GROUPE DE LA BANQUE AFRICAINE DE DÉVELOPPEMENT

IDEV
Independent Development Evaluation
Évaluation indépendante du développement

AfDB Energy Sector Evaluation
Emerging Findings

Hajime Onishi
Independent Development Evaluation (IDEV)
10 December 2015

Learning from AfDB and World Bank Evaluations

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Content

- Electricity is a “unique” product.
- AfDB has responded to the energy challenges in Africa.
- Innovation can overcome those challenges.

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Electricity is a “unique” product.

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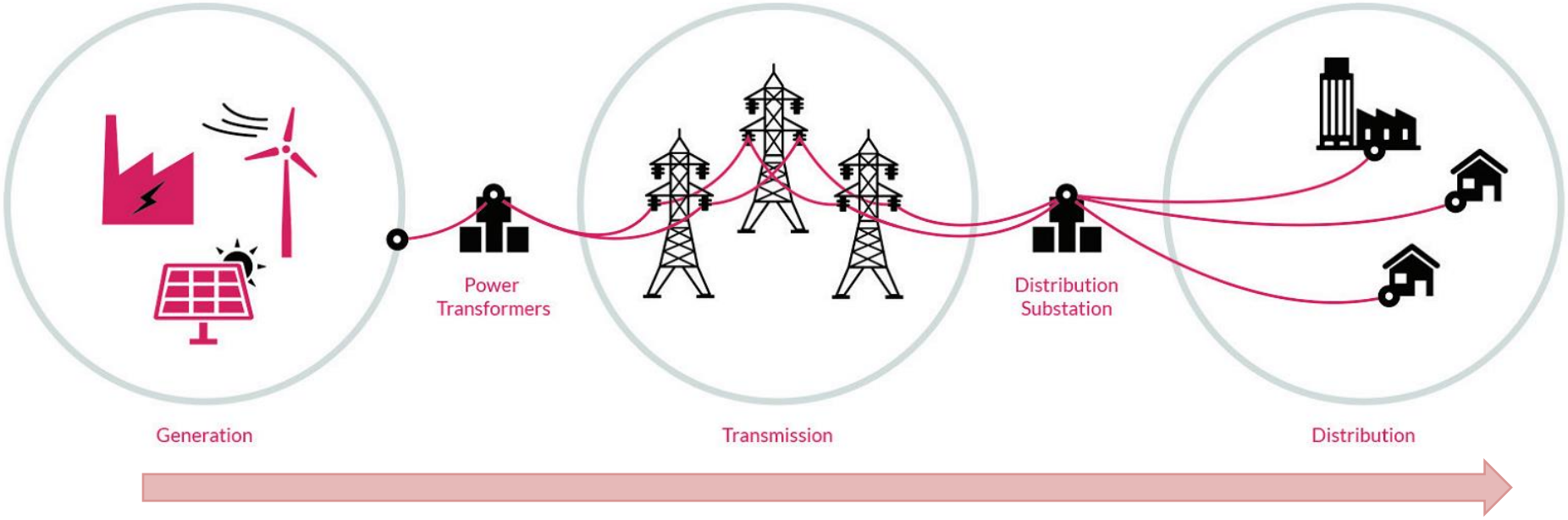

Electricity cannot easily be stored.

Electricity cannot be contained in national grids.

Source: African Legal Support Facility (2015) Understanding Power Purchase Agreements, pp.14.

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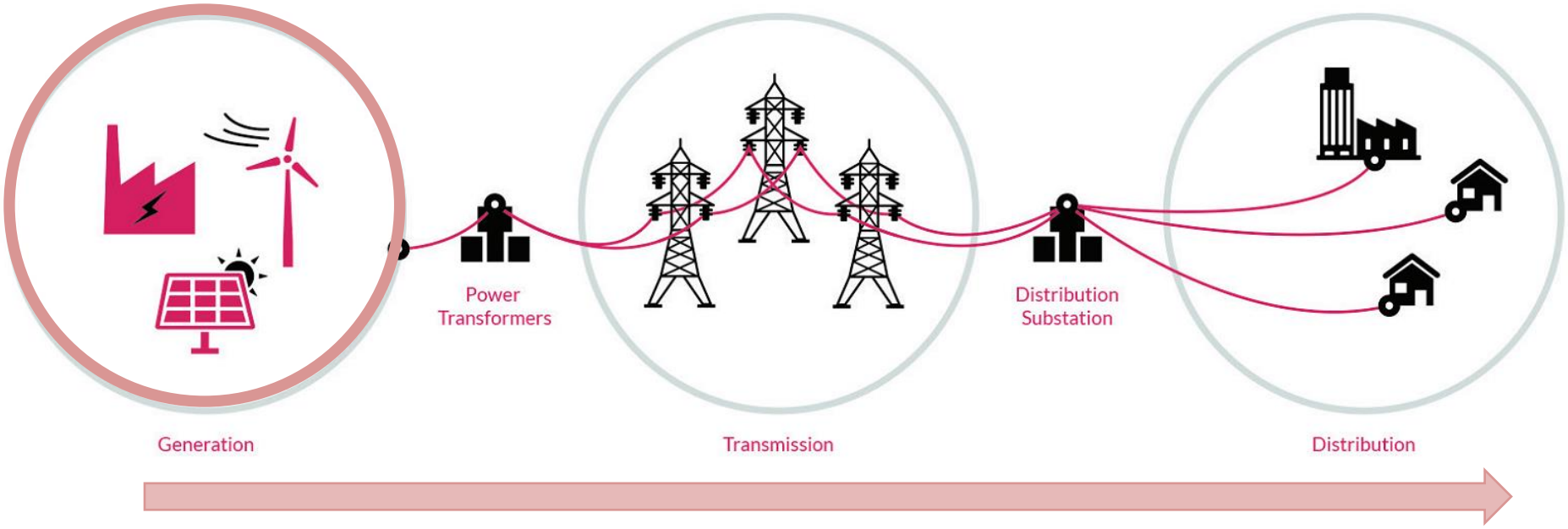

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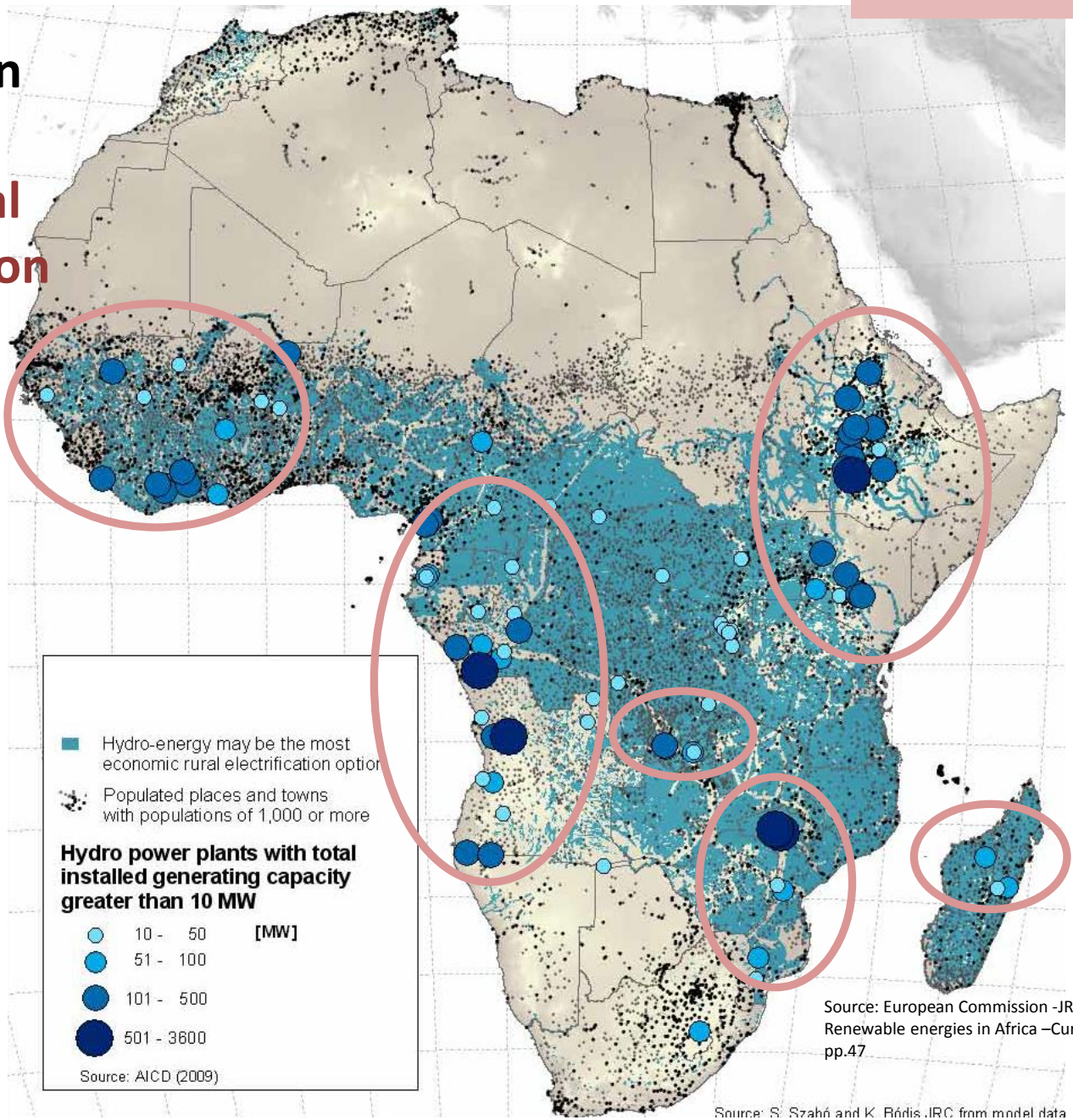
Energy Challenges in Africa – Geographical Constraints on Generation



Source: European Commission -JRC (2011) Renewable energies in Africa –Current Knowledge, pp.47

Source: S. Szabó and K. Bódis JRC from model data

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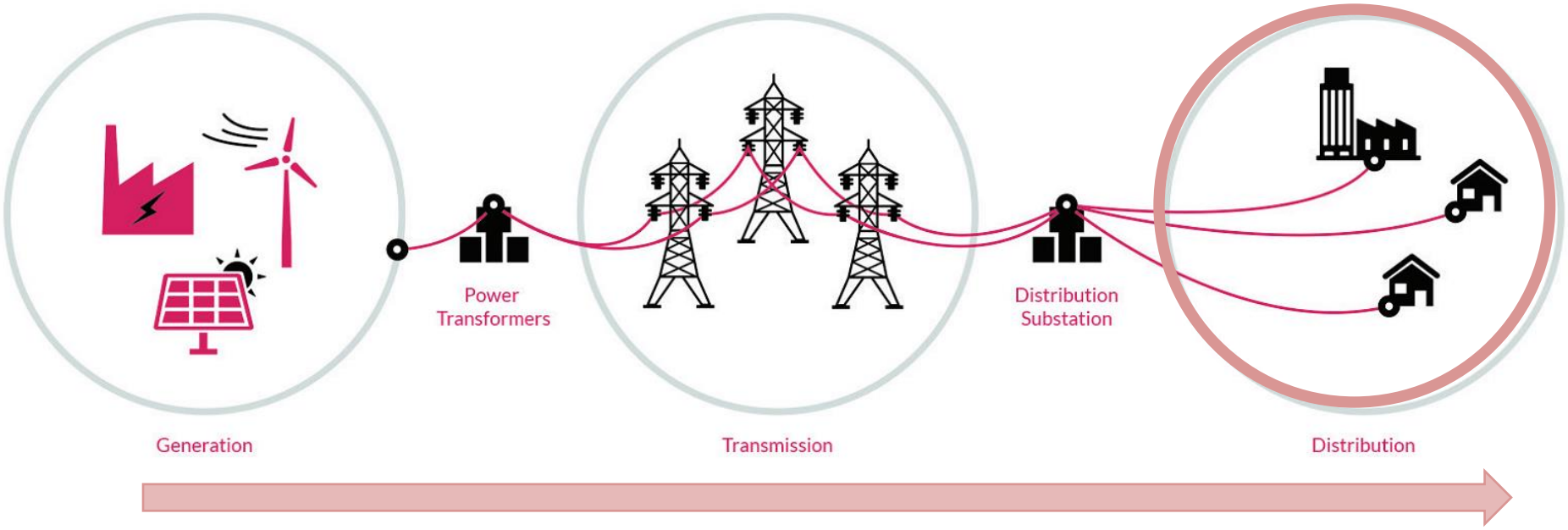

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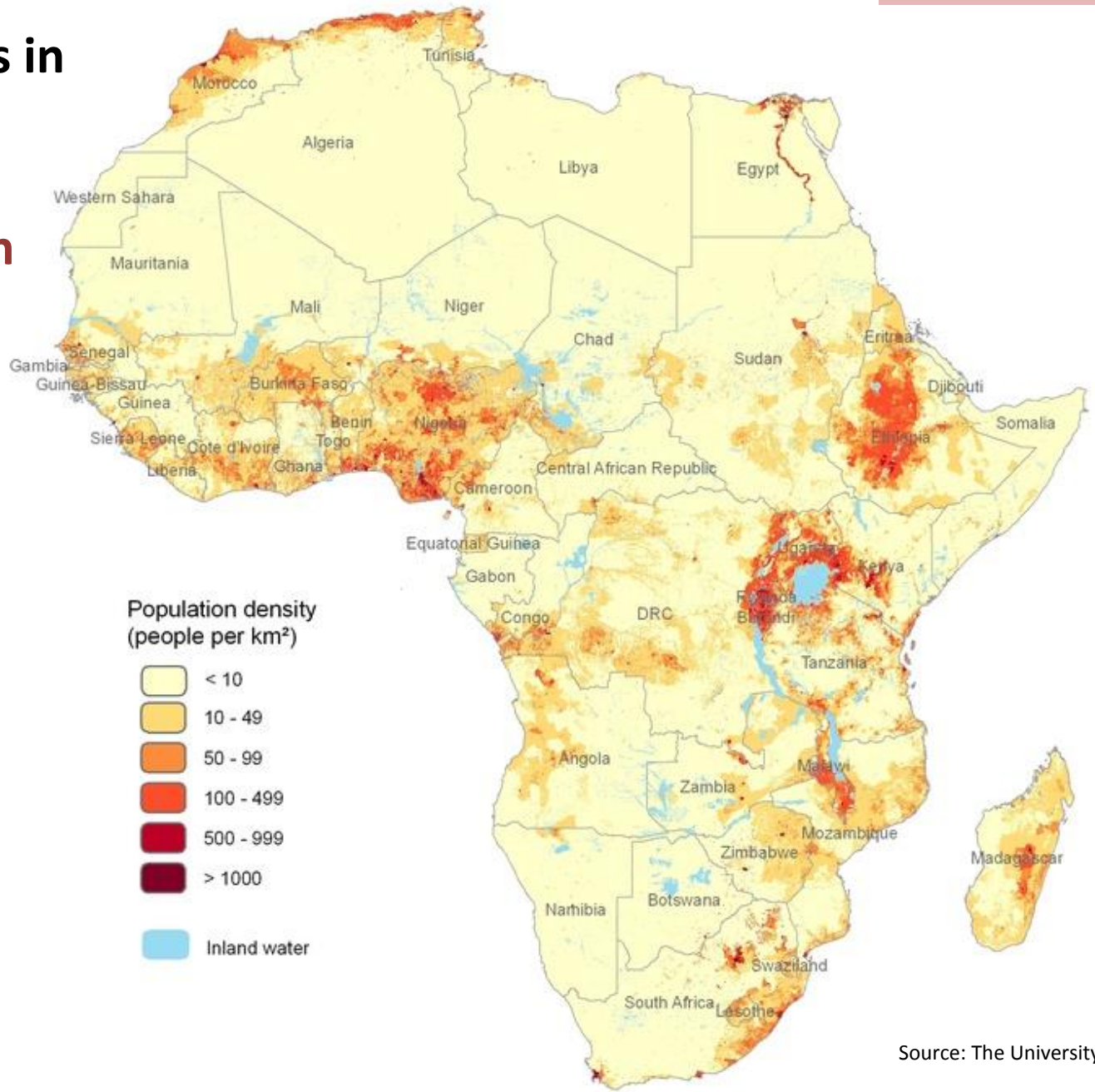
Energy Challenges in Africa – Dispersed Population



Source: The University of Florida

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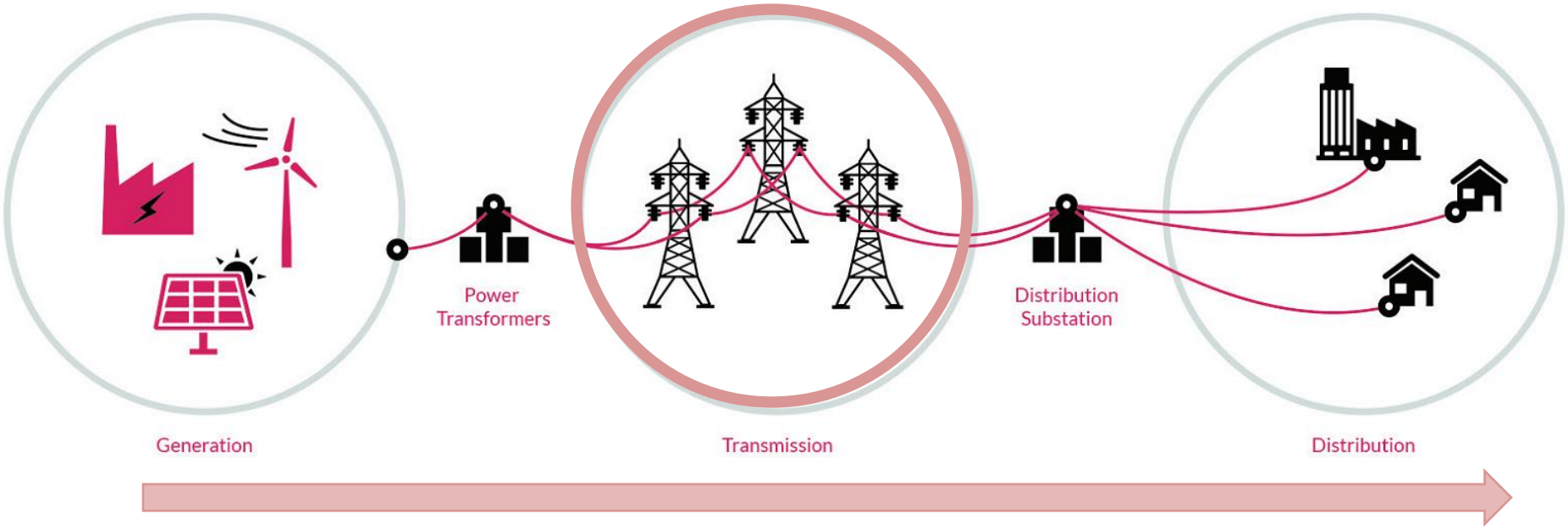

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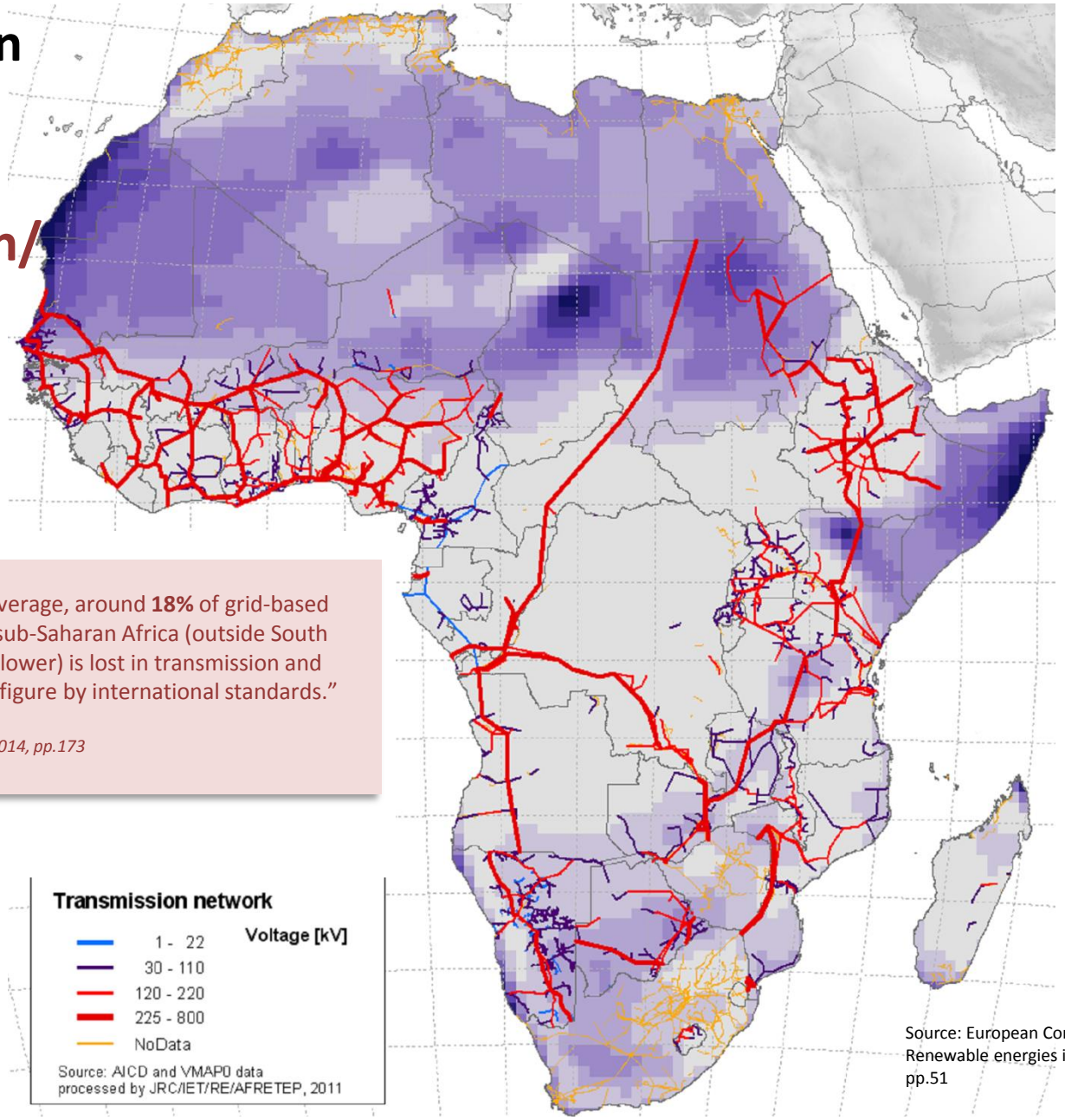
Source: African Legal Support Facility (2015) Understanding Power Purchase Agreements, pp.14.

Energy Challenges in Africa – Unreliable Transmission/ Distribution Network

"We estimate that, on average, around **18%** of grid-based electricity generated in sub-Saharan Africa (outside South Africa, where losses are lower) is lost in transmission and distribution, a very high figure by international standards."

Source: Africa Energy Outlook 2014, pp.173



Source: European Commission -JRC (2011) Renewable energies in Africa –Current Knowledge, pp.51

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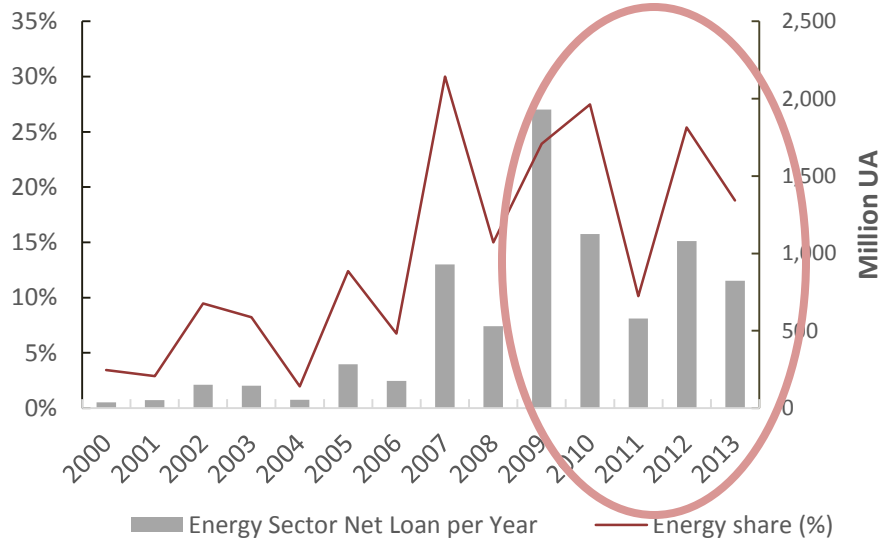
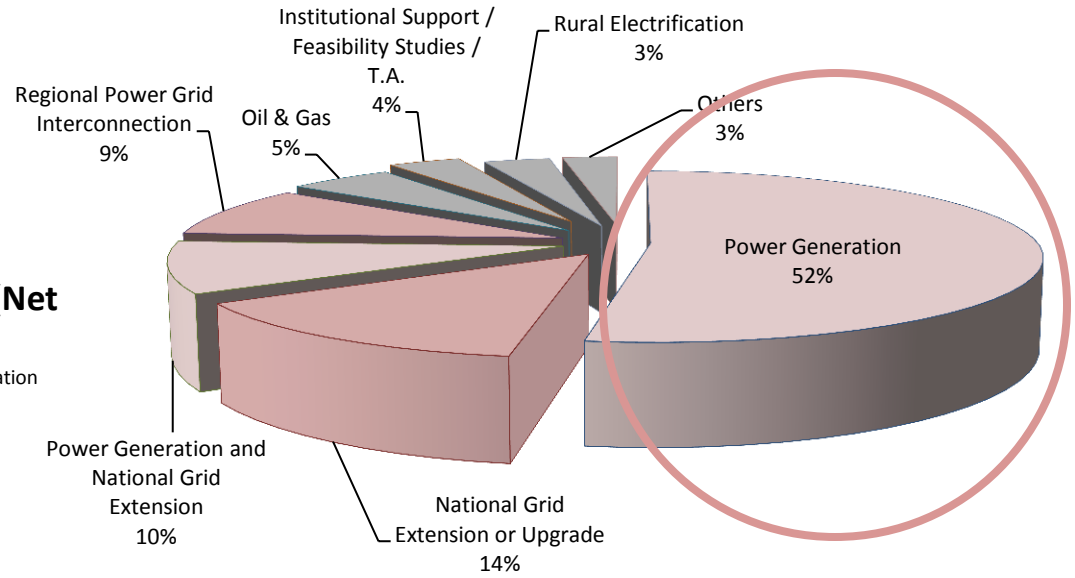
AfDB has responded to the energy challenges in Africa.

AfDB's Response to the Energy Challenges (2000-2013, N=152)



Energy Sector Share in Total Bank Group Commitments

Source: Portfolio Review of AfDB Energy Sector Evaluation



Share of Energy by Subsector (Net Commitments, 2000-2013)

Source: Portfolio Review of AfDB Energy Sector Evaluation

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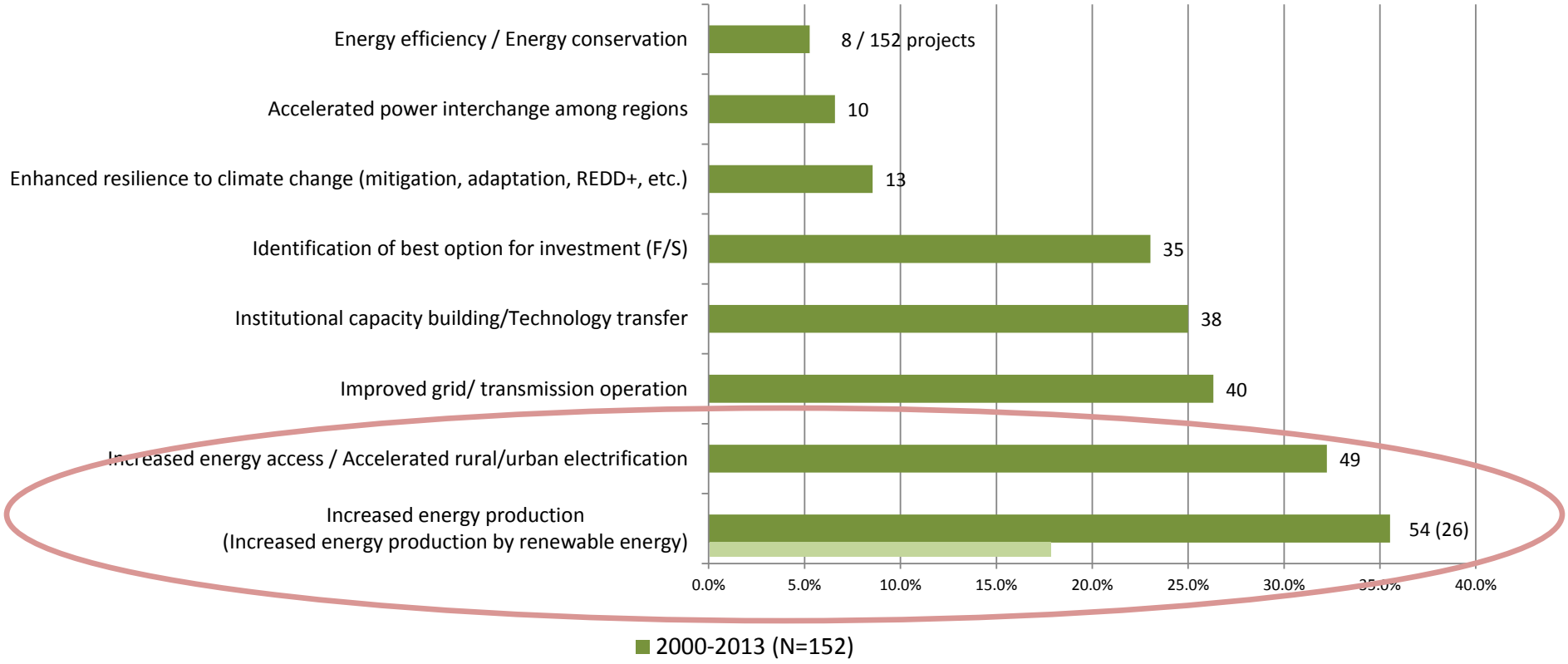
AfDB has responded to the energy challenges in Africa.

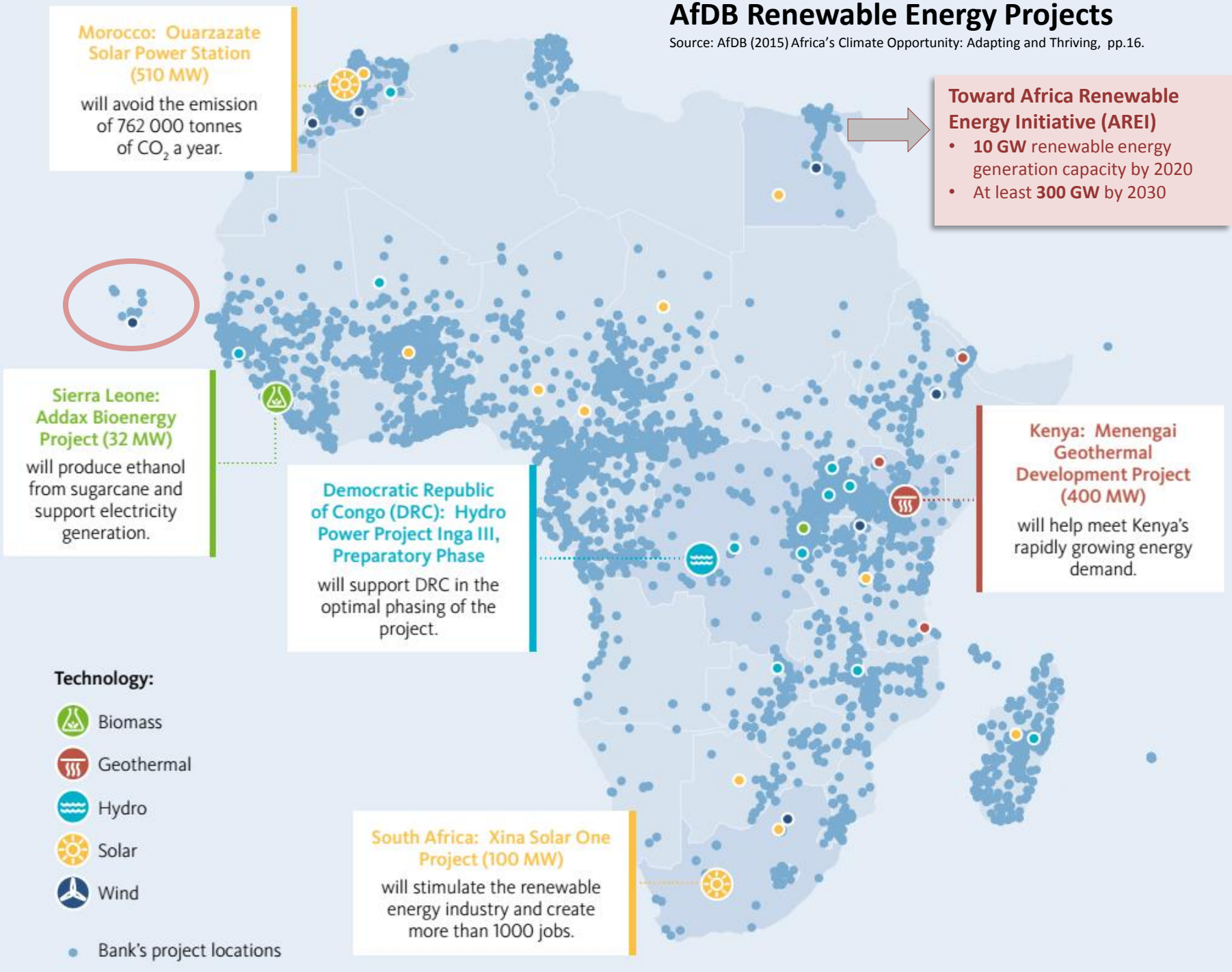
Classification of "Outcome Indicators" of AfDB Energy Projects (2000-2013, N=152)

Source: IDEV



AfDB Renewable Energy Projects

Source: AfDB (2015) Africa's Climate Opportunity: Adapting and Thriving, pp.16.



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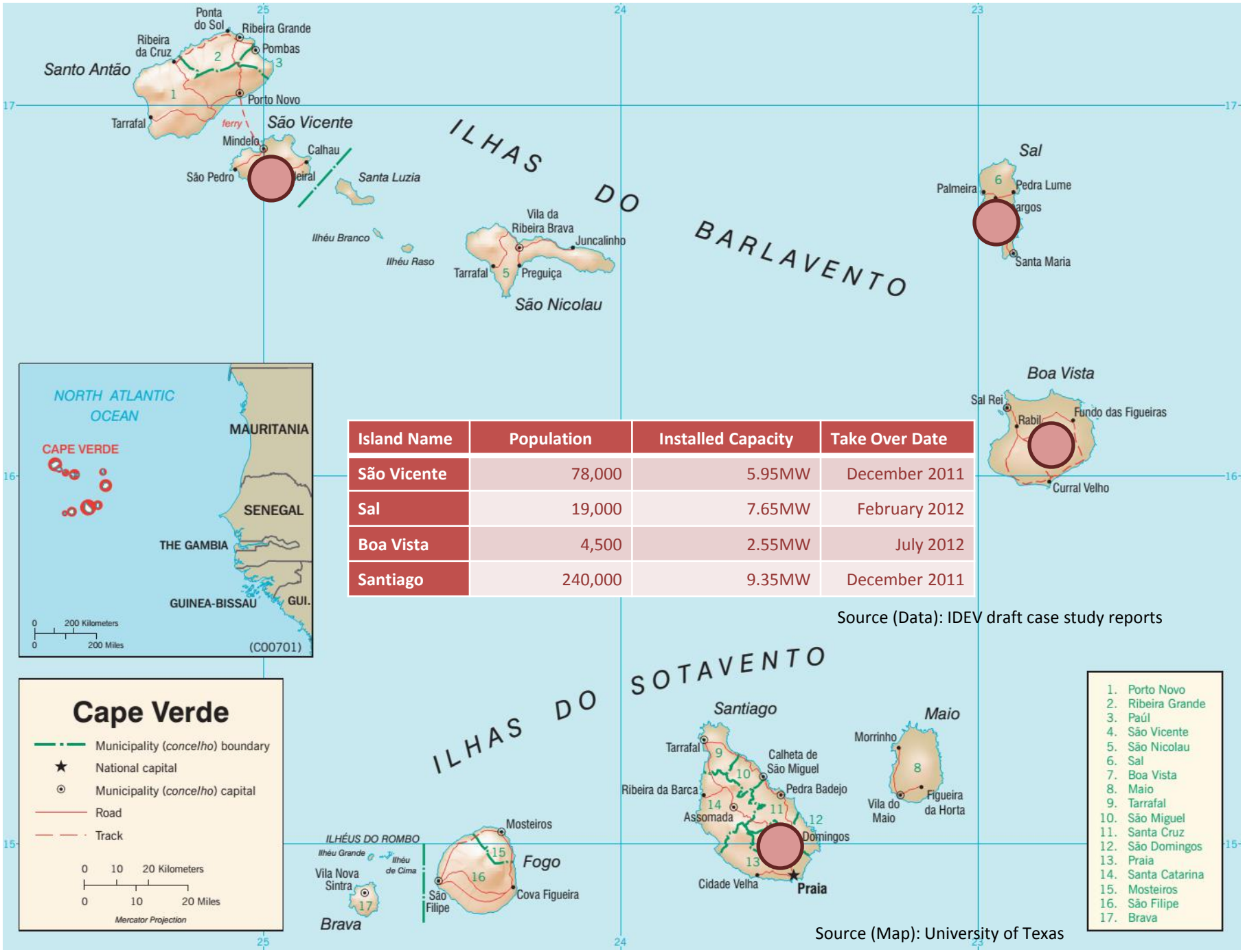
AfDB has responded to the energy challenges in Africa.

Case Study Project – Cape Verde Wind Farm

- Total project cost: **US$90** million
- Generation capacity: **25.5MW** in total
- First commercial-scale, privately financed, public private partnership (PPP) *wind farm* in Sub-Saharan Africa

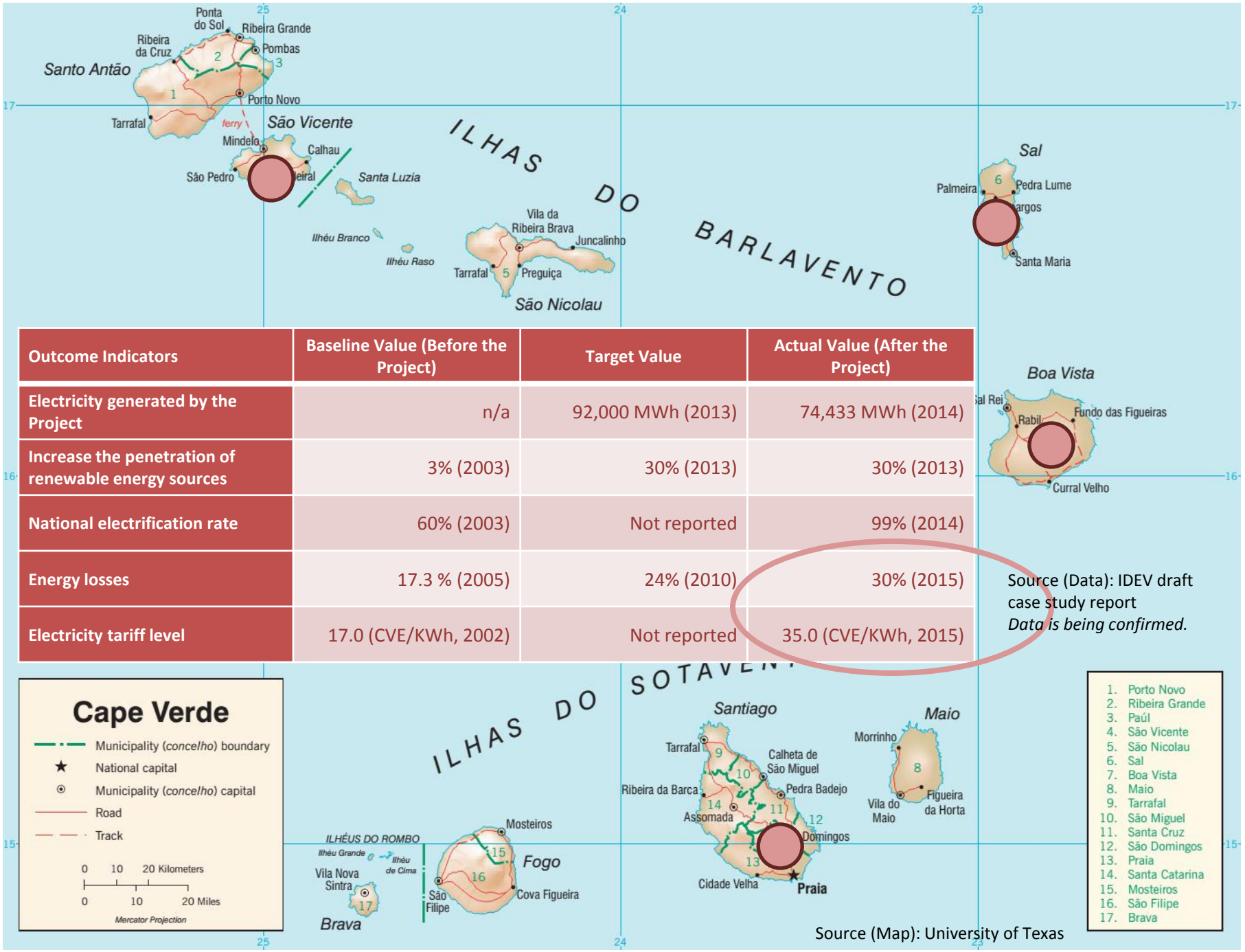
The project won the 2011 Africa Energy Award.



Island Name	Population	Installed Capacity	Take Over Date
São Vicente	78,000	5.95MW	December 2011
Sal	19,000	7.65MW	February 2012
Boa Vista	4,500	2.55MW	July 2012
Santiago	240,000	9.35MW	December 2011

Source (Data): IDEV draft case study reports

Source (Map): University of Texas



Outcome Indicators	Baseline Value (Before the Project)	Target Value	Actual Value (After the Project)
Electricity generated by the Project	n/a	92,000 MWh (2013)	74,433 MWh (2014)
Increase the penetration of renewable energy sources	3% (2003)	30% (2013)	30% (2013)
National electrification rate	60% (2003)	Not reported	99% (2014)
Energy losses	17.3 % (2005)	24% (2010)	30% (2015)
Electricity tariff level	17.0 (CVE/KWh, 2002)	Not reported	35.0 (CVE/KWh, 2015)

Source (Data): IDEV draft case study report
Data is being confirmed.

Source (Map): University of Texas

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AfDB has responded to the energy challenges in Africa.

Case Study Project – Cape Verde Wind Farm

- The level of operational *curtailment* enforced by the power utility Electra remains quite high.
- The total wind power wasted on the four islands - 25% of total available wind energy

Source (Map): University of Texas

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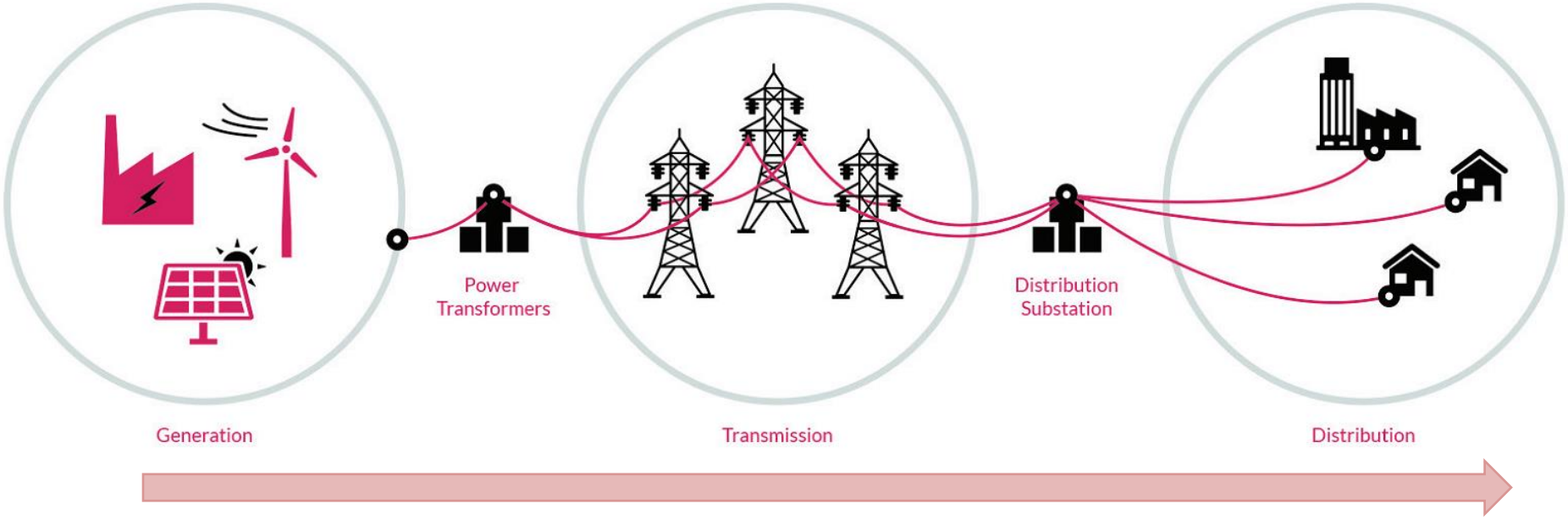
Electricity is a “unique” product, but innovation can overcome the challenges.

Electricity is a “unique” product.



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Innovations in the 21st Century

Grameen Shakti – Off-grid renewable energy supply (Solar Home Systems) with microcredit

Source: Grameen Shakti

Sodium-Sulfur (NaS) Battery – Grid Scale Electricity Storage Option

Source: NGK Ltd.

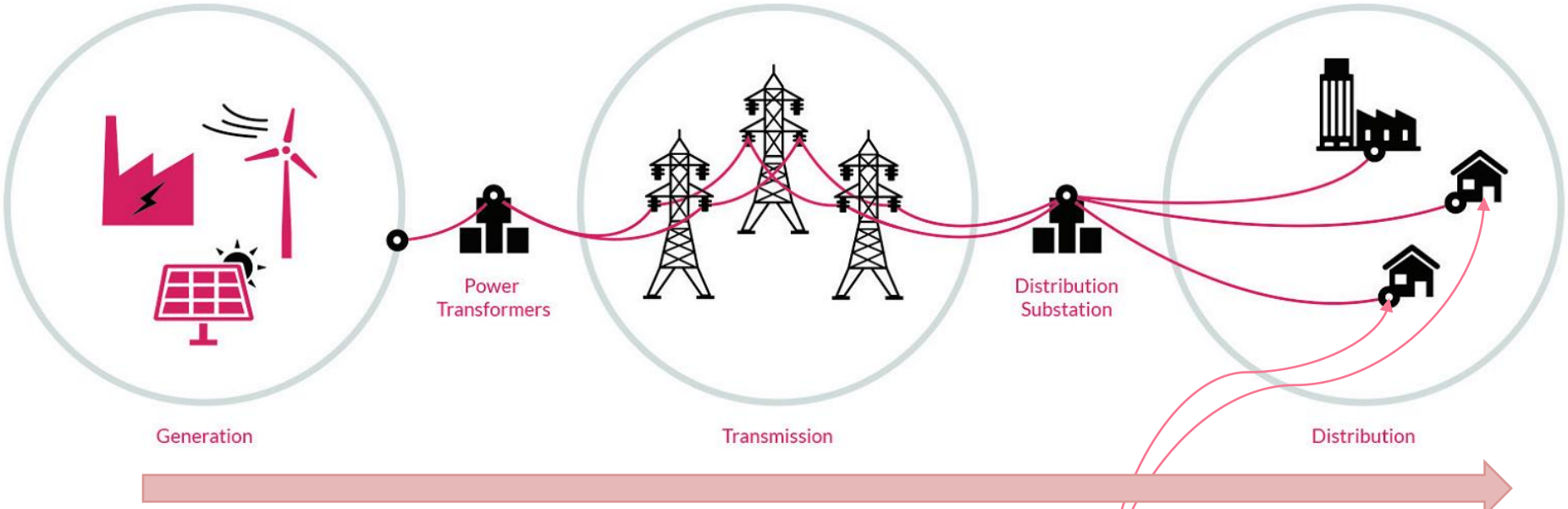
M-KOPA – Off-grid renewable energy supply (Solar Home Systems) with mobile money

Image: By BiztechAfrica

Light-Emitting Diode (LED) – General lighting with low power consumption

Source: ABC Radio website

Electricity **may no longer be** a "unique" product.



Electricity ~~cannot easily~~ can be stored.

Electricity can~~not~~ be contained in national grids.

Off-grid rural/urban electrification is another option.

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Innovation can overcome the challenges.

Case Study Project – Cape Verde Wind Farm

- The level of operational *curtailment* enforced by the power utility Electra remains quite high.
- The total wind power wasted on the four islands - 25% of total available wind energy

→ Power Utility Electra is currently considering a "bulk storage" option

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Innovation can overcome the challenges.

Emerging Lessons and Possible Recommendations

- Main land Africa may face similar challenges in the future
  - Much focus on “production”
  - Unreliable grid system
  - More “unstable” renewable energy (solar & wind, not geothermal & hydropower)
    - Generated electricity will be wasted??

- Innovation may change the way we intervene

- *Off-grid solution with innovative financing tool**
- *Carbon capture and storage (CCS)**
- *Deep ocean water application**
- Smart grid / Smart meter
- Grid-scale electricity storage option (NaS Battery, Seawater pumped-storage, etc.)
- Artificial Intelligence (AI) to the energy sector?
- Large scale RBF (Results-Based Financing) to the energy sector?
- Etc.

*Already experienced by AfDB/WB

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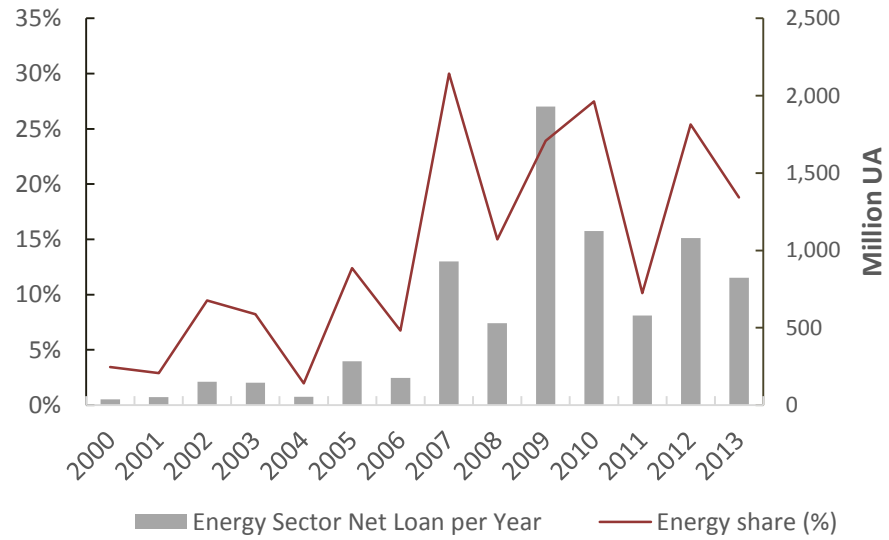
Thank you very much.

AfDB's Response to the Energy Challenges (2000-2013, N=152)



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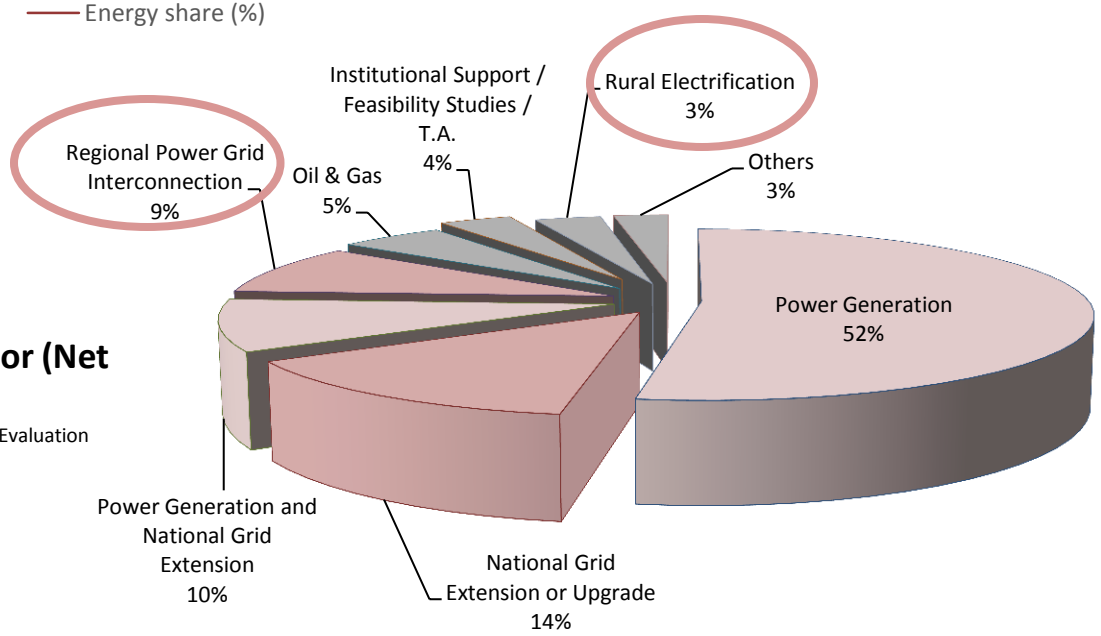

Share of Energy by Subsector (Net Commitments, 2000-2013)

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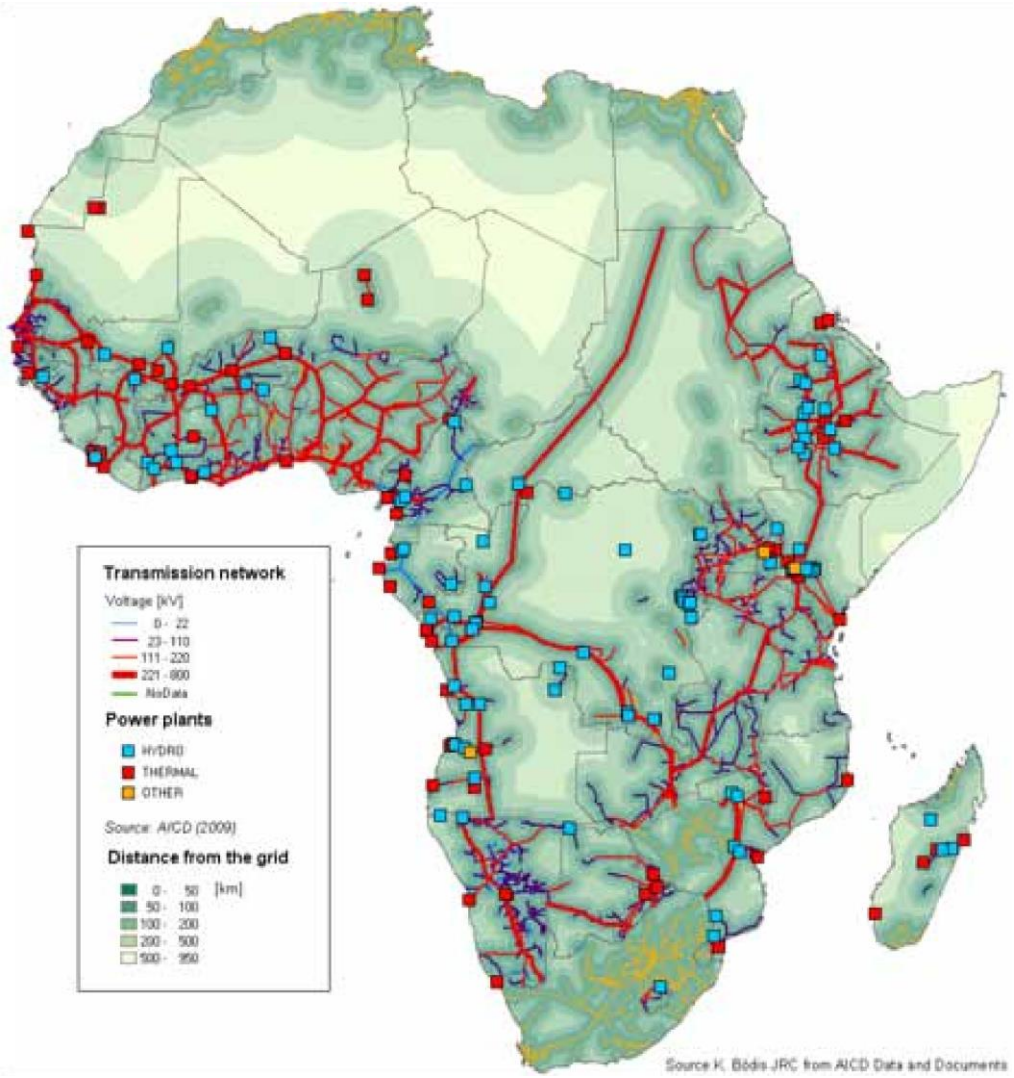
Energy Challenges in Africa – Landlocked Countries and High Fuel Costs for Thermal Power



Source: European Commission -JRC (2011)
Renewable energies in Africa –Current Knowledge

Average Transport Prices

Source: Teravaninthorn, S. and G. Raballand (2008) "Transport Price and Costs in Africa: A Review of the Main International Corridors", *Africa Infrastructure Country Diagnostic, Working Paper 14.*