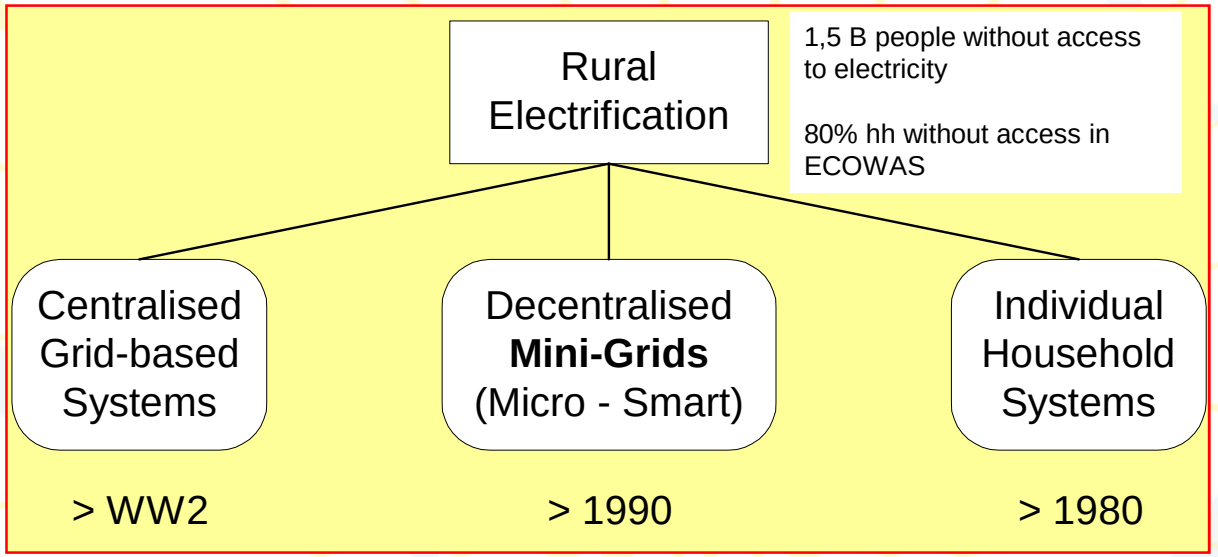
Review of International Mini-Grids Initiatives

Abidjan, December 11, 2012

T. de Villers – I.E.D.

1. Historical context
2. Present status of MG & GMG
3. Future Perspectives for GMG

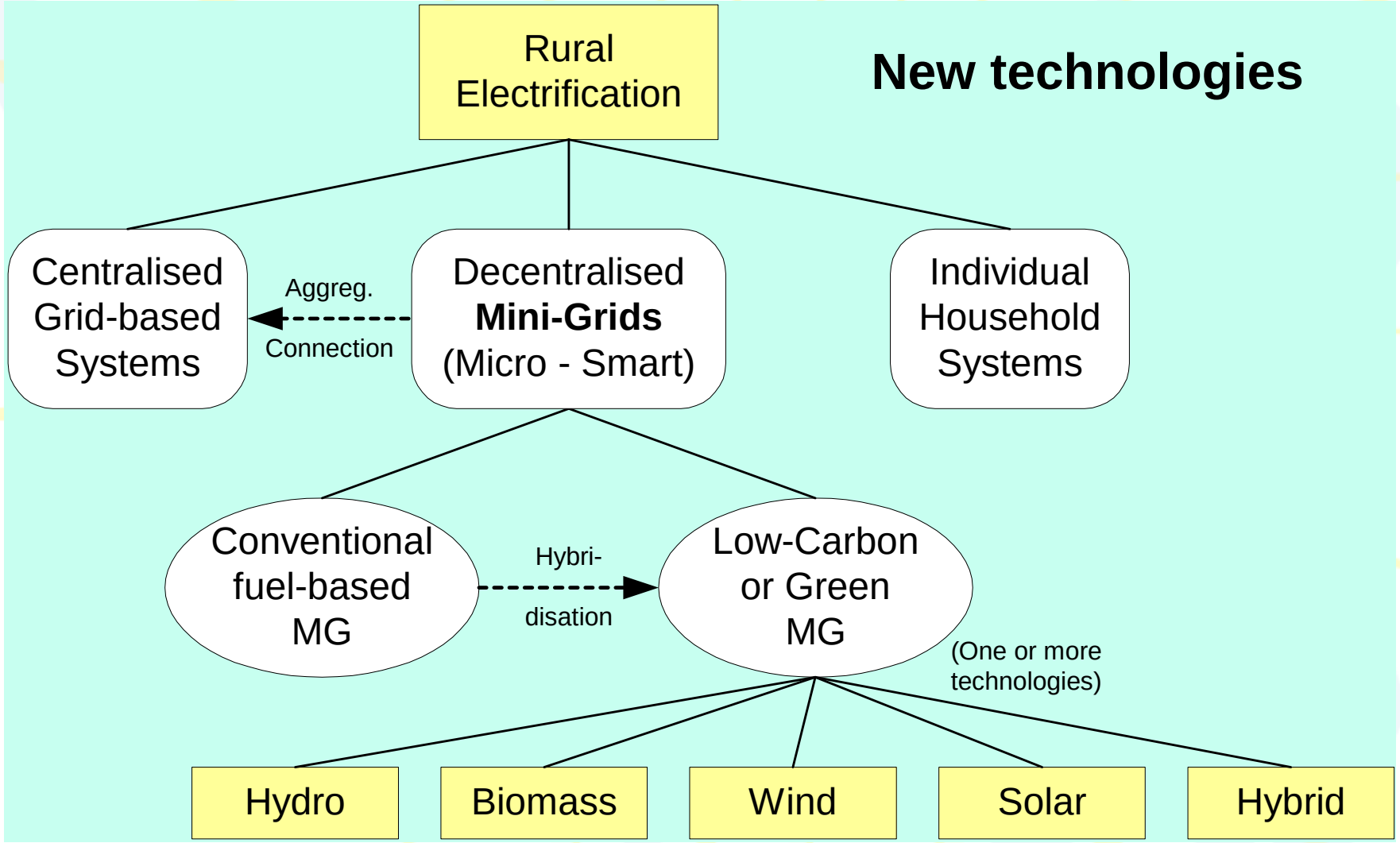
1- Historical context

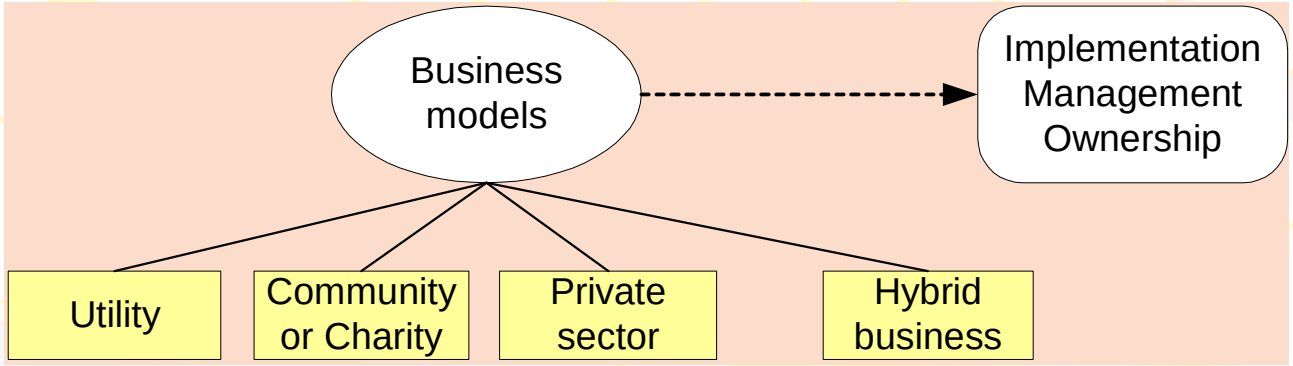


- Conventional grid extension is often very slow, poor quality and too expensive to reach remote population
- Over the last 20 years, many governments, power utilities and privates (industries) in DC have implemented mini-grids, most diesel-based MG and some hydro-based MG.
- Motivation was often more political or social than economical. Greatest MG development in Asia.

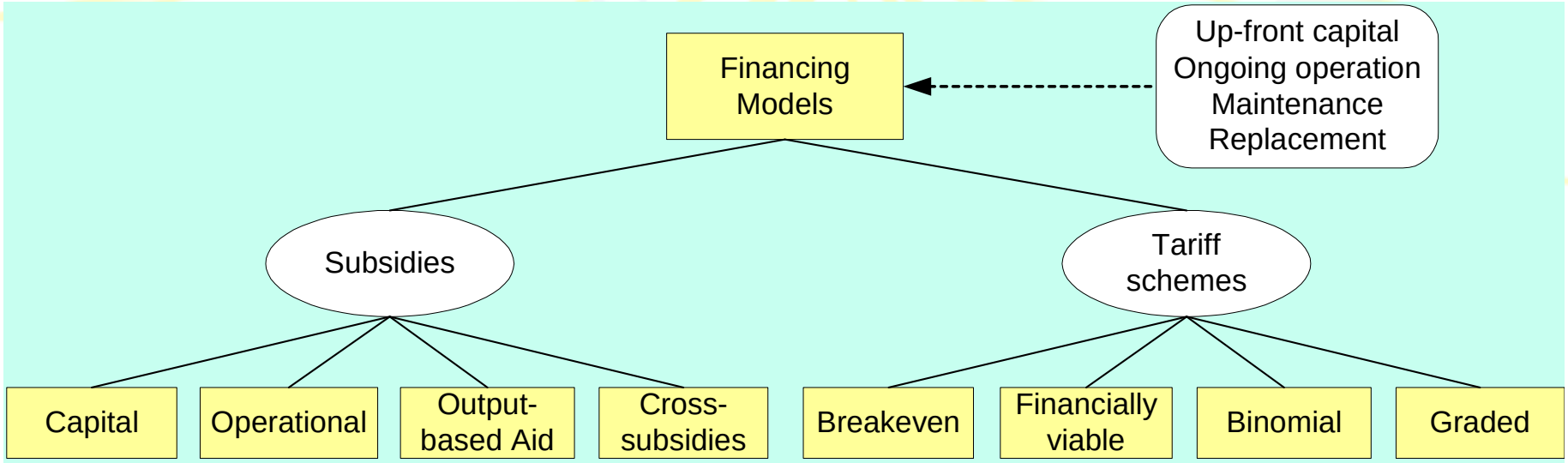
2- Present status of MG & GMG

- The characteristics of the MG market are similar to those of rural electrification: need effective technologies and adequate implementing schemes
- New technologies: renewable electricity costs have drastically reduced & reliability has considerably improved, giving an opportunity to develop **Green MG** and **hybrid** systems, in particular where grid is not well developed.
- New implementing approaches take into account various local contexts to ensure sustainability of RE projects
  - Business models,
  - Financing schemes,
  - Policy & regulatory environment


Rural Electrification
New technologies
Centralised Grid-based Systems
Aggreg.
Connection
Decentralised **Mini-Grids** (Micro - Smart)
Individual Household Systems
Conventional fuel-based MG
Hybri-disation
Low-Carbon or Green MG
(One or more technologies)
Hydro
Biomass
Wind
Solar
Hybrid



New implementation approaches



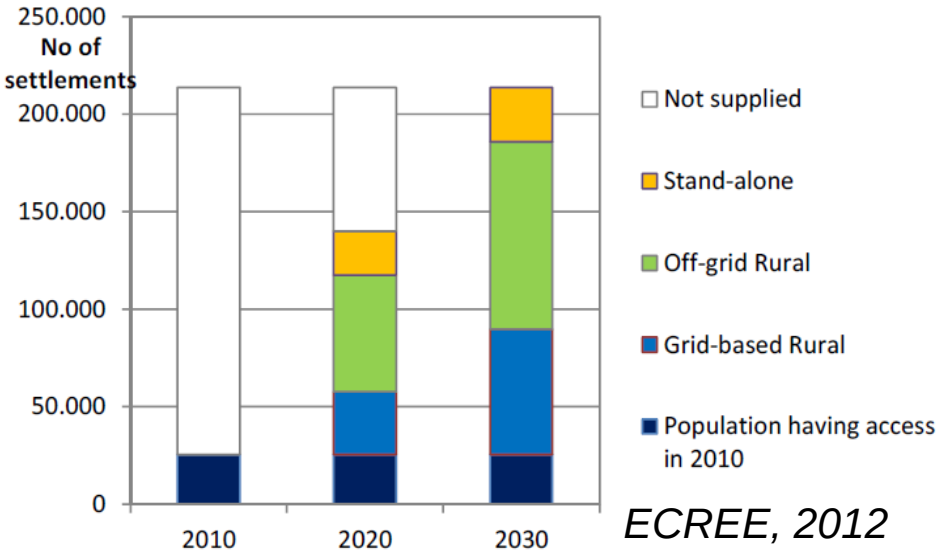
(GVEP & USAID/ARE – 2011)

2- Present status of MG & GMG

- Many different implementation models and schemes have been experimented and they usually focus on end-users' needs & involvement; private sector participation; capacity building; and key allocation of responsibilities.
- The cost-effectiveness of **MG** vs. grid extension and individual household systems (SHS, BCS …) depends first on geographical constraints (arid, mountainous, forests, islands), settlement density and grid network coverage.
- Then, the cost-effectiveness of **Green MG** vs. conventional MG will depend on local energy resources, fuel prices and financial incentives.
- **Sustainability** of MG and GMG is strongly improved with associated productive uses / IGA activities

2- Present status of MG & GMG

- Installed MG capacities are hardly available (>60.000 China). However potential has been assessed (SEFA, ECREEE)
- Target 2030 in ECOWAS: 96.000 localities (45%) with MG (104 million people) → 128.000 MG

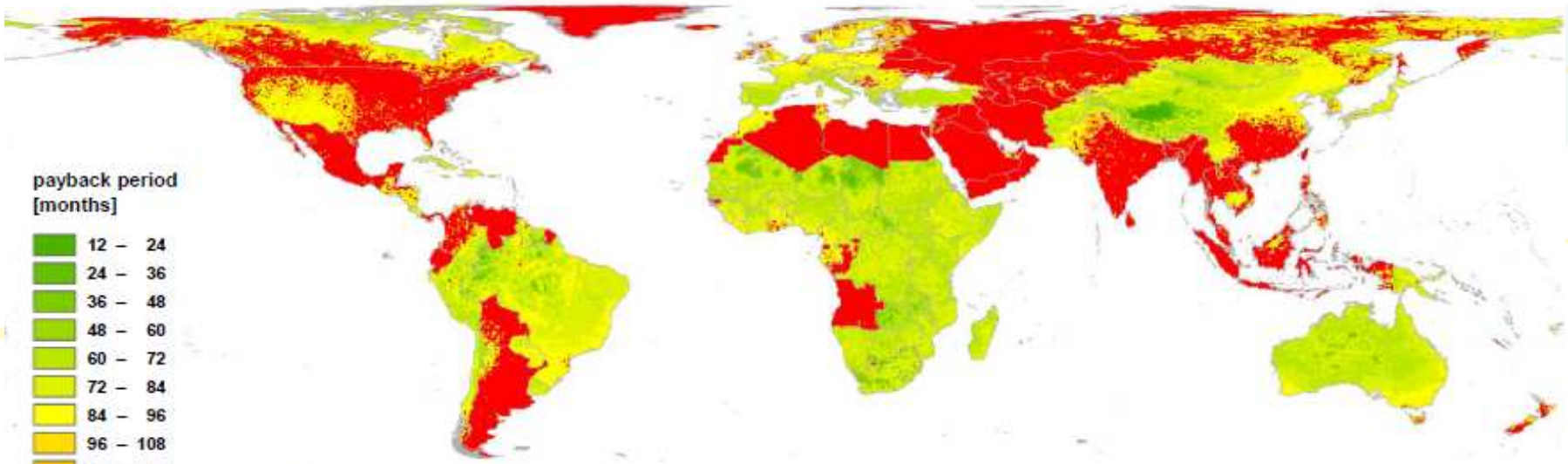


ECREE, 2012

	(ECREEE 2012)
Grid-based RE:	20-25 c€/kWh
Fuel cost:	33 c€/kWh
GMG:	14-19 c€/kWh

PV Mini-Grids: Payback Period

Amortisation of hybrid PV-battery-diesel systems vs. diesel



- The payback period of a PV mini-grid depends highly on the local diesel price.
- In many regions in Africa and South America very attractive payback periods of 5 – 7 years can be reached.
- In very remote areas very lucrative payback periods of less than 4 years arise for PV mini-grids.

source: Breyer Ch., Gaudchau E., Gerlach A.-K. et al., 2012. PV-based Mini-Grids for Electrification in Developing Countries, study on behalf of SMA Stiftungsverbund, study is not yet published

2- Present status of MG & GMG

- Today many DC are actively promoting GMG as a cost-effective electrification alternative for given local contexts. Some have launched national programmes or initiatives either on public or donor funds.

Africa	Asia	South Am.	Islands
Senegal	India	Brasil	
Ghana	China	Bolivia	
Mali	Sri Lanka	Peru	
Ken/Ug/Tz	Nepal	Honduras	
Rwanda	Bangladesh		
Namibia	Indonesia		
South Afr.	Cambodia		

Based on literature & case studies

2- Present status of MG & GMG

- There are also wider programmes launched by international organisations that promote demo or pilot GMG projects in specific countries:

ENDEV (>2005)	RET, MG & Grid (G, NL, NO + GIZ)	Energizing Devel. Prog. in 18 countries (11 Afr.) Cooperation with international prog (EU, Africa)
SREP	Scale-up RE progr. (ADB, AfDB, WB...)	Pilot MG investments in Kenya, Mali, Nepal +Ethiopia, Honduras, Maldives, Tanzania (LIC)
GEF-SPWA	Energy component (UNs,WB,ECREE)	Regional Project on Promoting Coordination, Coherence, Integration: 13 GMG projects

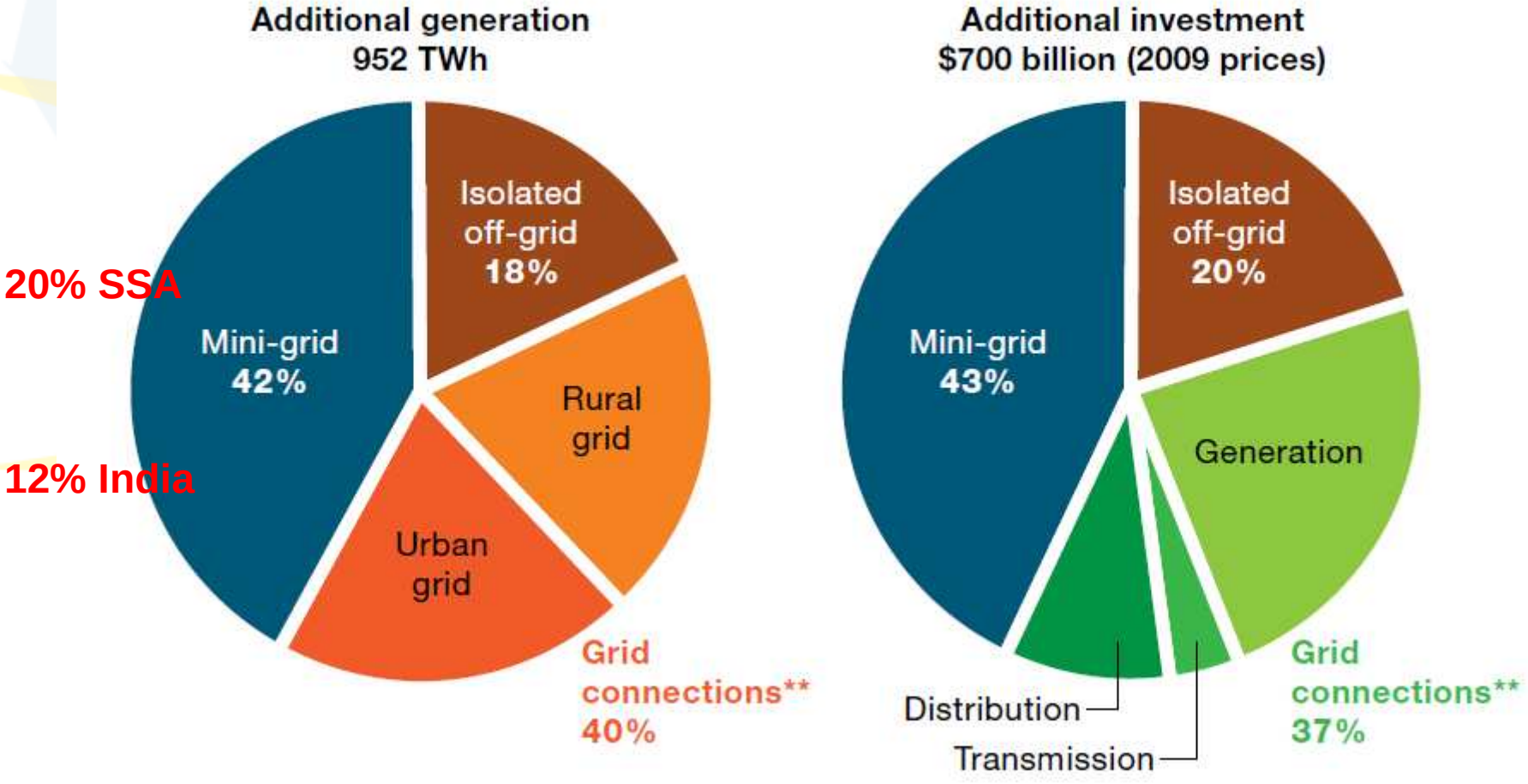
2- Present status of MG & GMG

- Other key activities have been developed for MG:
  - MG design manual (ESMAP, 2000); China Village guide
  - Softwares: Retscreen; Homer (+ webinar on µG)
  - REToolkit (ESMAP, 2008); MG Policy Toolkit (REN21, 2013)
  - Standards IEC 62257 for off-grid & MG
  - Many publications (>100) and studies
    - AfBD, ADB, AFD, DOE, EUEI, KfW, Danida, WB/IDB/IFC/GEF, UN, AusAID, USAid, SEFA, IEA, GVEP, ESMAP, ECREEE, ARE, REN 21, JRC, IIED, Imperial College, GIZ, …
  - PV Hybrid and Mini-Grid conference (EU)
  - Off-Grid Renewable Energy conference (IOREC, 2012)

3- Future perspectives for GMG

- The rising interest for GMG brings some actors to consider larger regional programmes or initiatives targeting the development of GMG on a wider scale, either upgrading existing diesel-MG or creating new GMG.
  - REN 21/RECP/ARE → MG Policy Toolkit (under dvl.)
  - SEFA (UN) → big role of MG to reach UEA by 2030
  - ECREEE (ECOWAS) → similar conclusion as SEFA
  - Energy4ALL (ADB Asia) → MG working group on business & financing sch, pilot & scale up, capacity bld.
  - DFID/ICF (UK) → low carbon portfolio could include MG

Figure 1. Incremental Electricity Generation and Investment in the Universal Modern Access Case, 2010-2030*



20% SSA

12% India

*Compared with the New Policies Scenario

**includes generation, transmission and distribution for both urban and rural grids

3- Future perspectives for GMG

- However such ambitious programmes have to overcome **several barriers** on business, policy and technology environment that hinder the development and the scaling up of GMG on a large scale.

Barriers	Key common issues
Technological failures	physical parameters, resources, design, quality, O&M, ...
Financing schemes	Up-front cost, realistic tariff, grants & subsidies
Policy & regulatory environ.	Political priorities, corruption/lobby, energy regulation, tariff structure, fiscal incentives, simplified procedures
Implementation & operation	Local skills, training, local involvement, private sector participation, productive use ...

3- Future perspectives for GMG

- We are actually conducting a **GMG study** on behalf of DFID (UK) to investigate the potential and the relevance to launch a **regional GMG programme**, foremost in East & Central Africa.
- The study includes a review of international past experiences and clear identification of the optimal technical-economical conditions, policy & regulatory environment, and financial and organizational schemes for sustainable GMG.
- All experience sharing and contributions related to MG are most welcome, and particularly on GMG.

Thanks for your attention

Taric de Villers – I.E.D.
t.devillers@ied-sa.fr