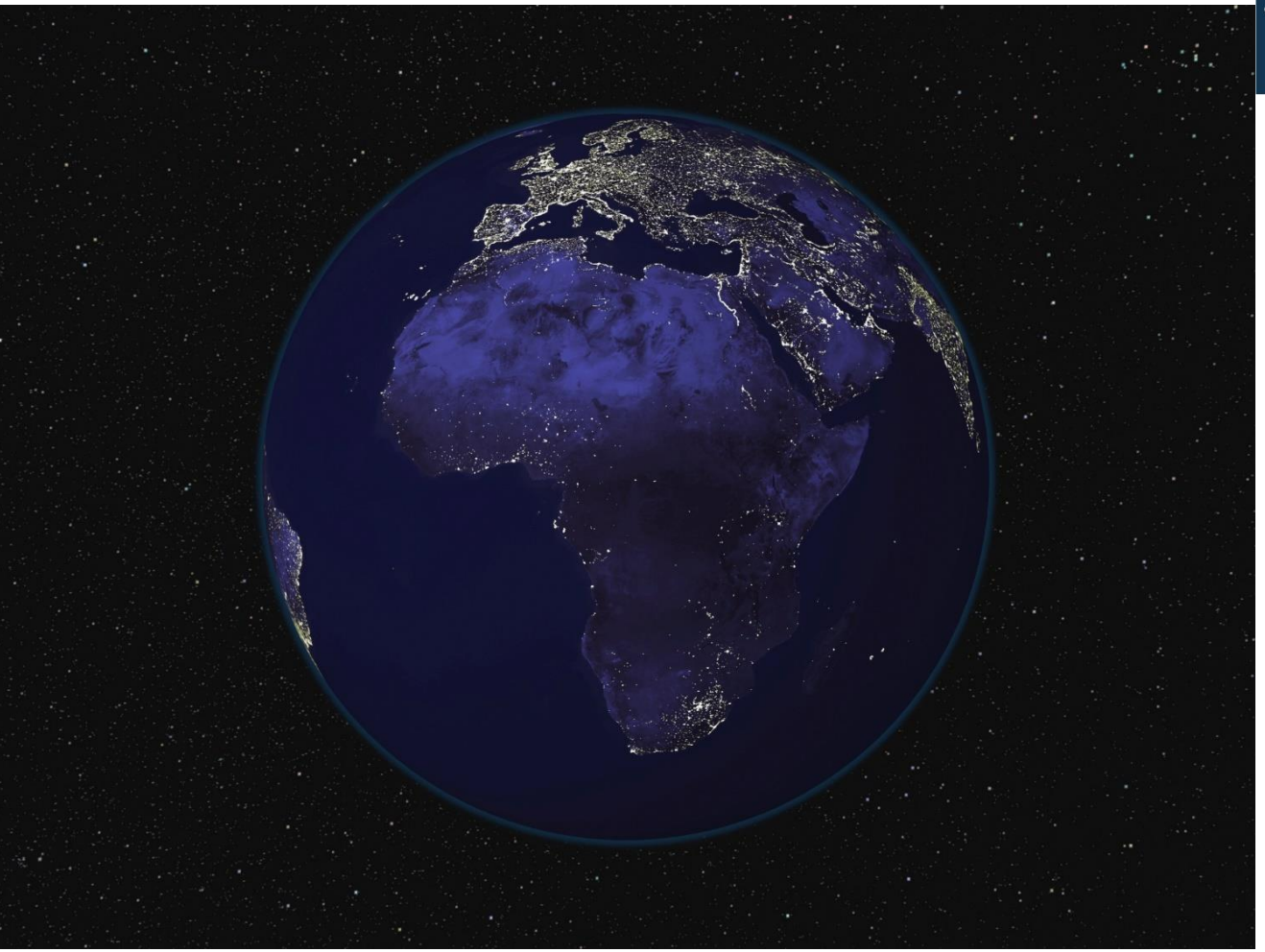

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Towards universal electricity access in Sub-Saharan Africa –

The role of decentralized systems

Anteneh G. Dagnachew
Paul L. Lucas
Andries F. Hof
Detlef van Vuuren

Twitter: @Antex_GD

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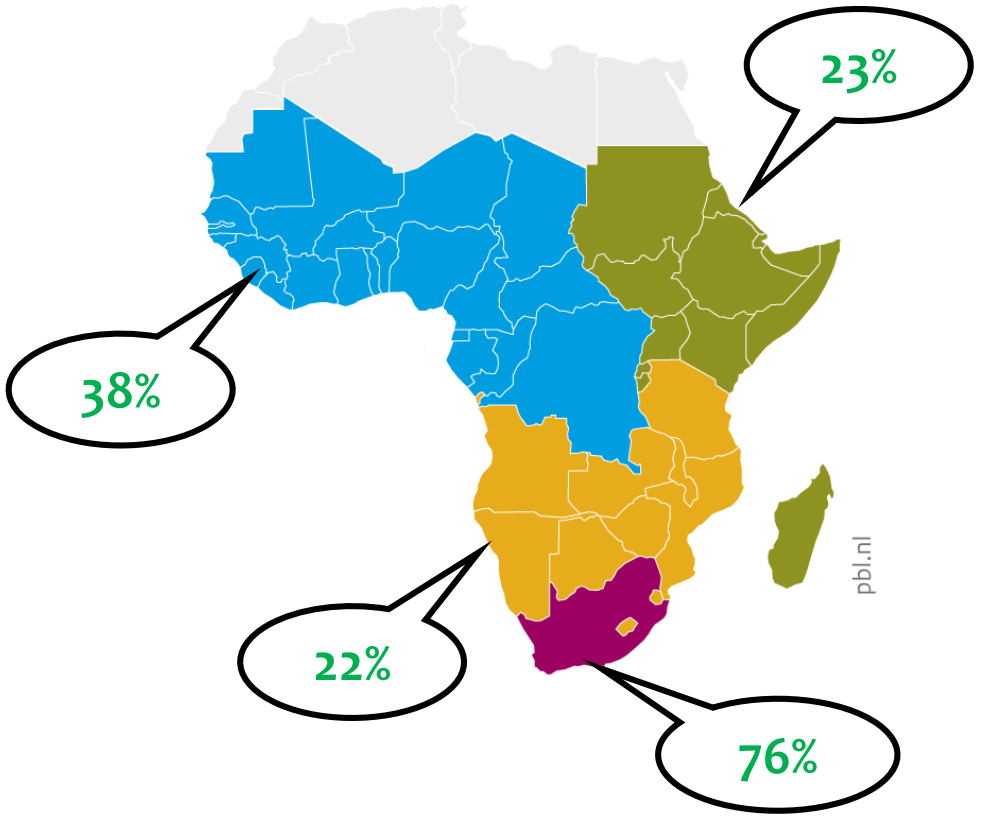
Electricity access 2010



= 5 million people

Sub-Saharan Africa

~280 million with access

>600 million without access

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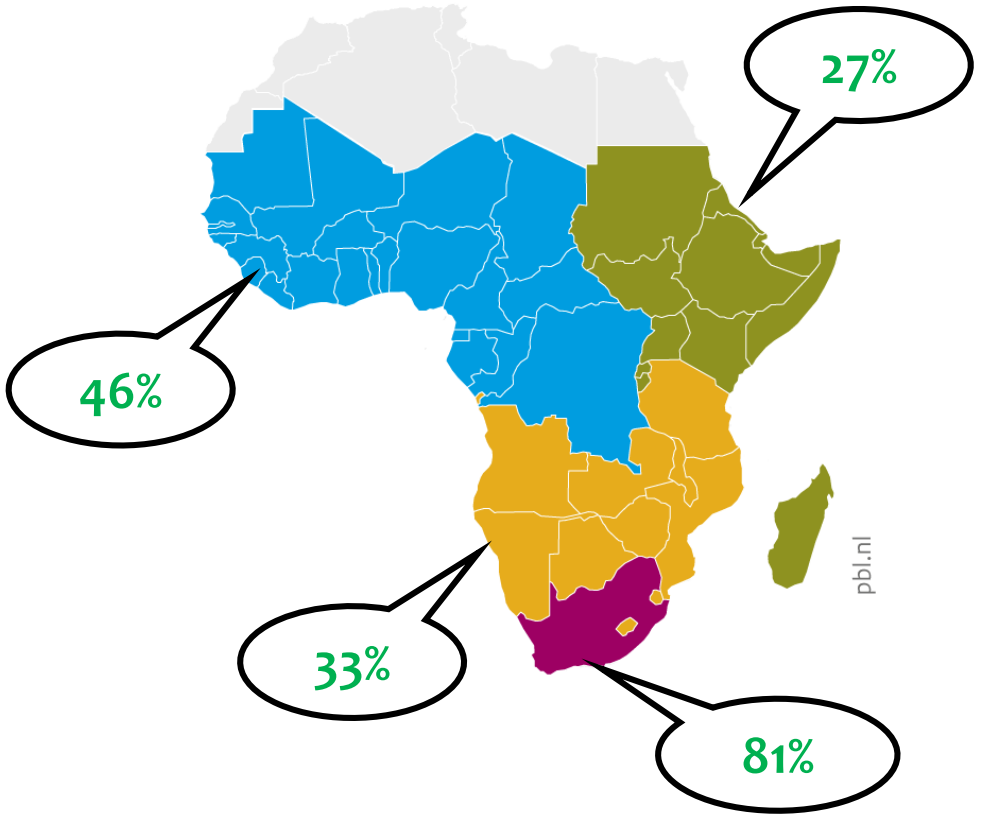
Electricity access 2015



= 5 million people

Sub-Saharan Africa

~400 million with access

>595 million without access

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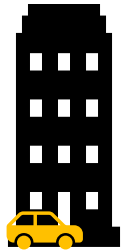
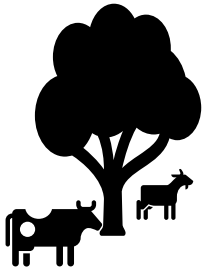
Electricity access 2010

5 million people



63% Urban has access



14% Rural has access

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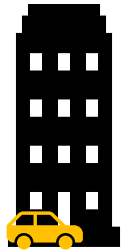
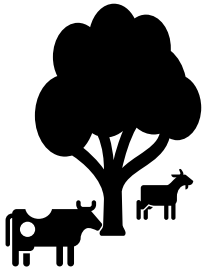
Electricity access 2015

5 million people



74% Urban has access



18% Rural has access

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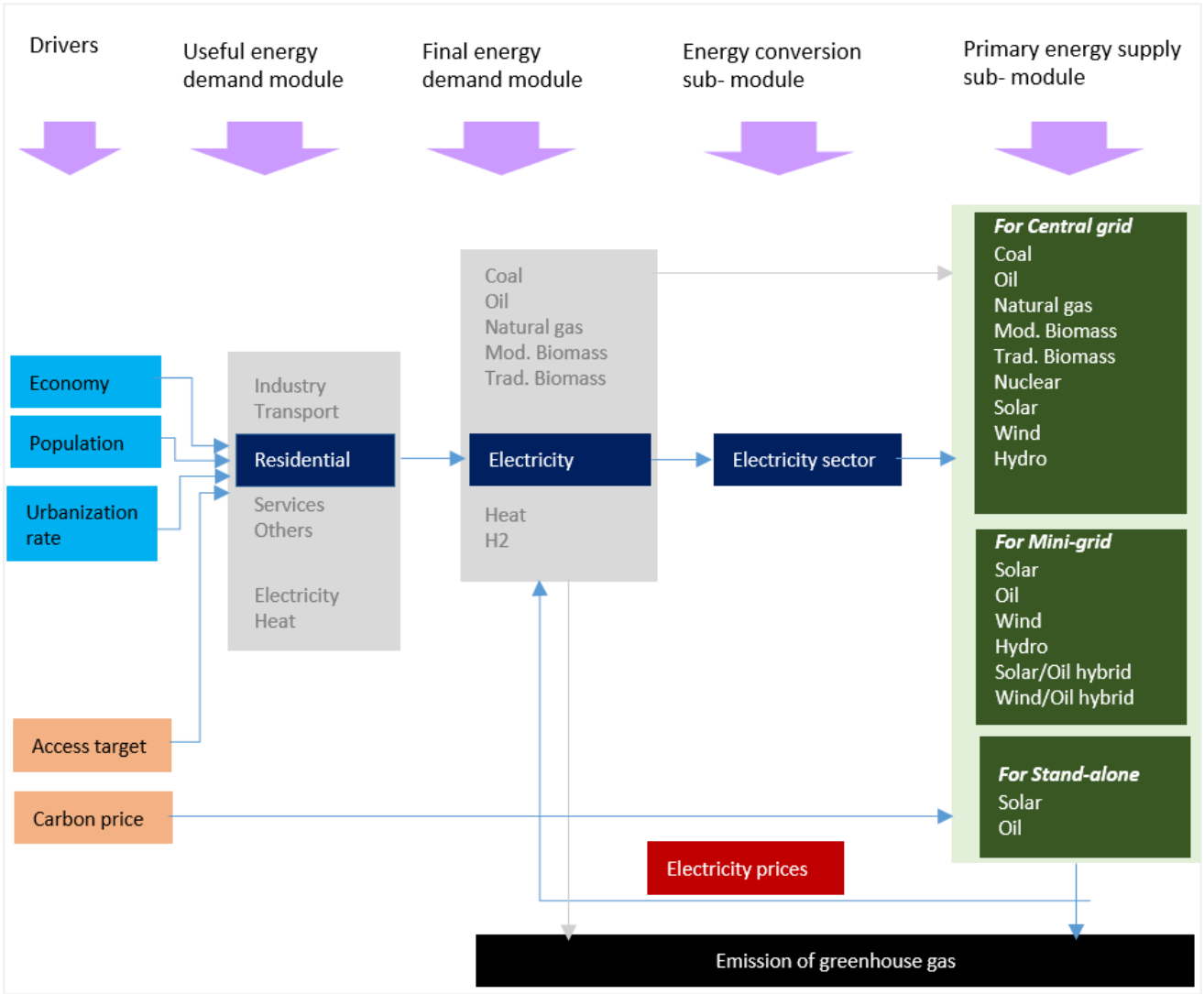
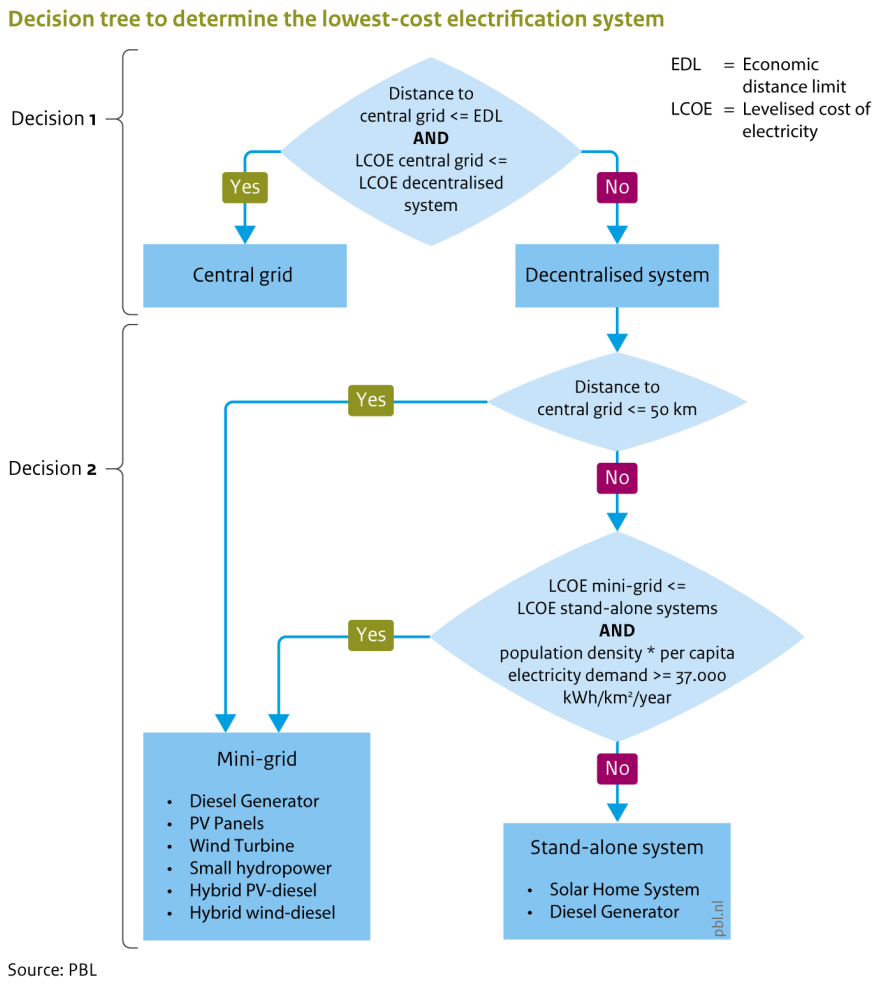
TIMER – the IMAGE energy model





Source: PBL

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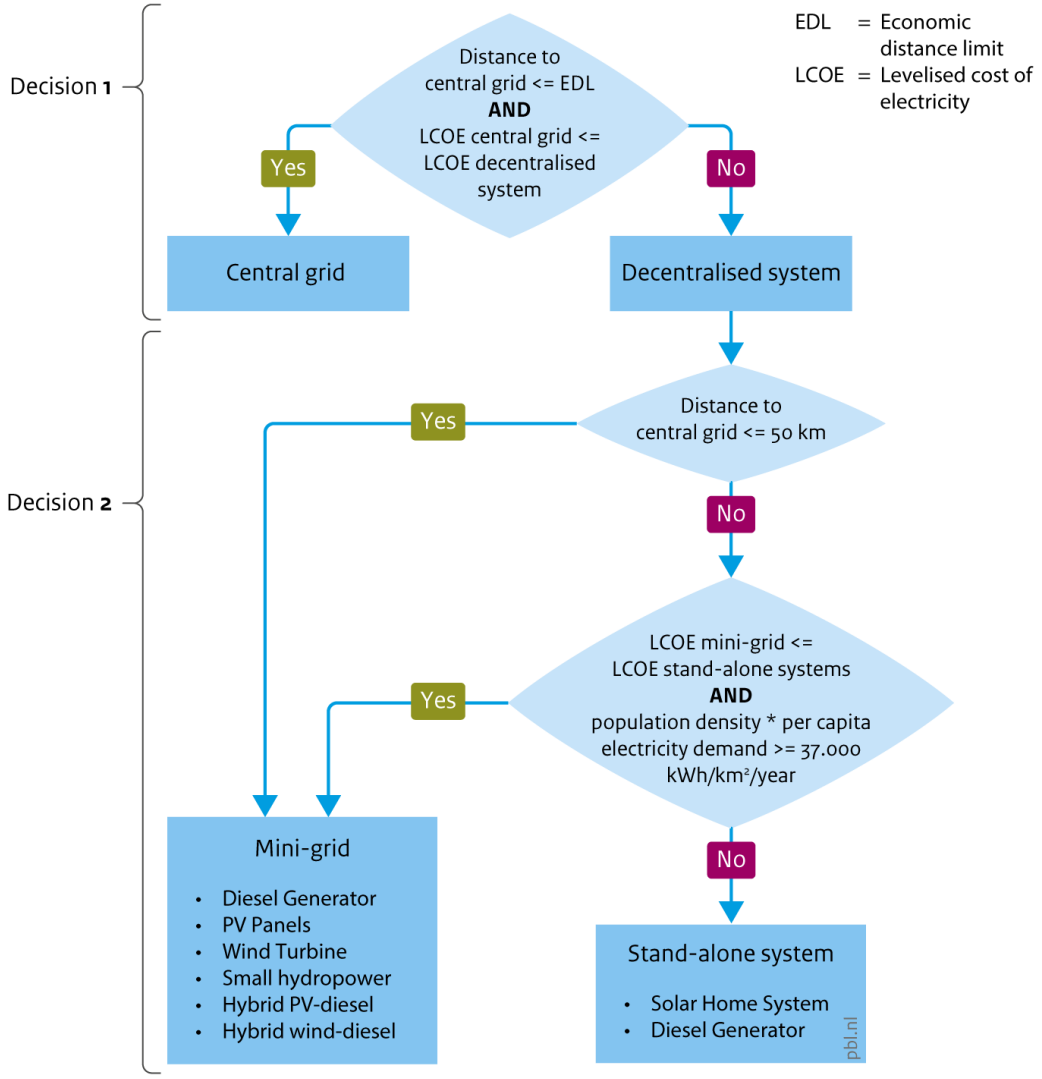
Electrification model

0.5°X0.5° grid-cell

Decision tree to determine the lowest-cost electrification system



Source: PBL

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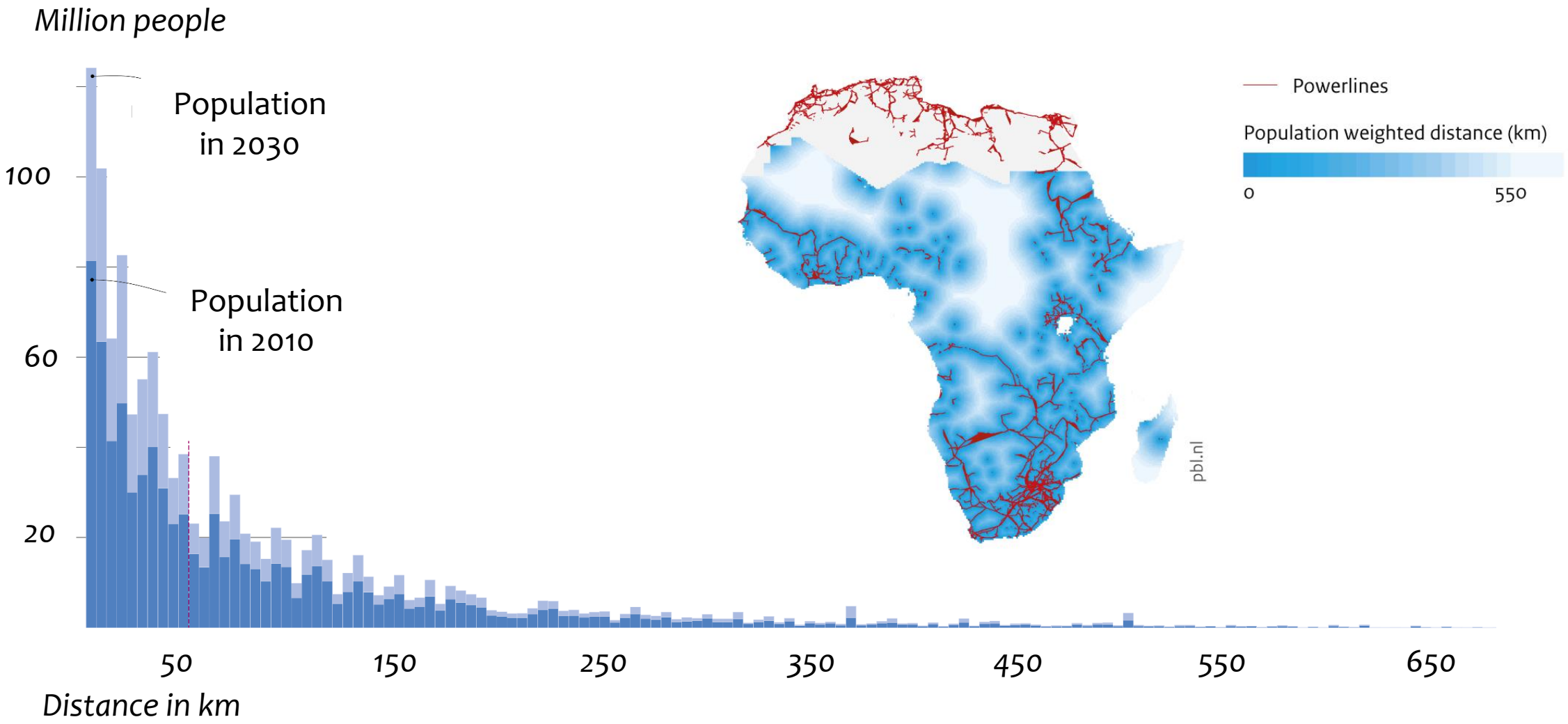
Distance to power line



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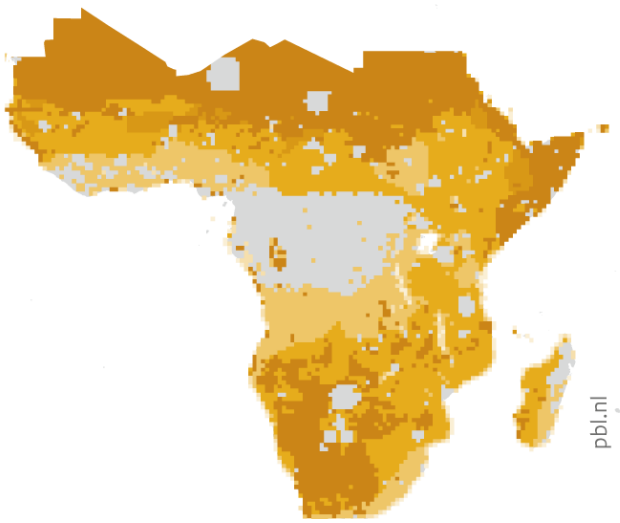
Renewable energy resources

Technical potential

Solar PV

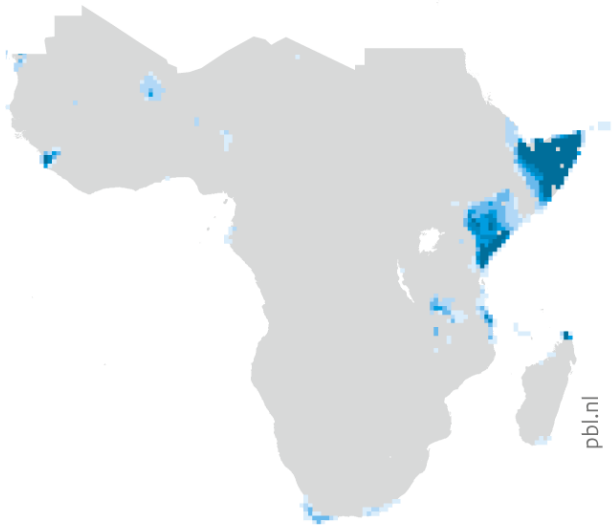


Renewable energy potential
(GWh per year per 0.5 x 0.5 degrees grid cell)

Solar PV

2000 4000 6000 8000 10 000

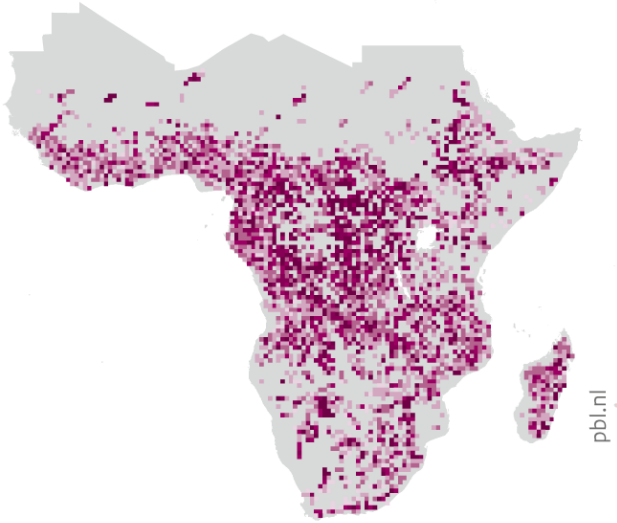
Wind power



Wind power (wind speed > 4 m/s)

2000 4000 6000 8000 10 000

Mini-hydro



Source: PBL

Mini hydropower

2 4 6 8 10

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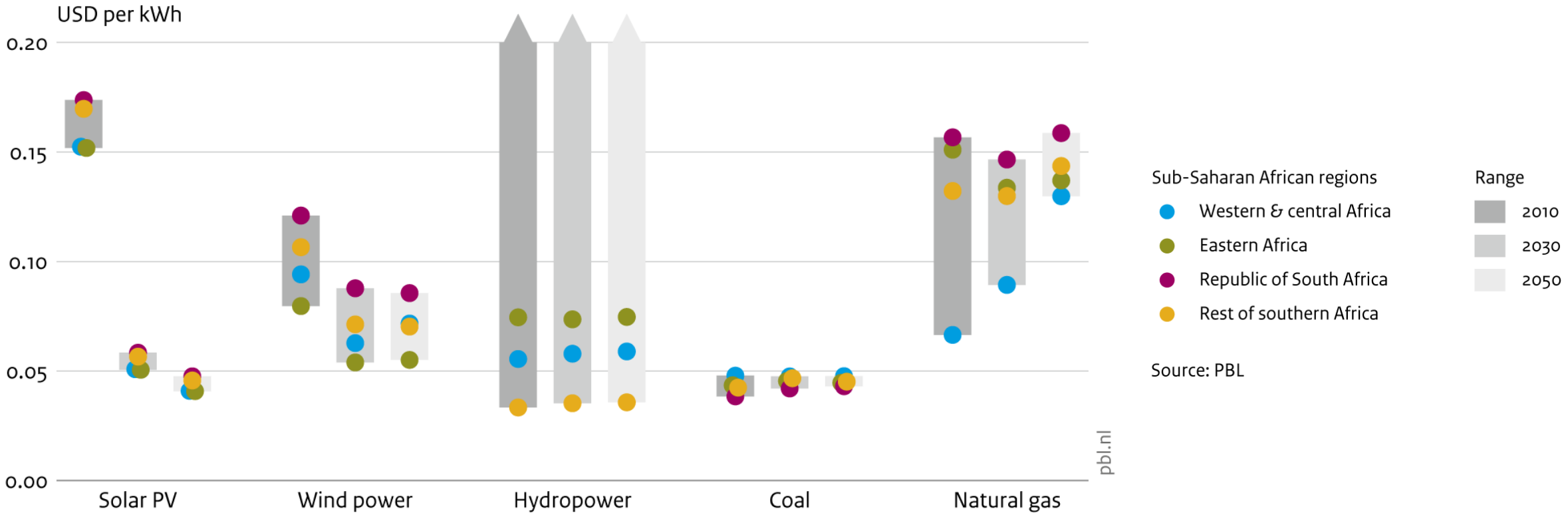
Development in renewable energy prices



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Access rate – Baseline 2030

= 5 million people

830 million with access

515 million without access

Regional differences

Urban-Rural differences

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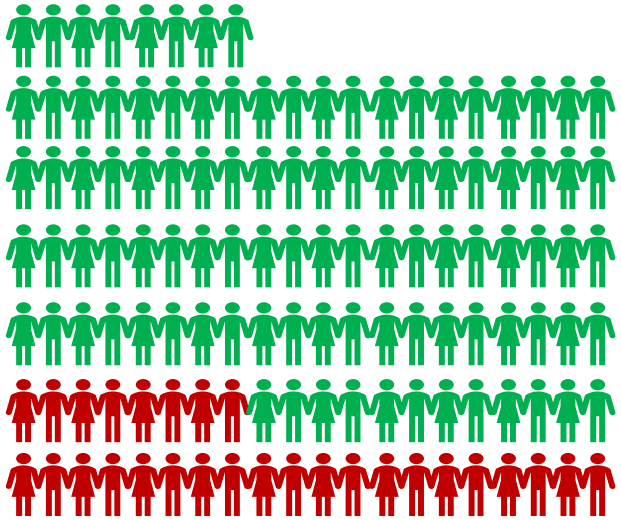
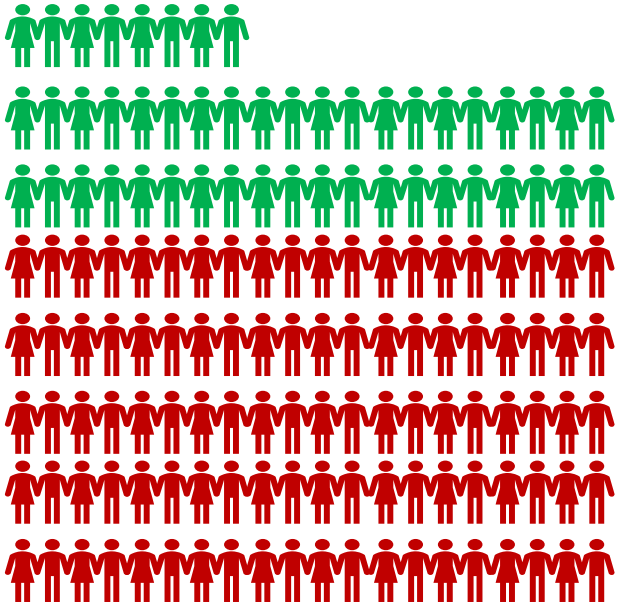
Access rate – Baseline 2030

URBAN
88% has access



RURAL
36% has access



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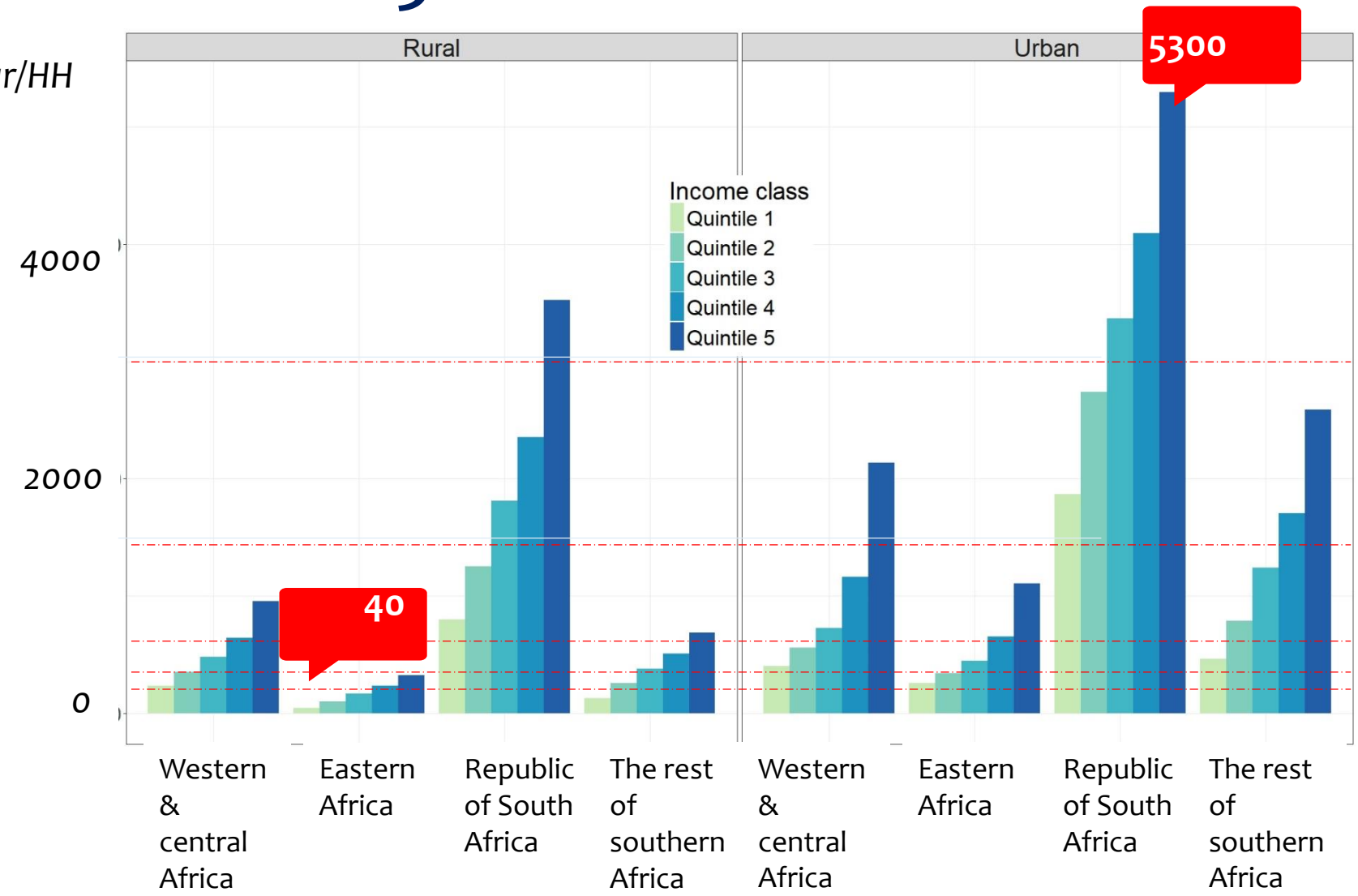
Household demand– Baseline 2030

kWh/Year/HH

Regional differences

Urban-Rural differences



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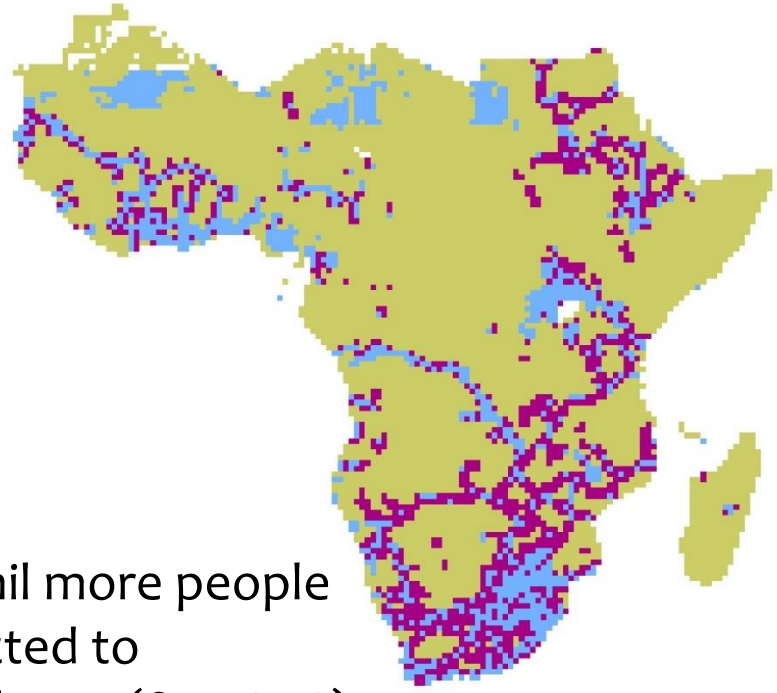
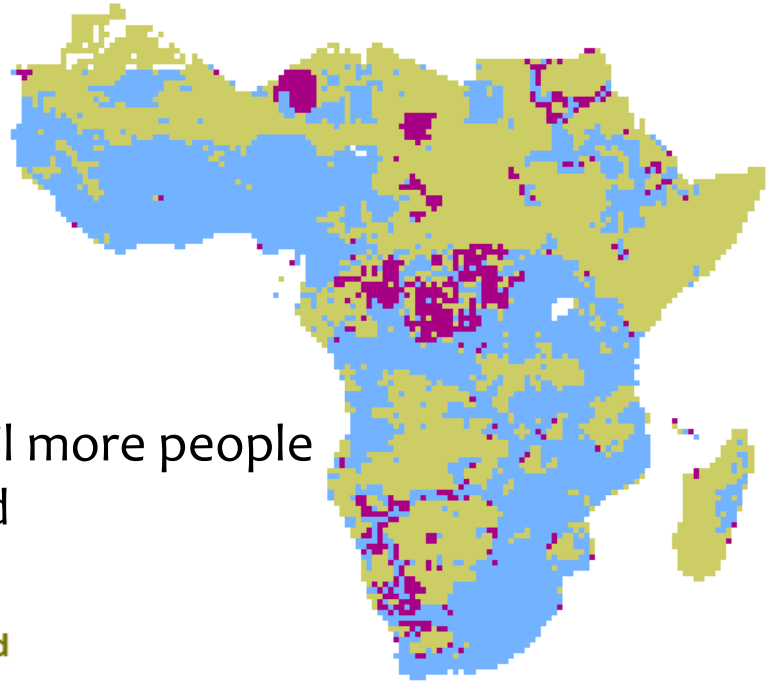
Electricity system mix

At a very low consumption level (Tier 1-4.5kWh)



>500 mil more people connected to standalones (80% SHS)

At projected consumption levels based on GDP per capita, fuel prices, appliance efficiency, etc..



>110 mil more people off-grid

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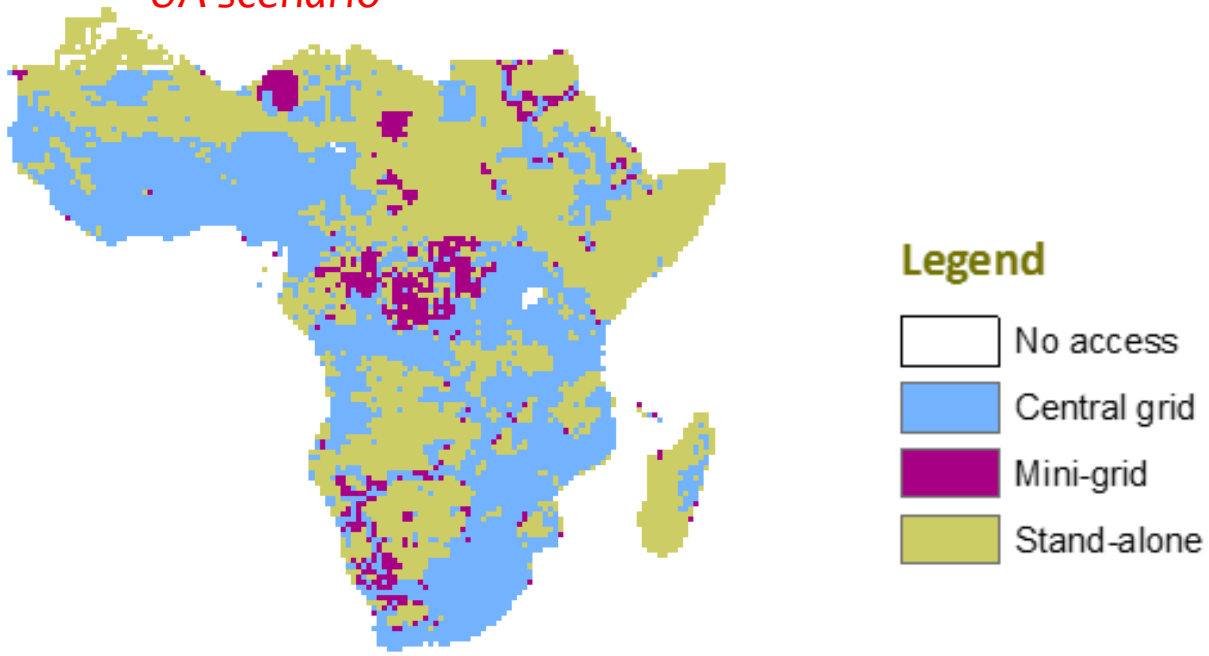
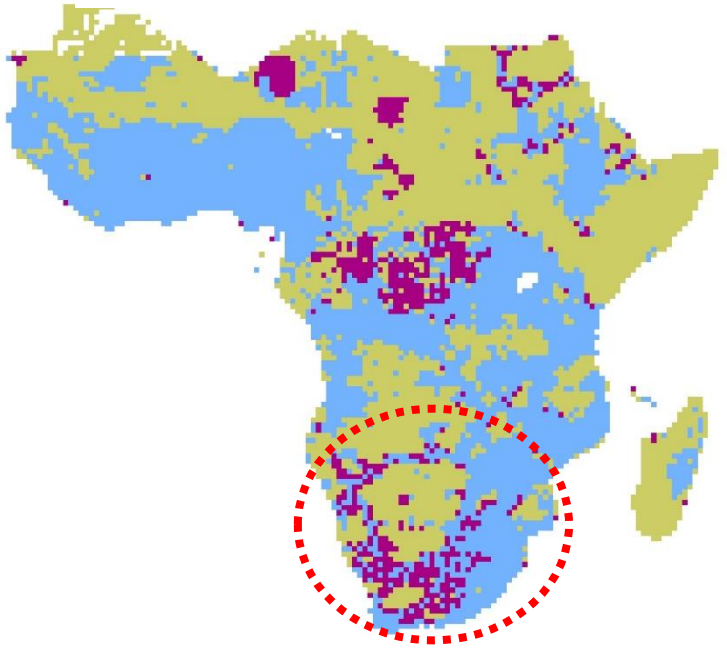
Climate change mitigation policy

UA scenario



UA-CP scenario



Niger, Chad, Ethiopia, Somalia, Angola, Namibia & Madagascar rely largely on standalone systems

Southern and Western Africa can be economically connected to the central grid

A considerable shift from fossil fuel to renewable under UA-CP!

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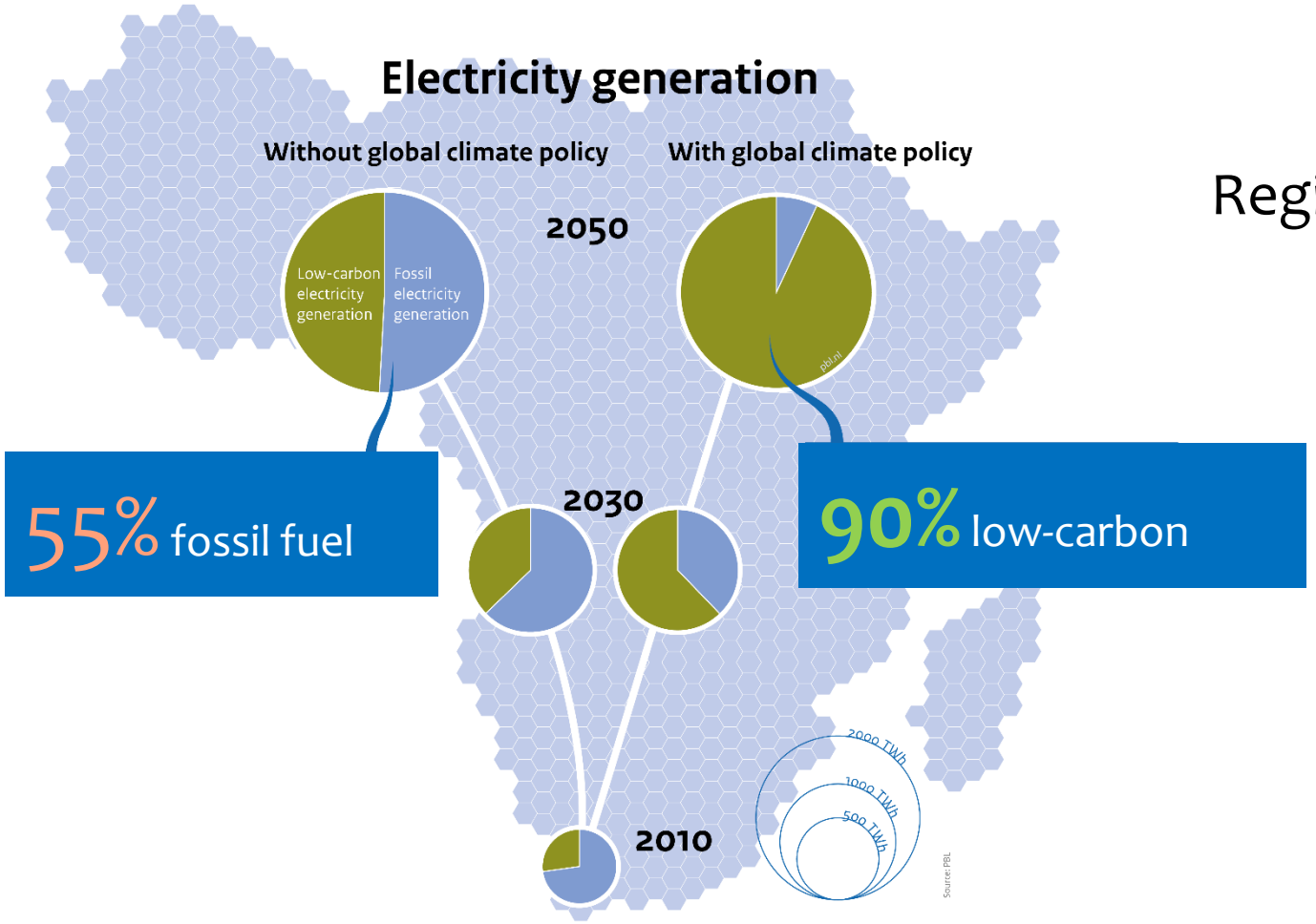
Fuel mix



Regional differences in RE shares 2030

10% in RSA

65% in Eastern Africa

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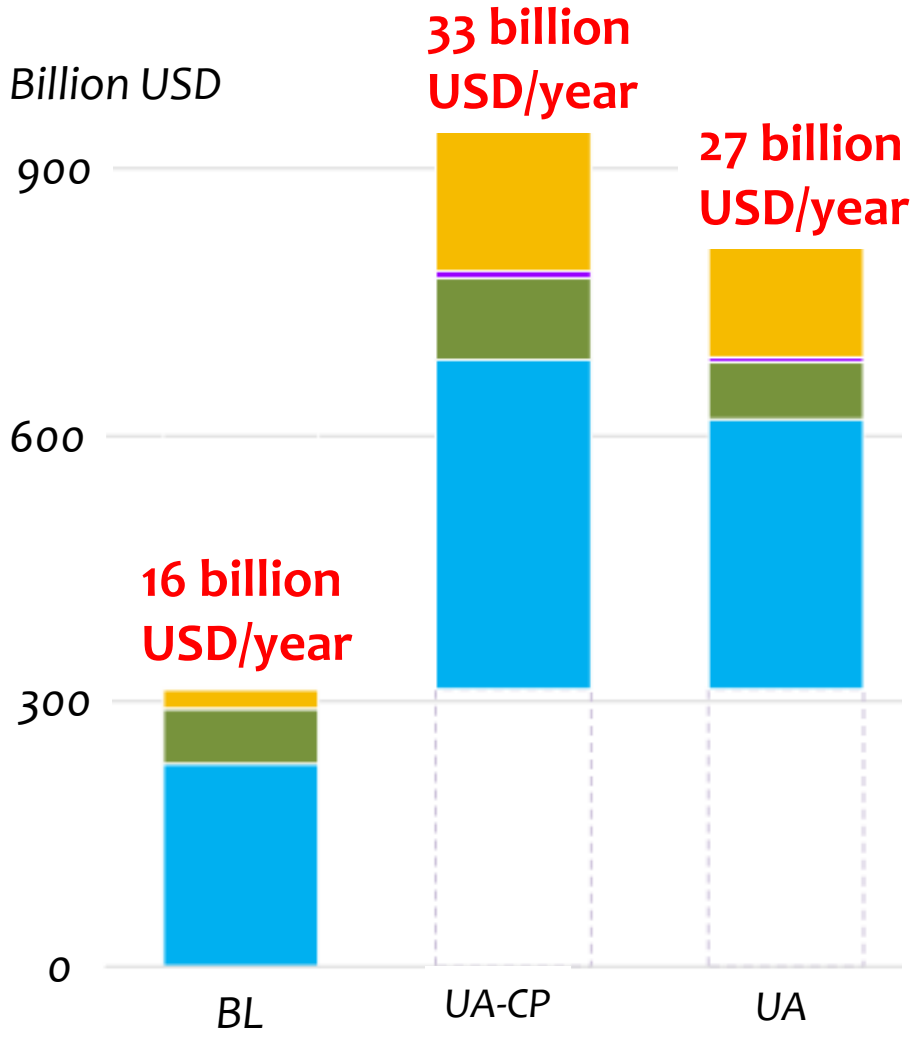
Electrification investment



Baseline requires 16-19 billion USD/year

Universal access needs 27-33 billion USD/year

70-80% goes toward T&D

+ recurring costs- fuel, O&M

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Conclusions

- Business-as-usual ≠ Universal electricity access
- Decentralized systems will play an important role to meet the SDGs
- Synergies between climate mitigation and universal access to electricity
- Imposing carbon price can increase electricity prices in the regions
- The increase in CO_2 emissions due to achieving universal electricity access is small
- Achieving universal electricity access requires at least a tripling of the current annual investments

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Thank you