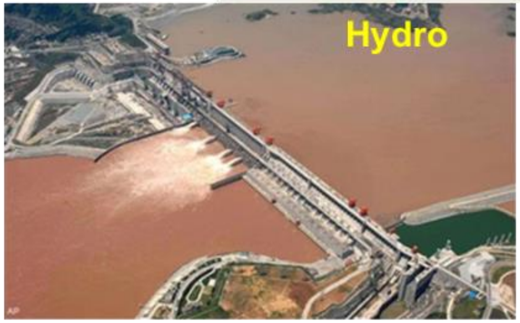
The consequences of business as usual … > +4°C!

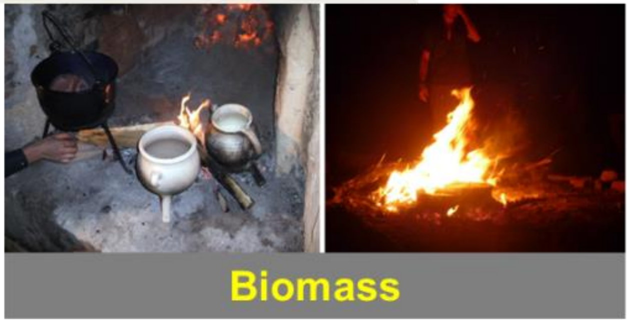
The PETM (Paläozene/Eocene/Temperature Maximum) 55 mio years ago was a ~+6°C increase happening over several 1,000 years … with catastrophic consequences!



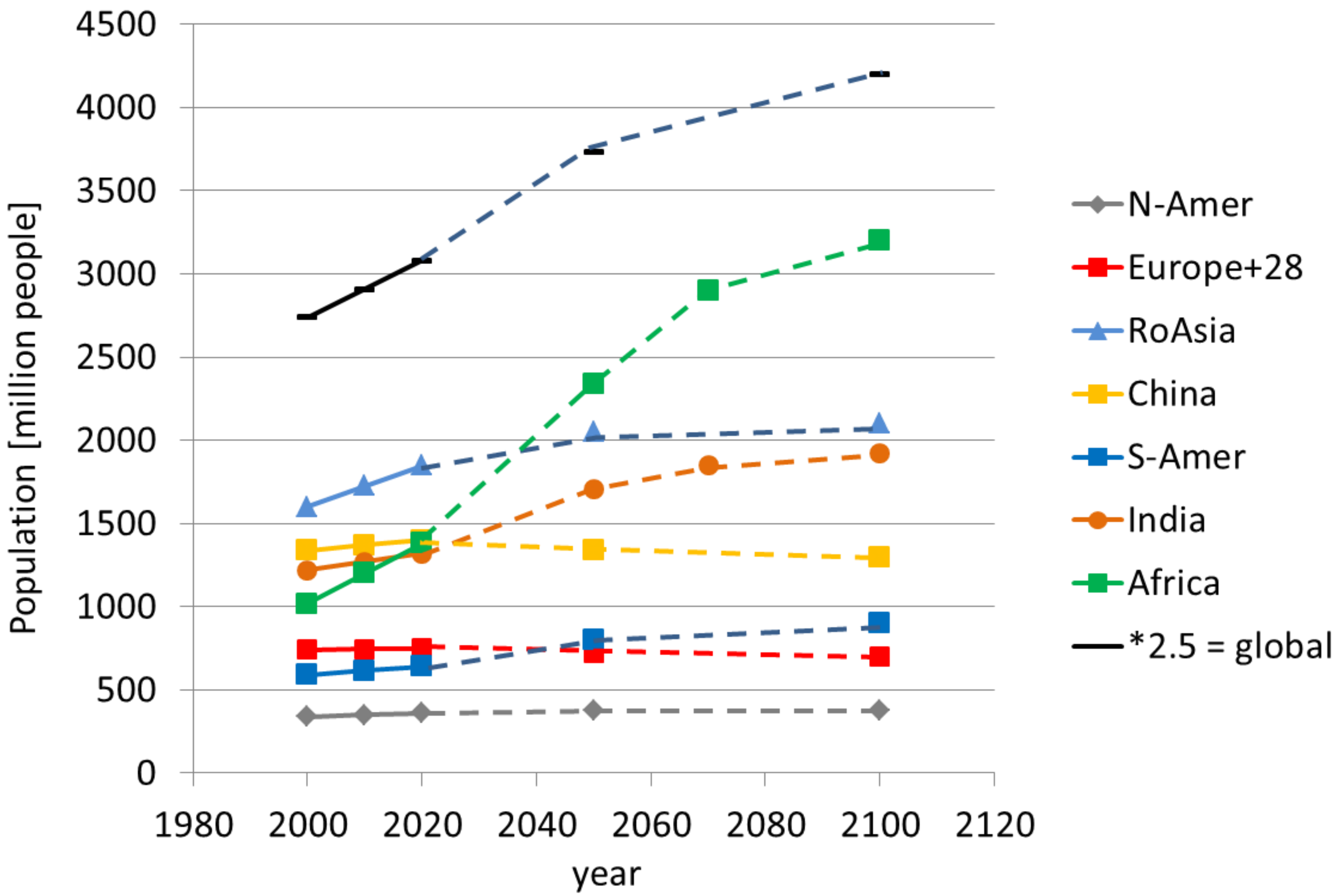
No fossil power plants, no oil for transport and no natural gas for chemical industry → Resourcing of energy with RE







How much energy will be needed globally? (1) how many people?



Source: UN reports, own research

How much energy will be needed globally? (2) Energy efficiency

2019: ~120 PWh secondary energy (SE)
¼ of mankind (~2 billion) consume ¾ of this SE (=90 PWh)
→ 45 PWh/1 billion with our comfortable living standard

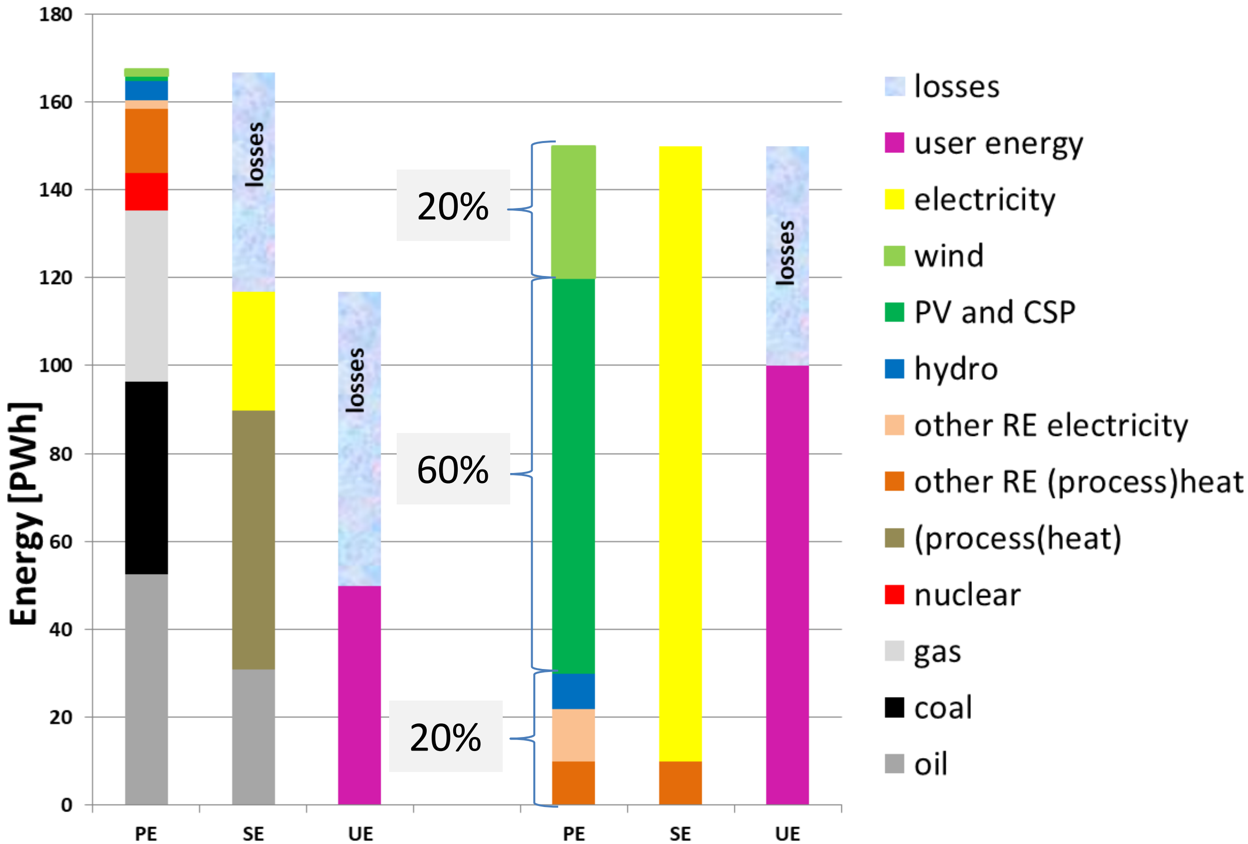
2050: **Energy efficiency increase by factor 3**
→ 15 PWh/1 billion our living standard
<~10 billion people (UN) will need 150 PWh **–**

ALL the same energy/capita with our today's living standard!
→ energy justice!

… easily said, but big challenge to do!

2100: <~12 billion people would need 180 PWh

today (~2019) → future (~2050+)



electricity in 2050 includes P2G(&X)

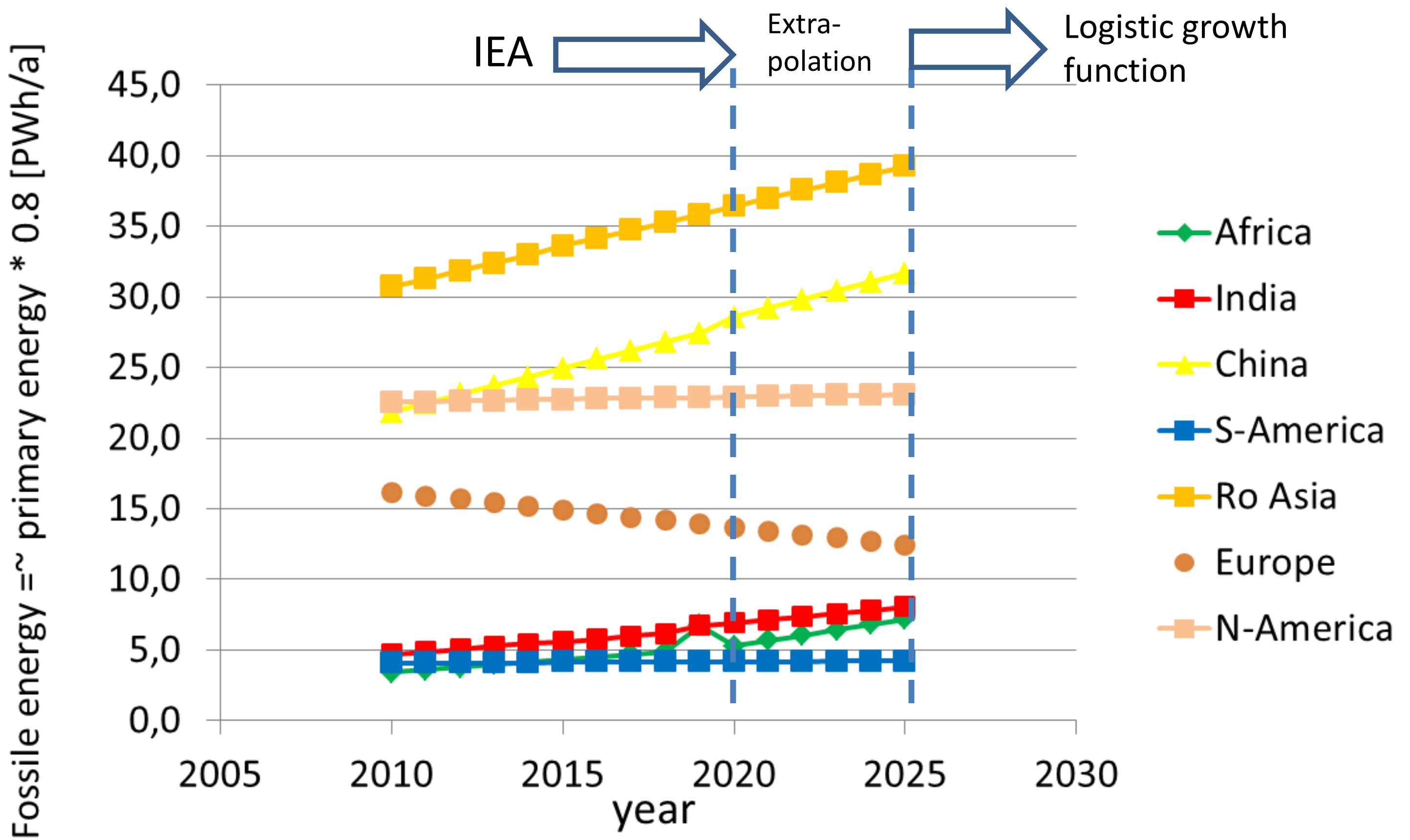
Zero Carbon

Equal energy for all 10 billion people

Efficiency & only RE

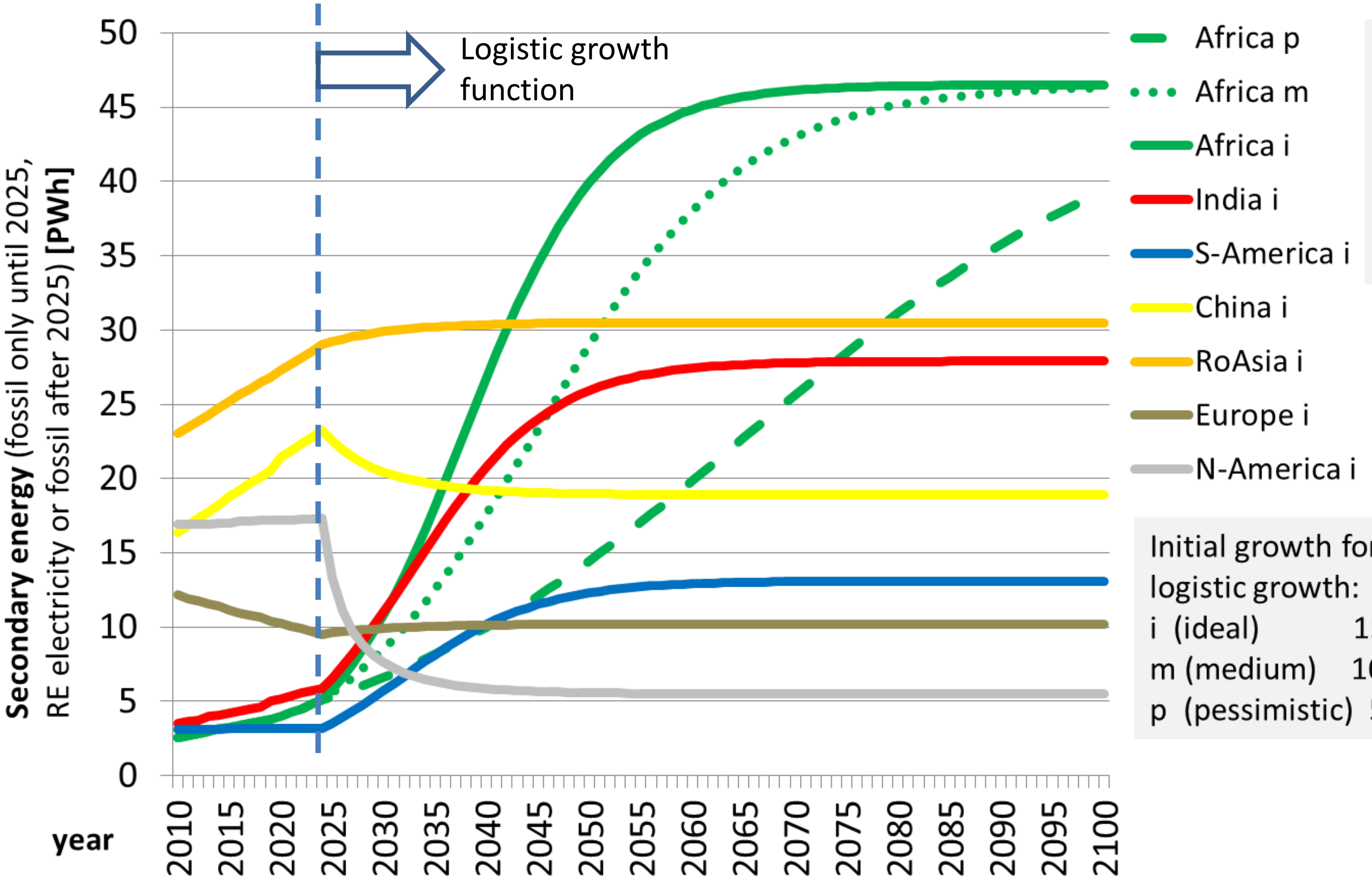
Source: 2019 data IEA WEO (2020), 2050 data Winfried Hoffmann (2021)

Estimation of the fossile energy in the 7 world regions 2010 bis 2025



Source: IEA WEO 2020 2010 bis 2019, danach Extrapolation W. Hoffmann

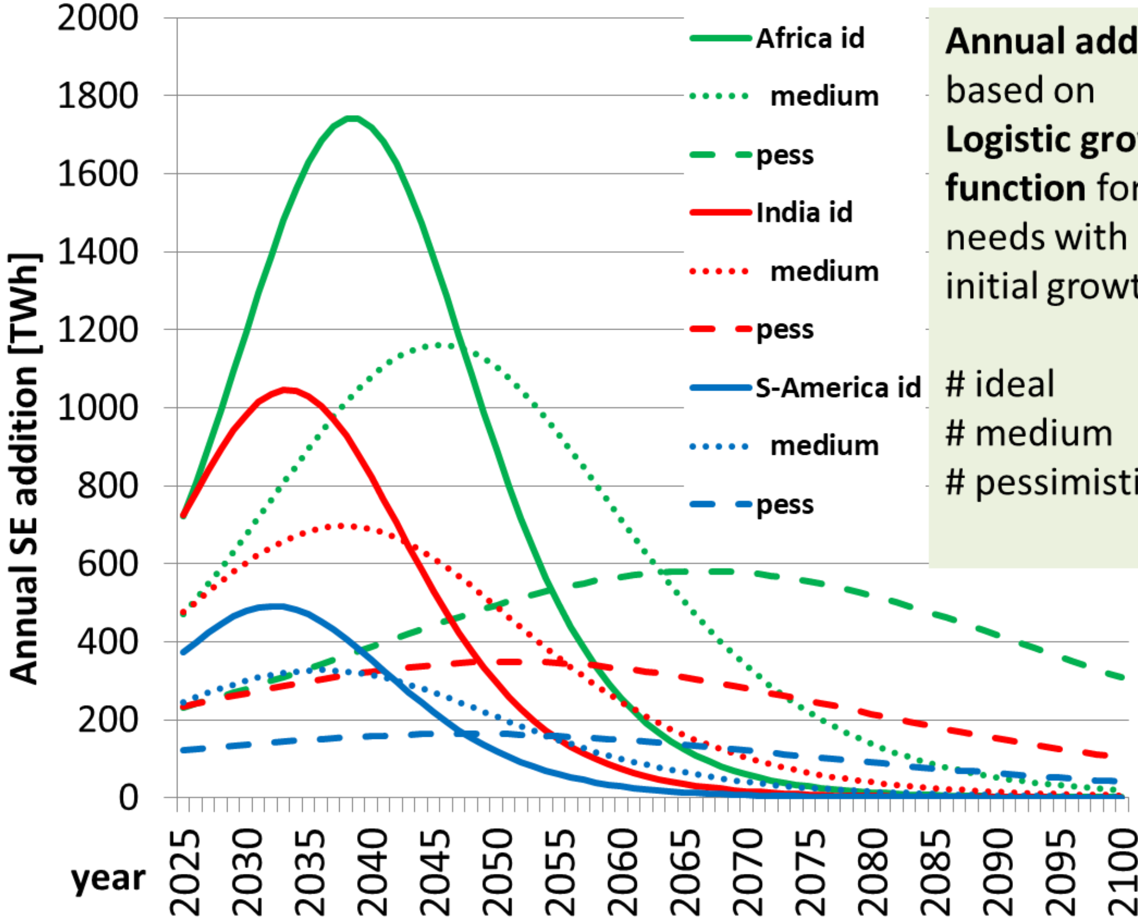
Consequences for the future regional energy needs



Assyptotic value
=
150 PWh split according to the respective population

Initial growth for logistic growth:
i (ideal) 15%
m (medium) 10%
p (pessimistic) 5%

Annual energy additions in Africa, India and South America

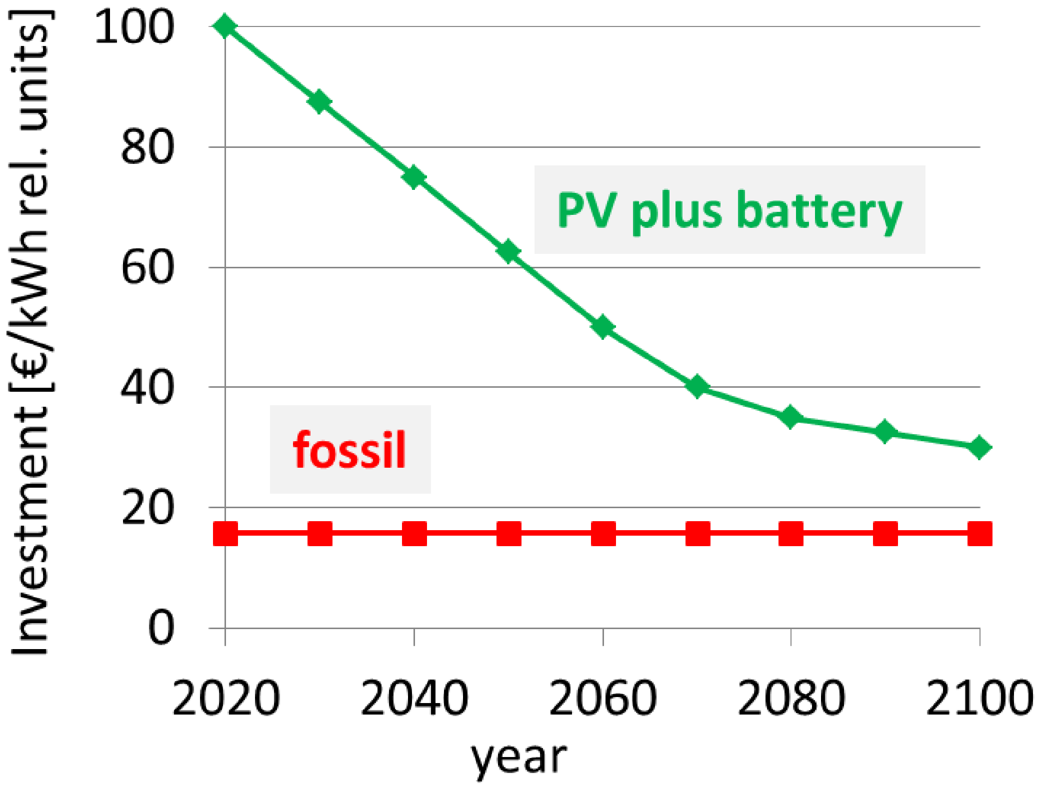


Annual addition based on **Logistic growth function** for SE needs with initial growth

ideal 15%
medium 10%
pessimistic 5%

Source: EUPVSEC 2022, MIlano

Comparison investments fossil versus (PV plus battery)



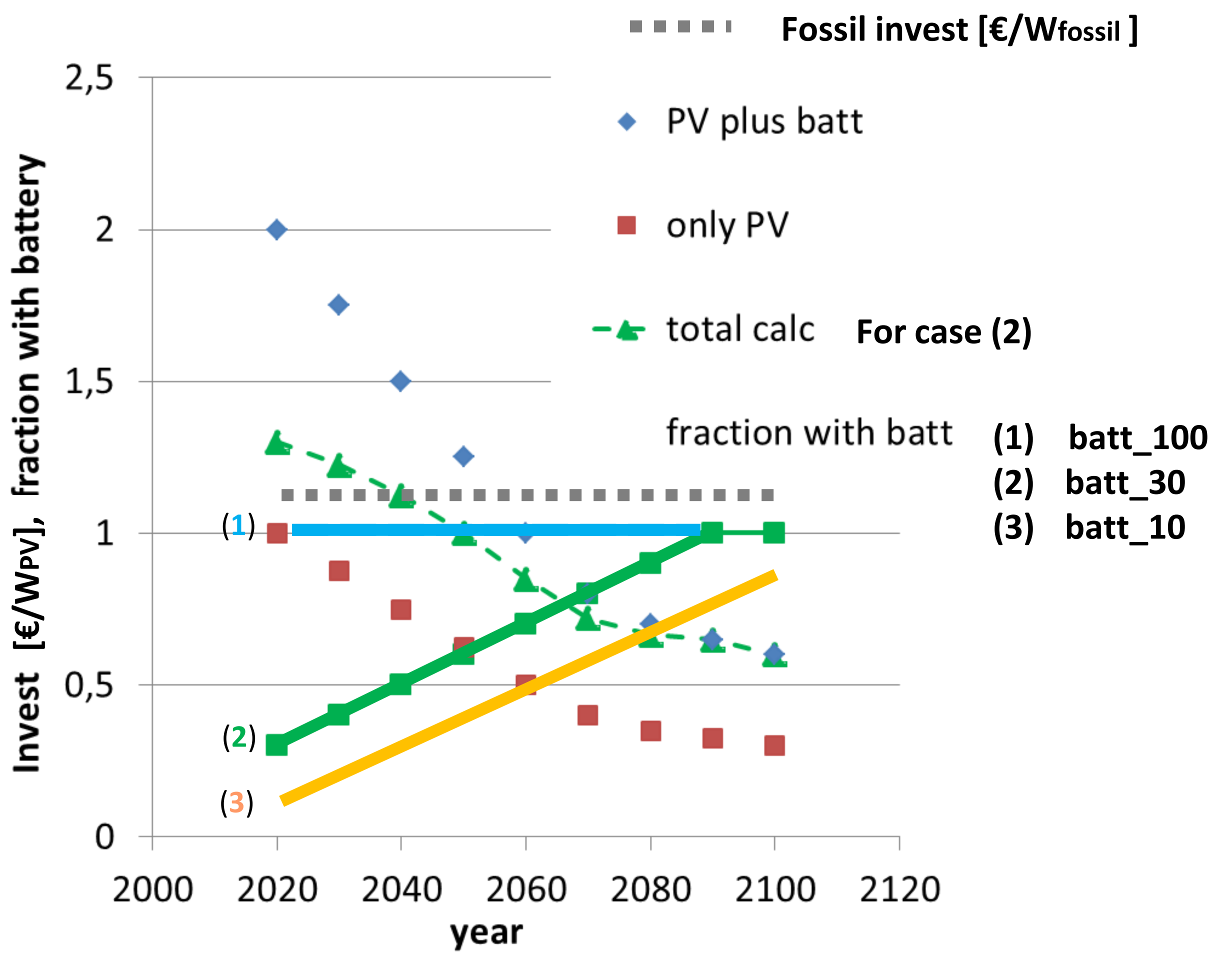
$$€/kWh = €/W_{installed} * W_{installed} /kWh$$

Africa	PV+b	fossil
kWh/W_{inst}	2	7

Whenever cash money is scarce
→ Lowest investment will be taken for the needed energy
→ which is fossil!
→ … although the LCOE is higher relative to PV
→ … and adding to the CO_2 budget!

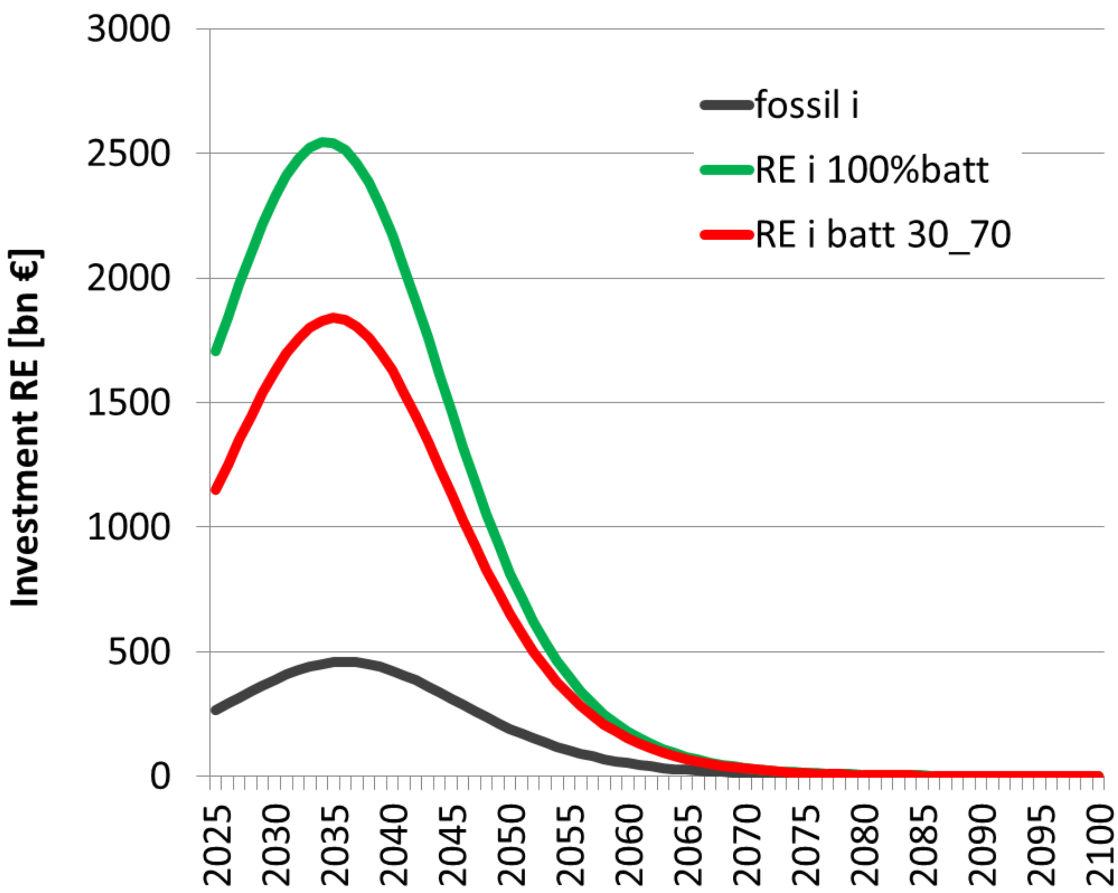
Source:

Investment assumptions for fossil and PV plus storage in detail



Source: EUPVSEC 2022, Milano

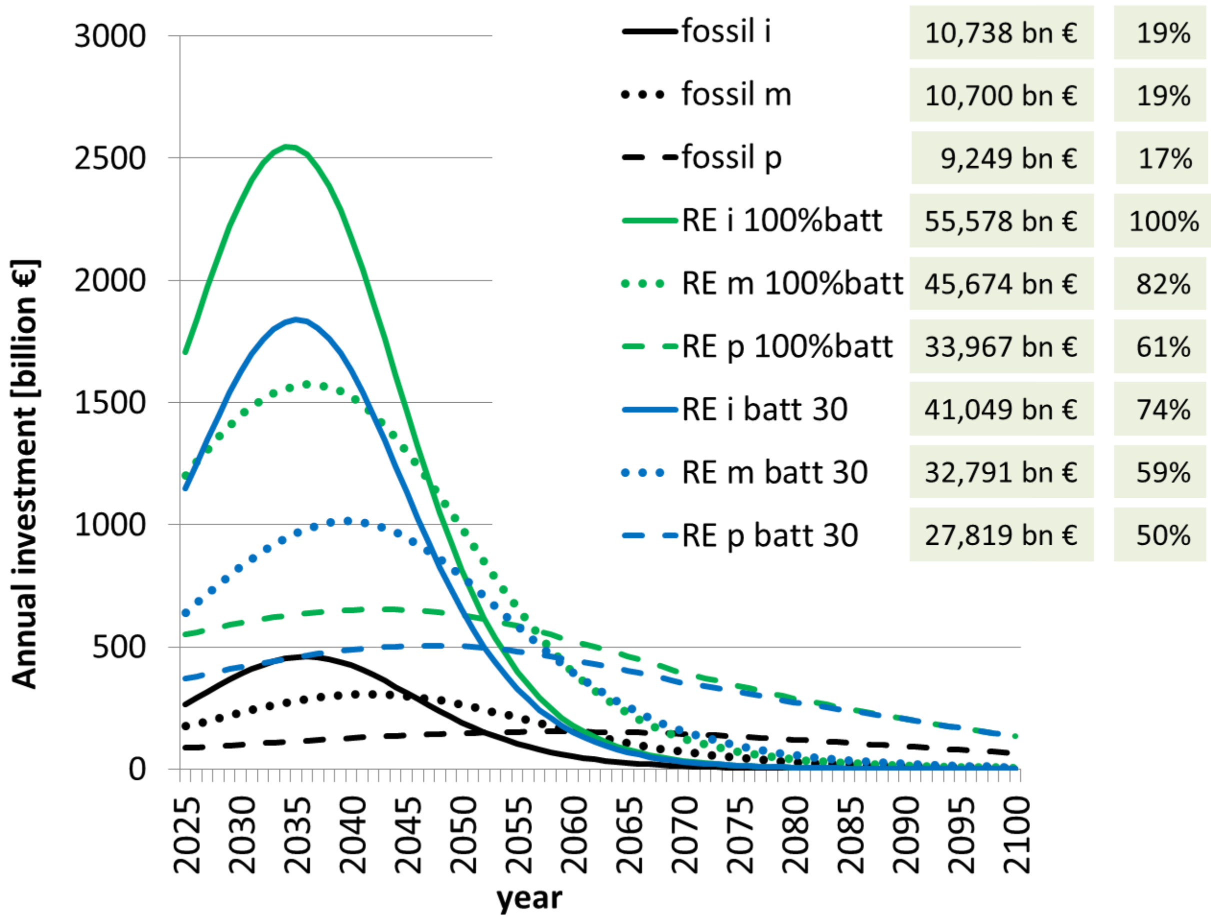
Annual investment needs for fossil and PV plus storage (only ideal case)



Africa, India and South America

Source: EUPVSEC 2022, Milano

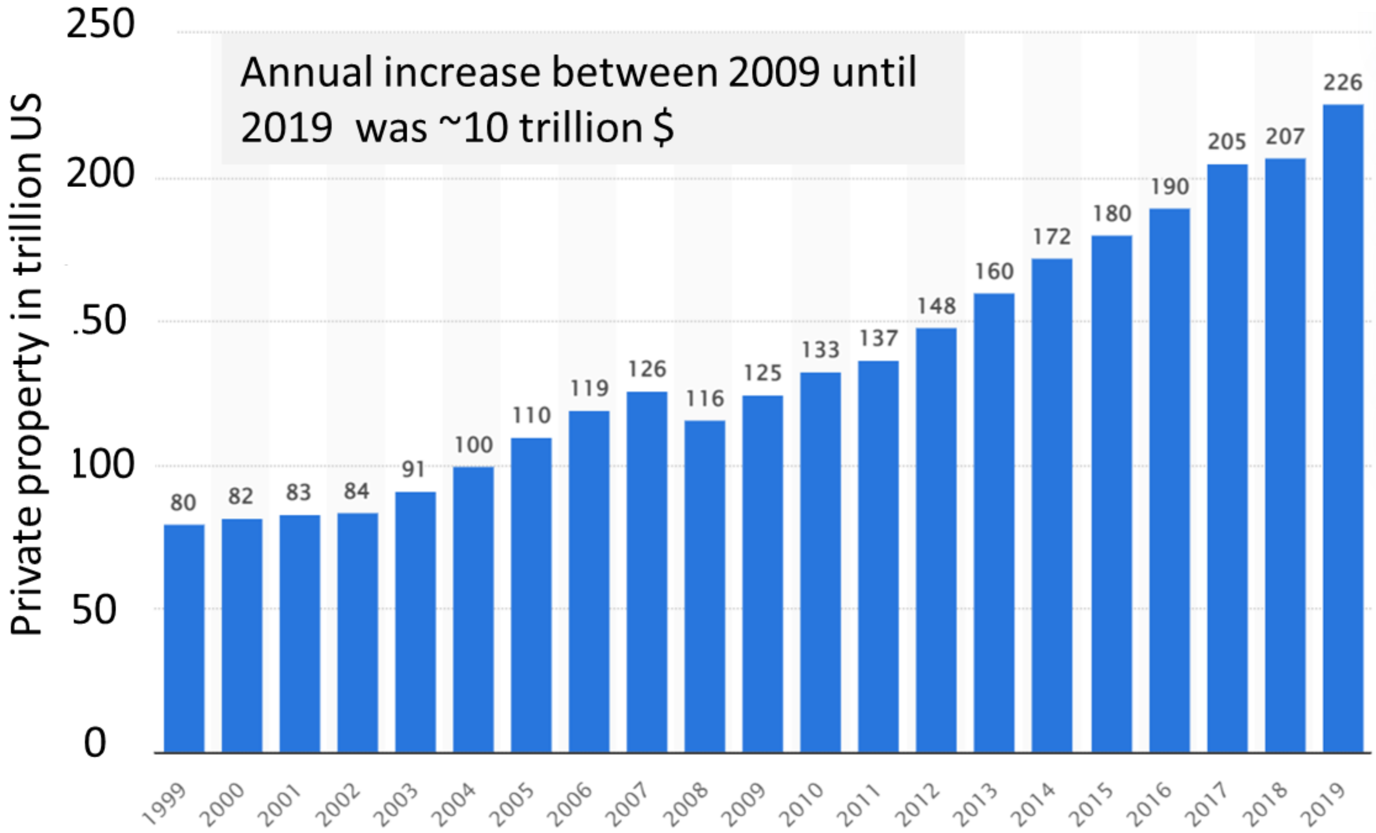
Annual investment needs for fossil and PV plus storage



Africa,
India and
South America

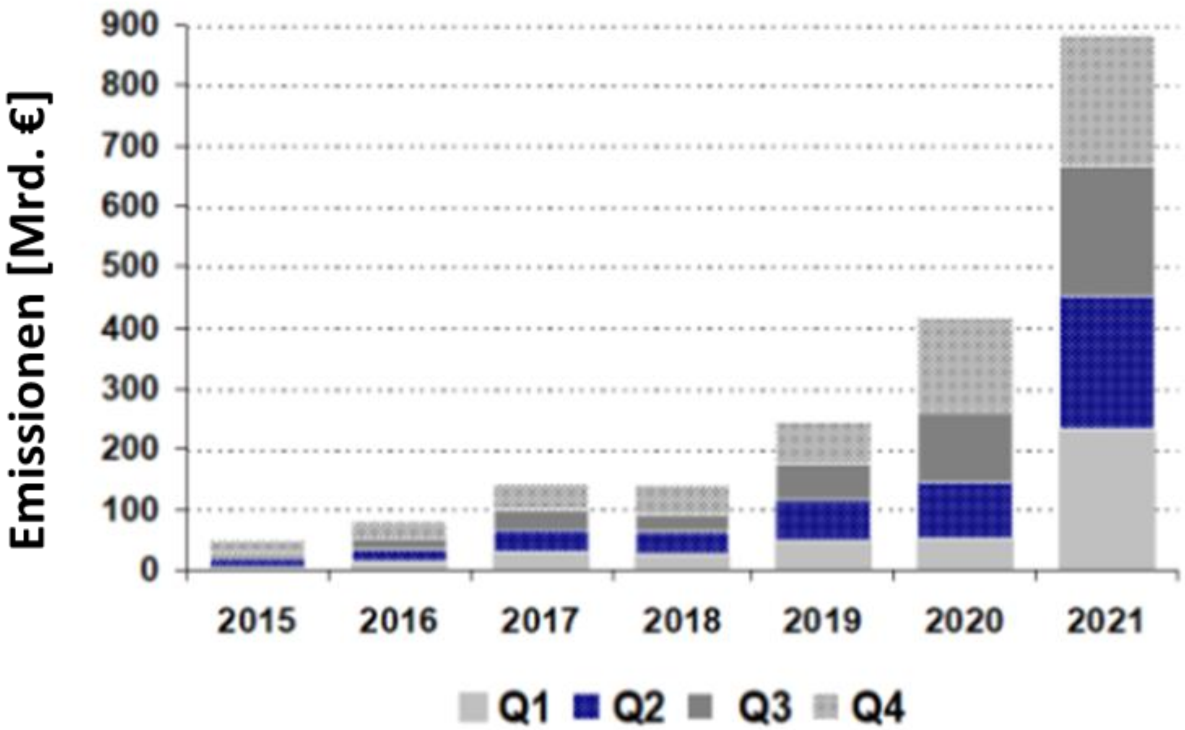
Source: EUPVSEC 2022, Milano

Global private property development



Source: Statista (de/statista.com/113 4213)

Globally placed issues for sustained financing [billion €]



Source:

We have the technology and we have the money ---
so, where is the problem?

Source:

Decentralized PV plus storage electrification project in Africa


Mali project

- In total 20 villages with 90,000 people
- ~4,000 households electrified (32,000 people served)
- 185 km electricity network

- **State banks do not treat RE investments as infrastructure projects!**
- **Financial resource from governmental institutions should be offered as subordinated loans and with decent interest rates.**
- **Only well developed technology should be used**

Characterictic numbers for a typical **Solar Power Center (SPC)** and mini grid:

- 1 Solartainer (40‘ container) plus greenfield installation
  150-300 kWp PV, 300-600 kWh battery storage
- ~10 km power lines from SPC to households (average from 20 villages)

Serves on average 1000 households (8 people each) per village and corresponds to ~30% people electrified from total population in a village

Source: AGT Asset GmbH, Heinz-Werner Binzel (private communication)

Boundary conditiones for large scale electrification in Africa (et al.)

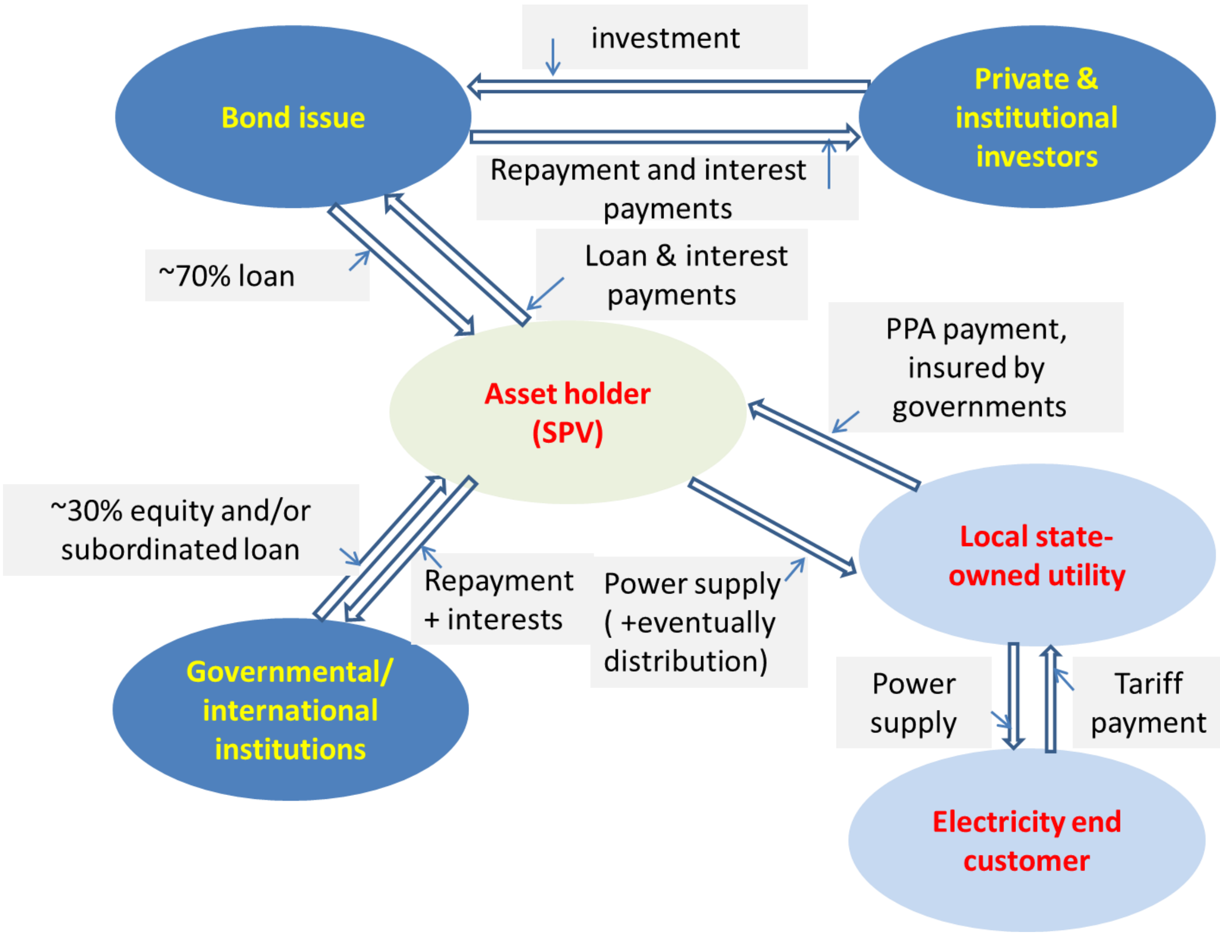
The majority of the **loans** must come from **private** and **institutional investors.** However, this will only happen if the **risk** for these huge infrastructure investments are **taken by governmental institutions and governments**.

Politics must influence their **state banks** to recognize **renewable energy** as important **infrastructure investment**, similar to the construction of large hydropower or nuclear power stations. **Financing duration** needs to be **~20 years**.

- **Risk money from governmental institutions such as KfW, EIB, Worldbank ,** e.g. equity participation and/or subordinated loan totalling to ~30% of the investment volume
- The **100 billion $ p.a.,** often discussed in the climate talks – like yesterday -, could be a start
- **Take over/participation** in various risks (exchange rate, political and credit risks; example is insurance provided by the German government for taking over credit risks associated with **P**ower **P**urchase **A**greement payments)
- Model best suited for **large renewable infrastructure projects**

Source: EUPVSEC 2022, Milano

Potential financing model



Source: EUPVSEC 2022 (Milano)

Summary

Without energy justice globally there will be the danger of heavy migration

Most of the energy increase will happen in Africa, India and South America

We have the cost effective renewable technologies at hand to power the future mankind

However, investment in power stations with fossil technologies is much cheaper compared to PV and wind (including storage), although LCOE is higher

Today's financing schemes do not allow renewable investments at large scale

Those regions responsible for the CO_2 -desaster – Europe, US, Japan, China – have not only the moral but also the selfish responsibility to finance the renewable technology

Win-win situation for heavy loans from old economies:

- Old economies have a chance to survive (<~2°C)
- The growth regions have cheaper electricity (lower LCOE with PV and wind)

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Thank´s for listening
and an urgent request:
please help actively, to master the huge challenges!
Otherwise latest our grandchildren will
no longer have a comfortable life!

7th November, 2022,
GCRNRE, Valencia

CV Winfried Hoffmann

- Since 1979 active in photovoltaic and CEO of production companies (RWE Solar GmbH: PV wafer, cells and modules, Applied Materials GmbH: Production equipment for deposition), president of associations (EPIA, today SolarPower Europe, BSW Solar), member/chairman of supervisory board (SMA Solar Technology AG/ Solar-Fabrik AG) and many institutes (FhG-ISE, ISFH, HZB, DLR, ZSW)

- **Today's activities in September 2022:**

❖ Member advisory board from Solnet group (EPC)

❖ Member scientific board at ISFH (Hameln)

❖ lectures/Seminars at universities in Konstanz and Freiburg