

A Not Impossible Mode of a Viable World for 11 Billion People and Polar Bears on Planet Earth

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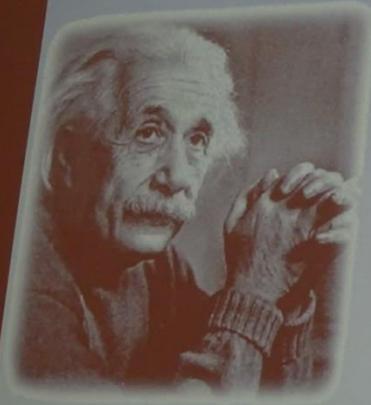
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Albert Einstein



"We cannot solve our significant problems from the same level of thinking we were at when we created these problems."

... we must see the world anew!

Humanity is in a deep crisis.

Design of a Reliable Viable World!

Humanity should act as **team for survival**. It needs

1. an exciting VISION :

➔ Build a reliable viable world for 11 billion people & polar bears, during 21st century

2. a convincing STRATEGY:

➔ energy without pollution, cohabitating nations

3. an effective MANAGEMENT for implementation

➔ world cohabitation alliance

a reliable viable world

= no human-made risk for self-destruction

	Man-made risk	Remedy
1	Uncontrolled Climate change	Energy w/o emissions
2	uncontrolled population growth	Prosperity for all
3	Overshoot & demolition of natural living base	No pollution, no overuse, no military forces
4.	Poverty , injustice	Clean prosperity for all
5.	Earth as battlefield	Cohabitation of nation states
6.	Dangerous traditions	Earth as space for life

Architecture: RE and Cohabitation of Nation States as pillars of a reliable viable world:

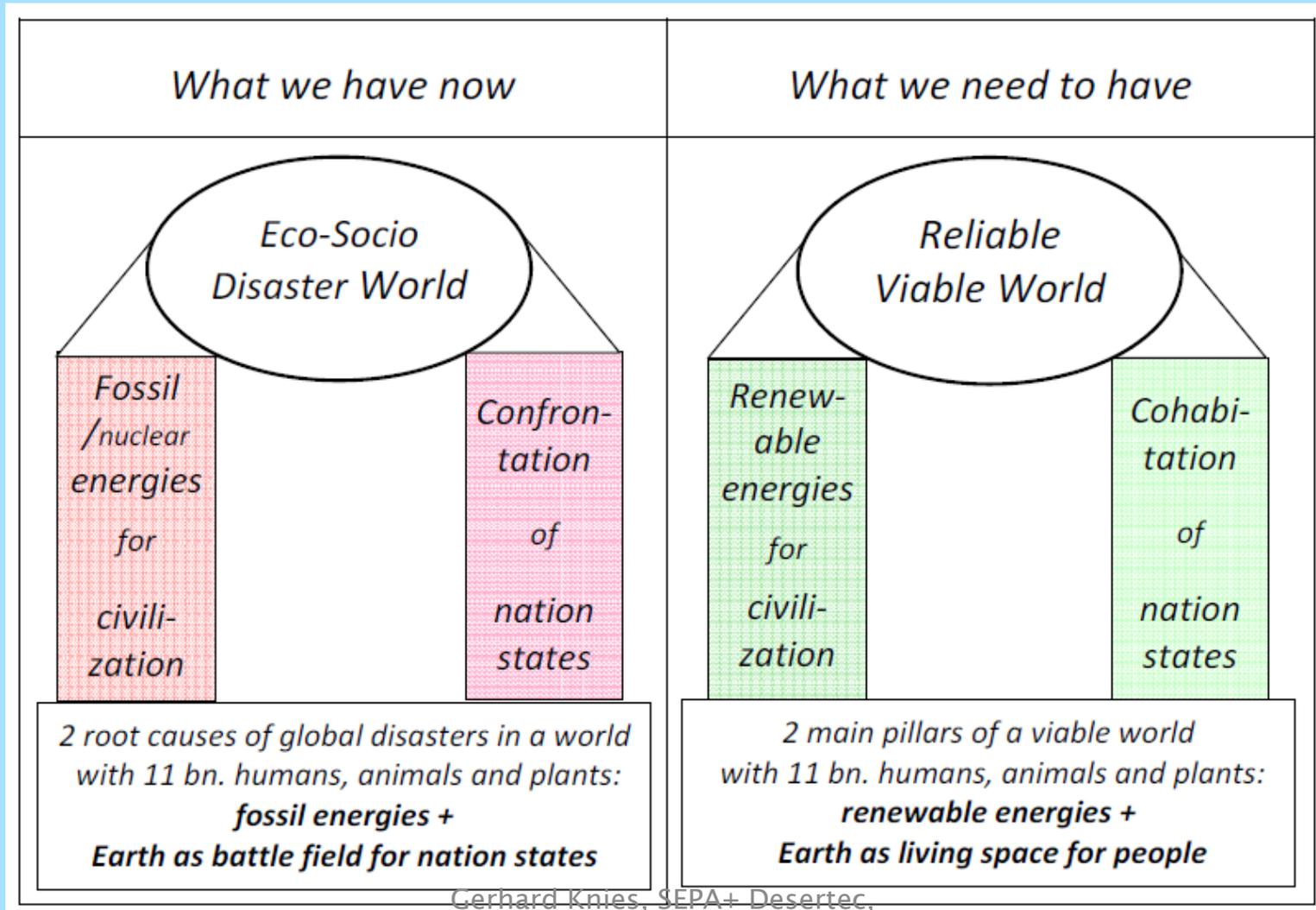
	Risk of man-made self-destruction	remedy	RE	COH	RE + COH
1	uncontrolled climate change	Energy w/o emissions	X		
2	Uncontrolled population growth	Prosperity for all			X
3	Overshoot & demolition of natural living base	No pollution, no overuse, no military forces			X
4.	Poverty , injustice	Clean prosperity for all			X
5.	Earth as battlefield	Cohabitation of nation states		X	
6.	Dangerous traditions	Earth as space for life			X

present world

fossil/nuclear energy
confrontation of states

future world:

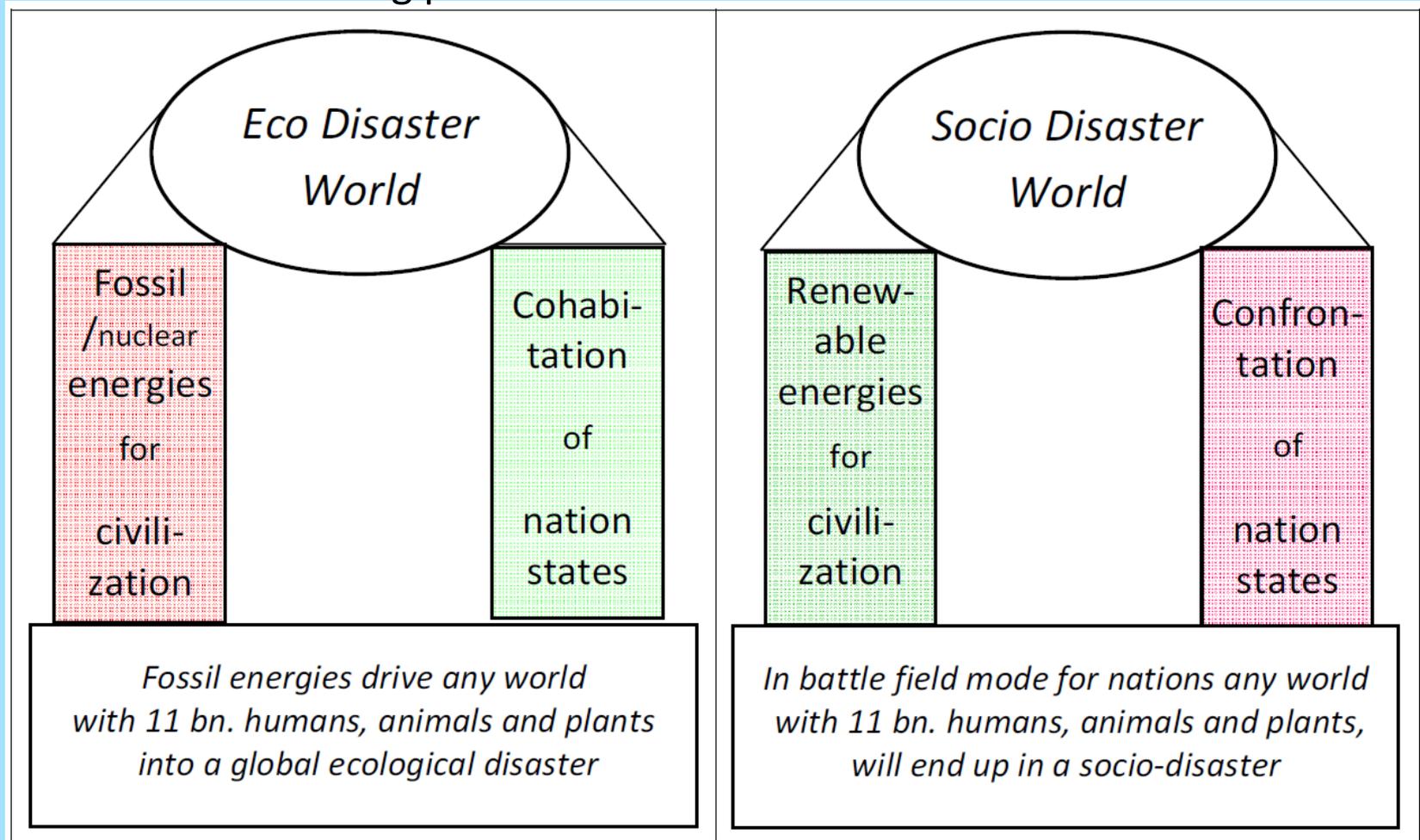
→ renewable energy
→ cohabitation of states



only 1 pillar replaced – not enuf: **reliable** viable → **maybe viable** world

fossil energy +
Earth as living place

renewable energy +
Earth as battlefied



=> maybe viable is not good enough

How to design a reliable viable world ?

1. In view of the progressing decline of Earth's bio-capacity by overuse and climate change, and of growing demands by mankind for bio-services,
humanity needs to take 2 measures with highest urgency:
 1. keep climate change below 2°C limit
→ *i.e. build a civilization without CO2 emission*
 2. upgrade present carrying capacity from 4.5 → 11 billion humans, by co-operating worldwide for reducing footprint/person,
→ *i.e. build a world with maximal co-operation*
2. Traditional external sovereignty of nations = recipe for suicide of humanity:
→ *rules for co-habitation instead of militarized rulers*
3. To avoid developmental disaster, humanity needs
World Climate Rules + World Cohabitation Rules.
World Climate Conferences + World Cohabitation Conferences

How to design a reliable viable world ?

World Cohabitation Conferences

What should be at **top of agenda** ?

- 1. Align 200 national foreign policies to a consistent world interior policy**
- 2. Replace gradually 200 militarized national security policies by rules for civilized cohabitation of states on planet Earth – like traffic rules enable safe driving of vehicles on a street system – and organize non-military forces for their enforcement.**

3. ??

- Can civil society/academic sector initiate world cohabitation conferences ?
- Can civil society/academic sector develop world cohabitation rules ?
- Can former directors of CERN and Nobel Laureates become Advisory Board of an ***International Journal of Viable-World Community for all***, to “Promote the ideal of nations’ peaceful cohabitation on planet Earth and build the team spirit which is essential for achieving the final aim: **a reliable viable world for all humans”** (*inspired by CERN Courier*)

ViableWorld Design: Reduce footprint, not population!

present carrying capacity: 4.5 bn → ~ 11 bn people

Carbon footprint => 1/10 : > 80% of coal,oil and

↳ Cropland footprint: new agriculture without using land

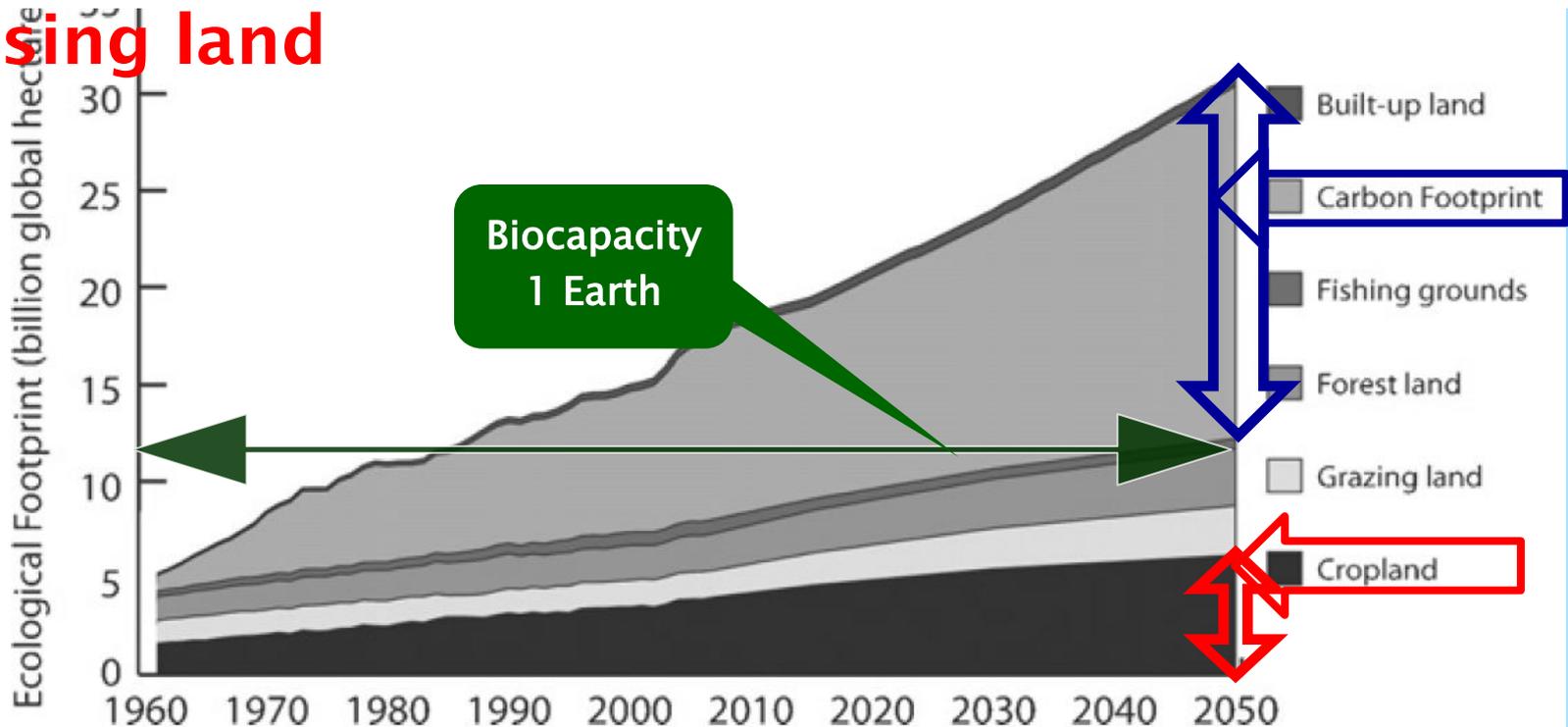


Fig. 1. Total Ecological Footprint projections to 2050 following baseline estimates.

Eliminate Carbon Footprint

How much cleanpower for 10 bn people (2050) ?

Assumption: German demand/person (2010) = world average for 10 billion in 2050

1. 2011 Final Energy per person Germany.

<https://de.wikipedia.org/wiki/energieverbrauch>

fossil fuels
except for electricity prod.
MWh/y: 20,1

electricity MWh/y 7,6

2 MWh primary fossil = 1 MWh
final electric

equivalent electricity
demand per person

Germany 2050 MWh/y: 18

2.

World population 2050:
10 billion

150 PWh/y

(+/- 20%)

Permanent
Cont's consumption
17 TW

Insolation 89,000
TW

on full planet

3.

Req. capacity for
2000 full load
hours/y (wind, solar)

75,000

GigaWatt

Solar +Wind

collectors & turbines

40 years, 2250

GW/y

5 GW/day

Military exp.

Wind=0.15, PV=0.15

Ready for that ?

5 GW/day ~ 5000 bn (Mrd.) €/year investment, ~ 1/2 car industry ~ 2 year military expenses

Financing cost: < ~ 10% investment < ~ 20% global military expenses

RE path cheaper than fossil/nuclear energy path with environmental/climate cost included

PV cost reduction curve: average annual module price vs. cumulative shipments

Annual data, last point: end 2014: 184 GWp/ 0.62 US\$/Wp (ITRPV 2015)

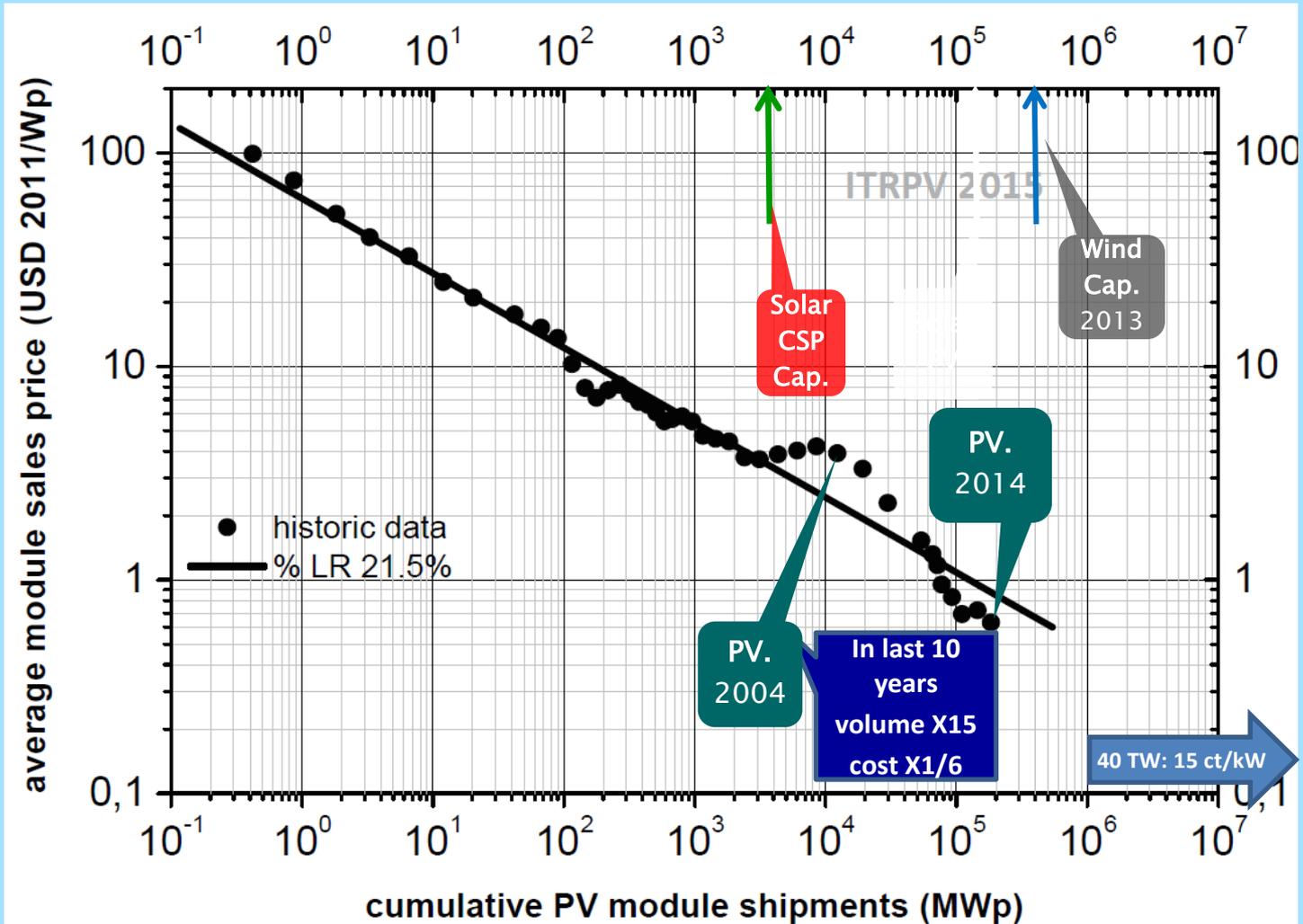


Fig.1 Learning curve for module price as a function of cumulative PV module shipments.

Expected continuous cost reduction for PV = economic end of fossil power generation

PV systems costs (BOS + panel) 2014: \$1000/kWp - \$1200/kWp PV systems costs 2020: \$500/kWp - \$600/kWp

Finance costs: 5.8%/year (with YieldCos or similar instruments available in safe countries, e.g. in the most recent contract in Abu Dhabi) Yield: 2000 kWh/year (to be on the safe side). Resulting electricity costs in Abu Dhabi 2020: \$C 1.4/kWh + 1% Operation & Maintenance + 25% profit, total: \$C 1.75/kWh, up to \$C 2.1/kWh for systems costs of \$600/kWp.

Costs offers in Austin/Texas, to be build in 2016: \$c 4.0/kWh
- 40% in 2020: \$c 2.4/kWh

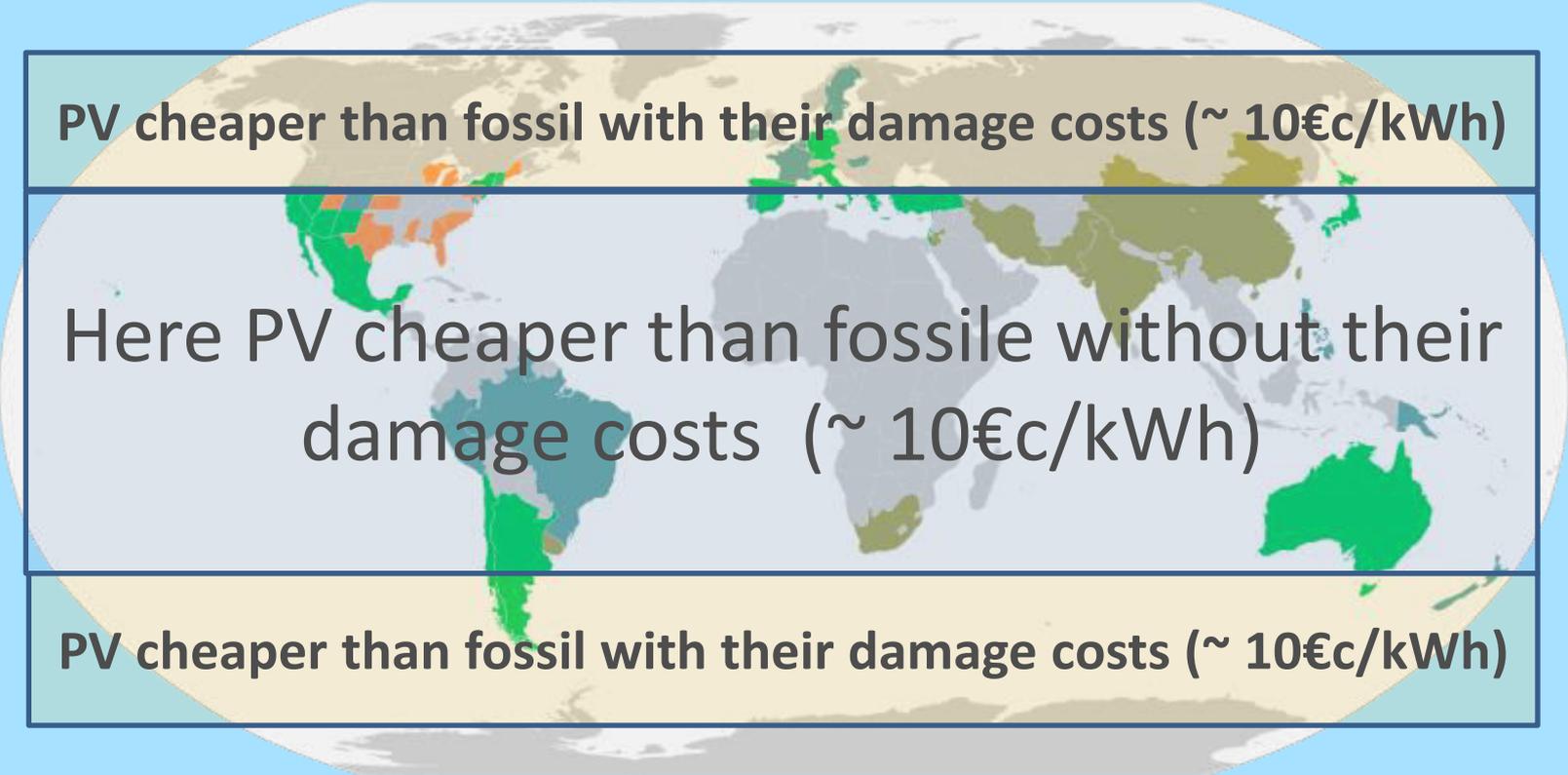
Daily electricity storage, 2020: < \$c 9.2/kWh

Electricity mix 1/2 direct +1/2 storage < \$c 5.8/kWh

Externalised fossile cost (climate, environment damage) ~ \$c 10/kWh

Until 2020 costs minus 36% gives electricity costs of \$C 2.56/kWh at insolation of 1900 kWh/m²/year, or at insolation of 2400 kWh/m²/year: \$C 2.02/kWh. Battery costs for large installations, 100 kWh Powerblock Tesla: \$220/kWh To be on the safe side: Battery costs of \$250/kWh give annual battery costs of \$20/year/kWh, The Powerblock gives 1 kWh x 365 x 0.6, i.e.: Electricity costs from storage: \$C 9.2/kWh. Total day costs after year 2020: \$C 2/kWh. Total night costs: < \$C 11.2/kWh.

Fastest way forward:
Clean power for all, where cheaper than fossil :
PV grid parität 2014



PV cheaper than fossil with their damage costs (~ 10€/kWh)

The map shows a world map with three horizontal bands. The top and bottom bands are light green and contain text. The middle band is light blue and contains text. The map itself is colored in shades of green, orange, and grey to indicate different regions where PV is cheaper than fossil.

Here PV cheaper than fossile without their
damage costs (~ 10€/kWh)

PV cheaper than fossil with their damage costs (~ 10€/kWh)

Reduce Crop Footprint by agriculture without using arable land

Agri-culture

Solar Photosynthesis:



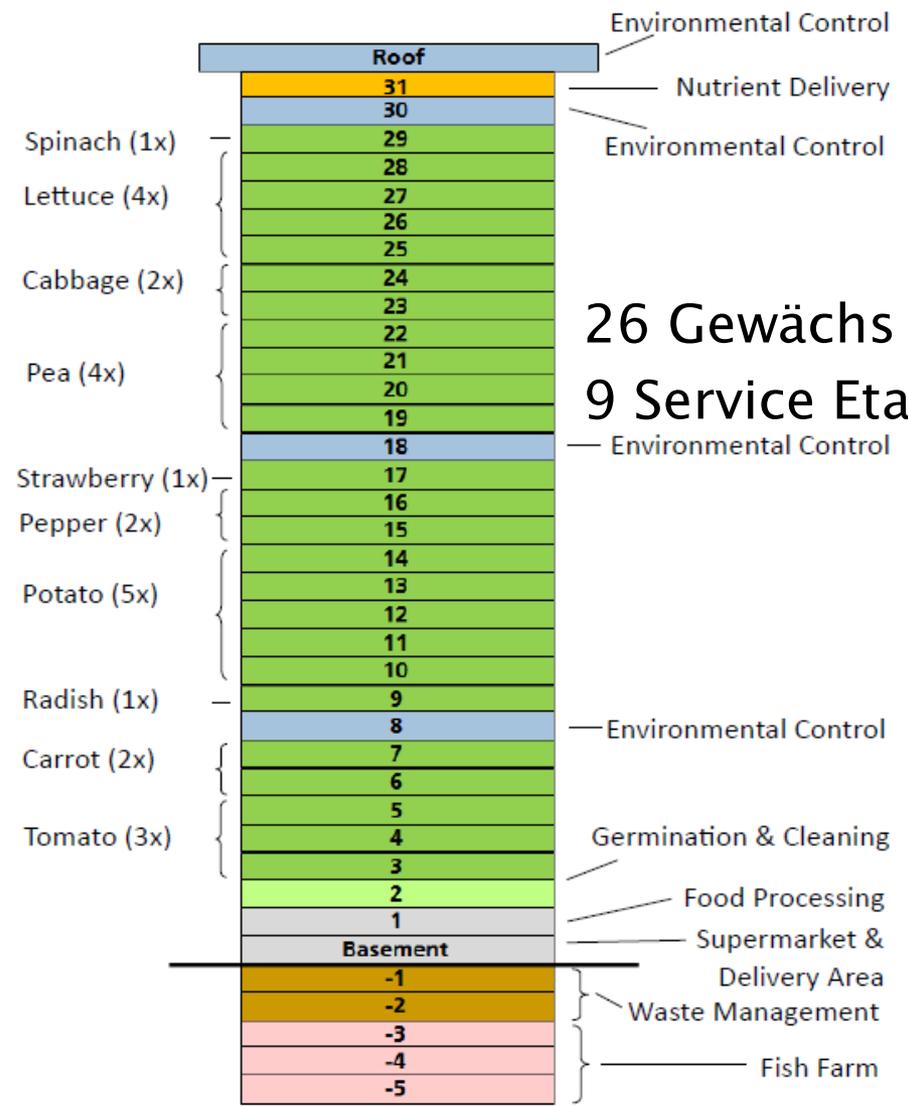
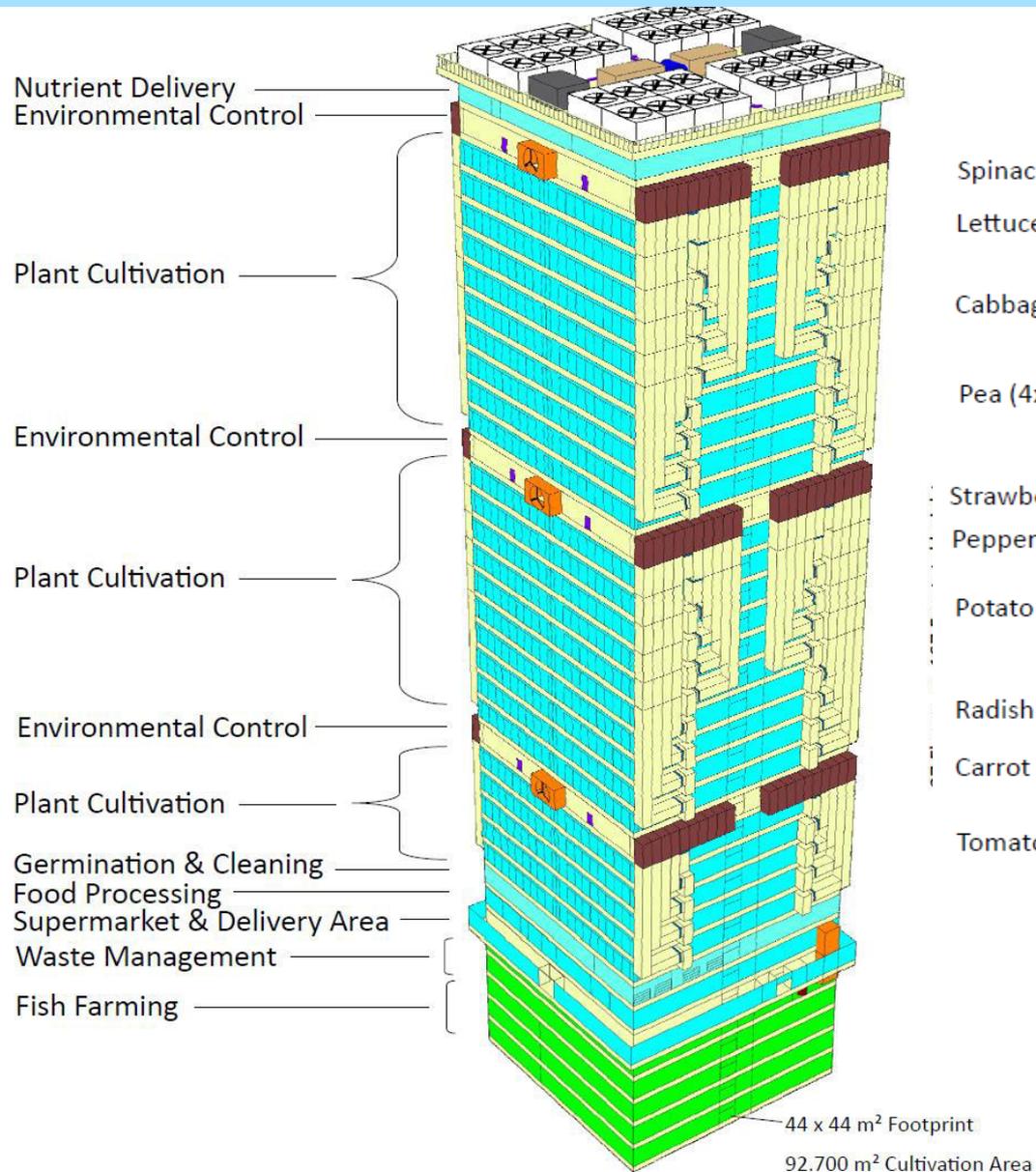
Greenhouse-culture

LED Photosynthesis:

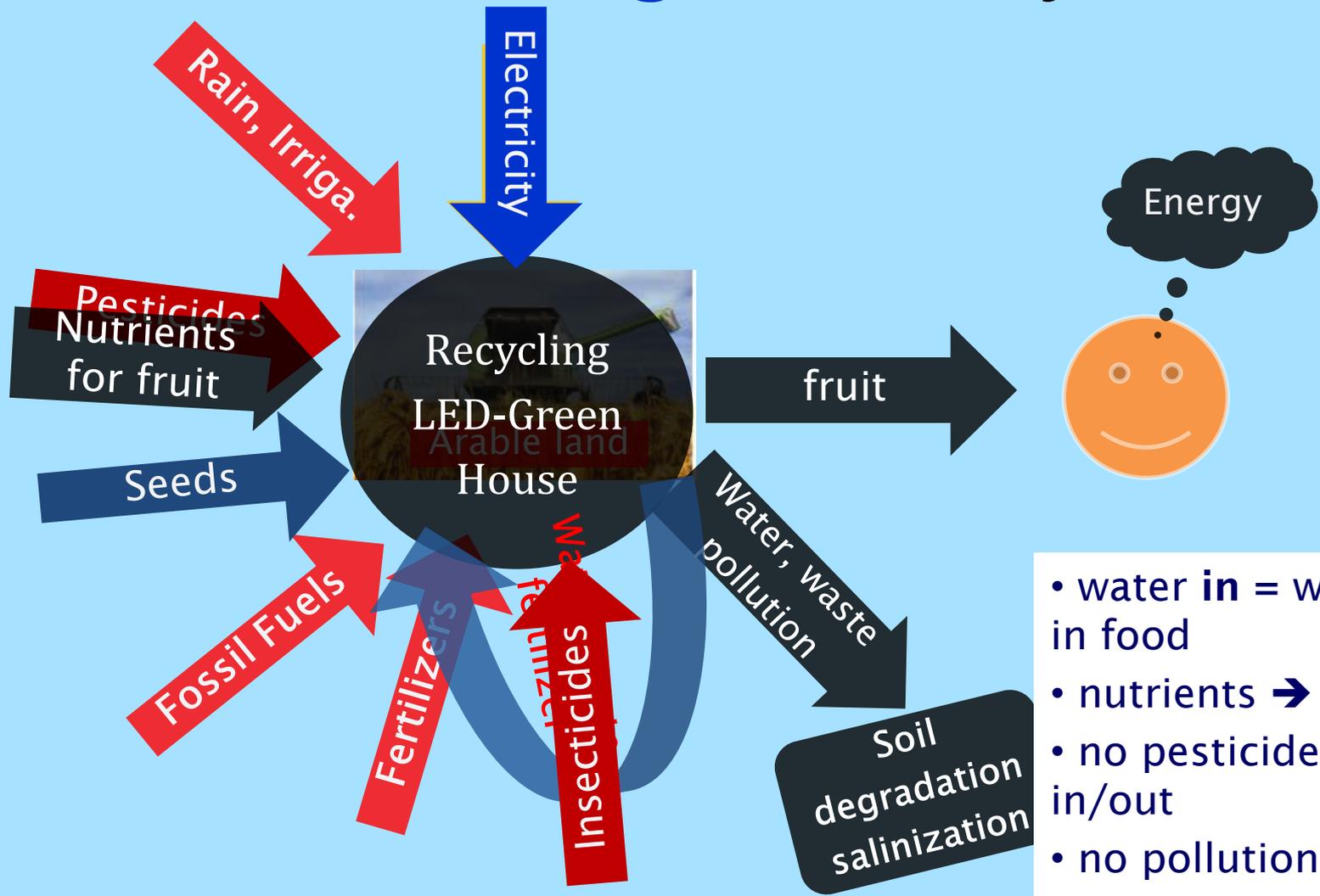


LED-Photosynthesis floors





Food from L Solar Air H Photosynthesis



- water **in** = water in food
- nutrients → food
- no pesticides in/out
- no pollution out
- **no arable land occupied**

• no slash+burn of forests

Global Population Growth: Africa

explosive population growth in Africa

Development of world population 2015-2100

<i>Region</i>	<i>2015</i>	<i>2030</i>	<i>2050</i>	<i>2100</i>	<i>2100/2015</i>
World	7 349	8 501	9 725	11 213	1.50
<u>Africa</u>	<u>1 186</u>	<u>1 679</u>	<u>2 478</u>	<u>4 387</u>	<u>3.70</u>
Middle Africa	936			3 588	3.83
<u>World w/o Africa</u>	<u>6163</u>	<u>6822</u>	<u>7247</u>	<u>6826</u>	<u>1.11</u>
Europe	738	734	707	646	0.86
Asia	4 393	4 923	5 267	4 889	1.11
Latin America and Caribbean	634	721	784	721	1.14
Northern America.....	358	396	433	500	1.40

- ➔ World-wide: stagnation – in Africa explosion:
- ➔ Bring prosperity to Africa: to ~ 1/2 prosperity
- ➔ **Security through prosperity!** Not by weapons

Poverty and pop. explosion:
=> Rich-Poor development alliances: nations, communities ?

[as designated by the United Nations](#). Date: 9. Januar 2008

Clean energy alliance of
high+low developed
Countries, regions,
communities

HDC (GNP >
20,000€/cap):

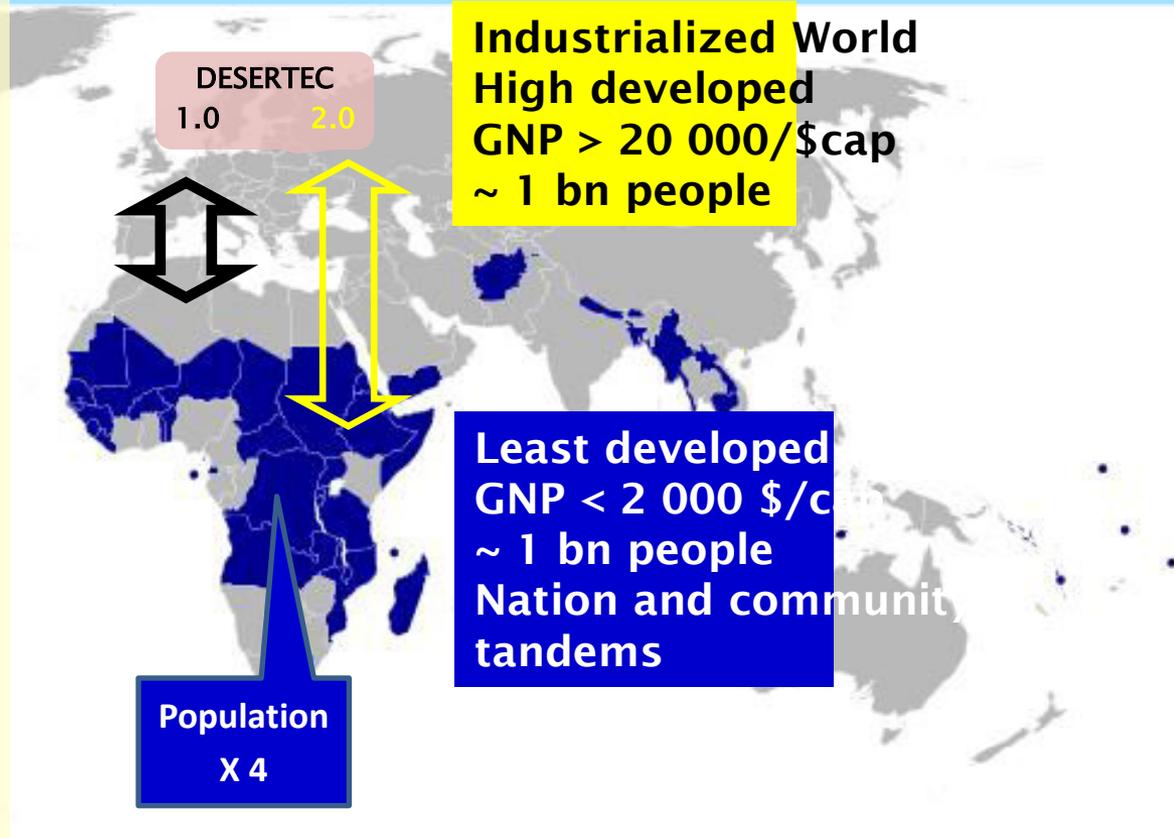
LDC (GNP < 2,000€/cap)

global partnership for

1. rapid global climate protection
2. clean prosperity for all
3. North-South justice
4. fairness between generations

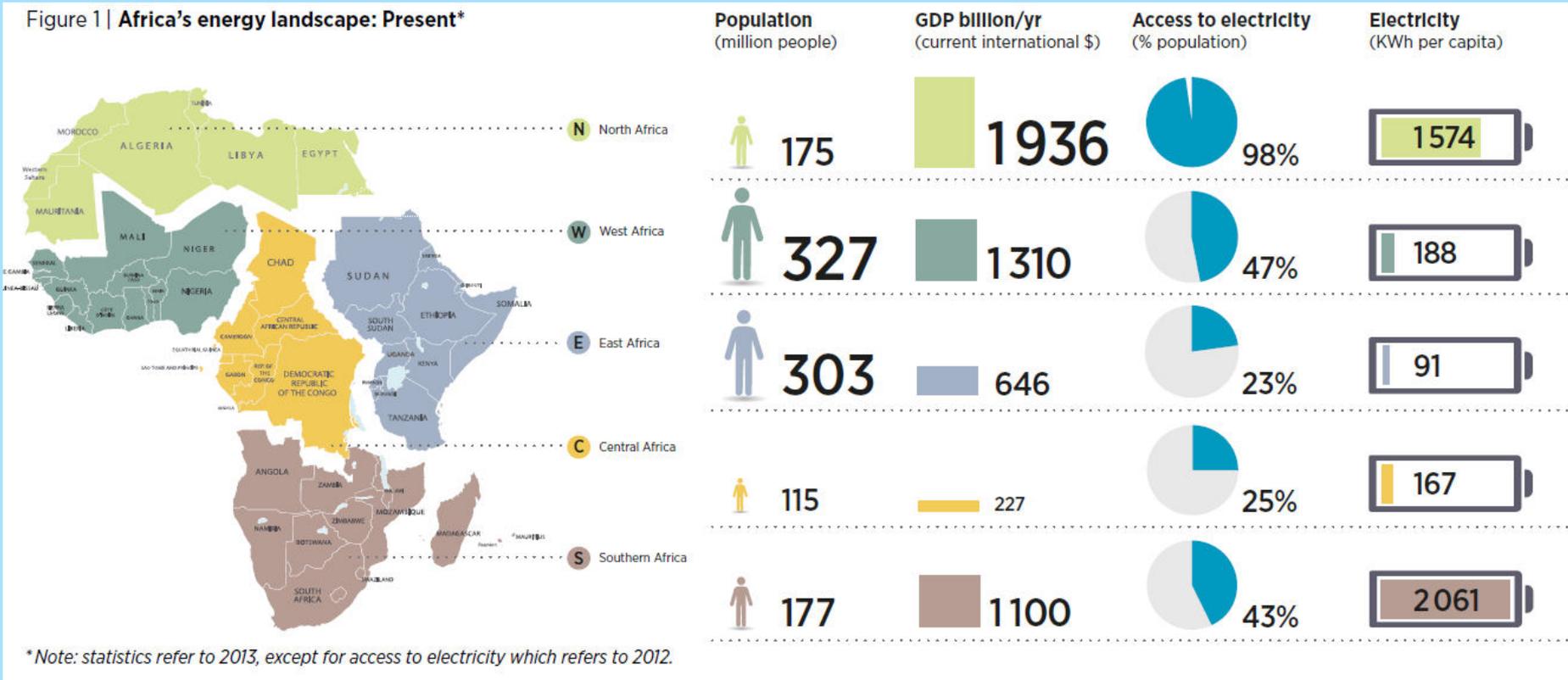
Build a reliable viable
world for all

21 from 1 month/year
military expenses



IRENA (2015), Africa 2030: Roadmap for a Renewable Energy Future. IRENA, Abu Dhabi.

Figure 1 | Africa's energy landscape: Present*



AfDB President Akinwumi A. Adesina,

“Our sons and daughters are fleeing

Gerhard Knies, SEPA+
Desertec, Gießen 2015

Clean power for Africa –

2.5 bn people in 2050, ½ of German consumption

1. 2011 Final Energy per person Germany.

<https://de.wikipedia.org/wiki/energieverbrauch>

2. fossil fuels except for electricity prod. MWh/y: 20,1

Electricity MWh/y 7,6

2 MWh primary fossil = 1 MWh final electric

equivalent electricity demand per person

Germany 2050 MWh/y: 18

2050 Africa wide ~ 40%

2.

Africa population 2050: 2.5 billion

20 PWh/y

(+/- 20%)

3.

Req. capacity for 2000 full load hours/y (wind, solar)

10,000

GigaWatt

Solar +Wind

collectors & turbines

35 years, 300

GW/y

0.8GW/day ~1000 bn (Mrd.)€/year investment, Financing cost:

cheaper and faster than from fossil/nuclear energy, no environmental/climate cost

8.000

0.8 GW/day

Now MWh/y: 0.15

PV: 0.15

Ready for that ?

Now MWh/y: 0.150

Jerrald Knies, SEPA+ Desertec, Gießen 2015

Basic features of a not impossible viable world for 11 bn humans and polar bears

1. *Stop battlefield mode and CO2 emissions simultaneously!*
2. Focus science, technology and policies on building a new reliable viable world for 11 bn humans:
 1. cohabitation of nations by rules, instead of ruling by violent nations
 2. raise ecological carrying capacity to 11 bn humans, by clean RE
 3. enable prosperity to all , to end global population growth

Thank you, gerhard.knies@viableworld.org