

# Rural Electrification and Renewable Energy: a major social, economic and environmental challenge

THE RENEWABLE ENERGY  
ISLANDS  
25-26 JUNE 2014, EL HIERRO - SPAIN

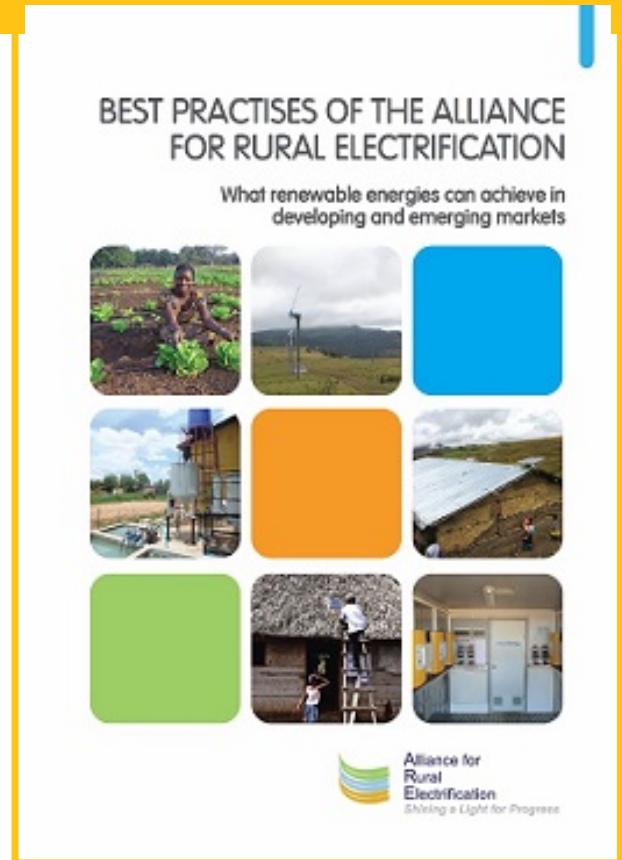
*Ernesto Macías Galán, President of the Board, ARE*

# Agenda

1. Introduction: Background and Scope of ARE
2. Global Scenario: The energy needs, Plans and Investments
3. The New Technical Solutions
4. The Actors
5. Conclusions

# Who we are, what we do

- International business association representing the **decentralised energy sector** working towards the integration of renewables into **rural electrification markets in developing and emerging countries**
- Enabling improved energy access through business development support for more than 80 members by **targeted advocacy** and facilitating **access to international and regional funding**
- Global platform **for sharing knowledge and best practices** to provide for rapid implementation of available and advanced RE technologies and services



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# Introduction - Strong partners

We partner with **international and national organisations, projects and initiatives, the media and other industry platforms.**

Selected international organisations with which we have formalised cooperations



# Agenda

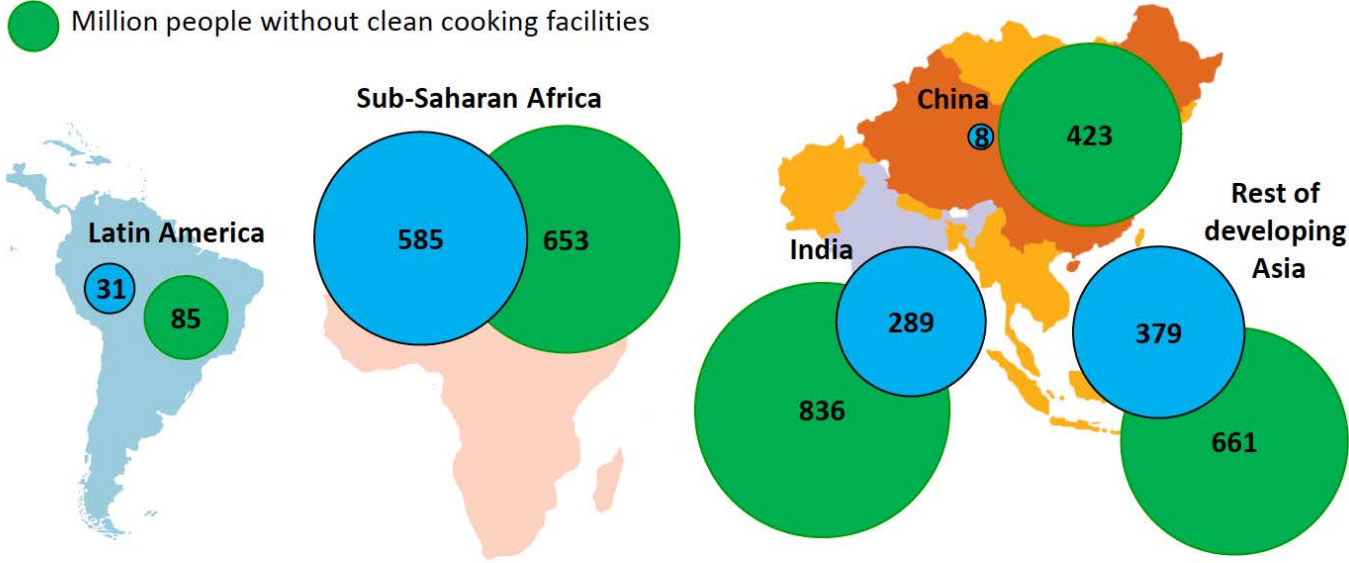
1. Introduction: Background and Scope of ARE
2. **Global Scenario: The Energy Needs and Plans**
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# Global Scenario: Needs

## Energy poverty is widespread



- Million people without electricity
- Million people without clean cooking facilities



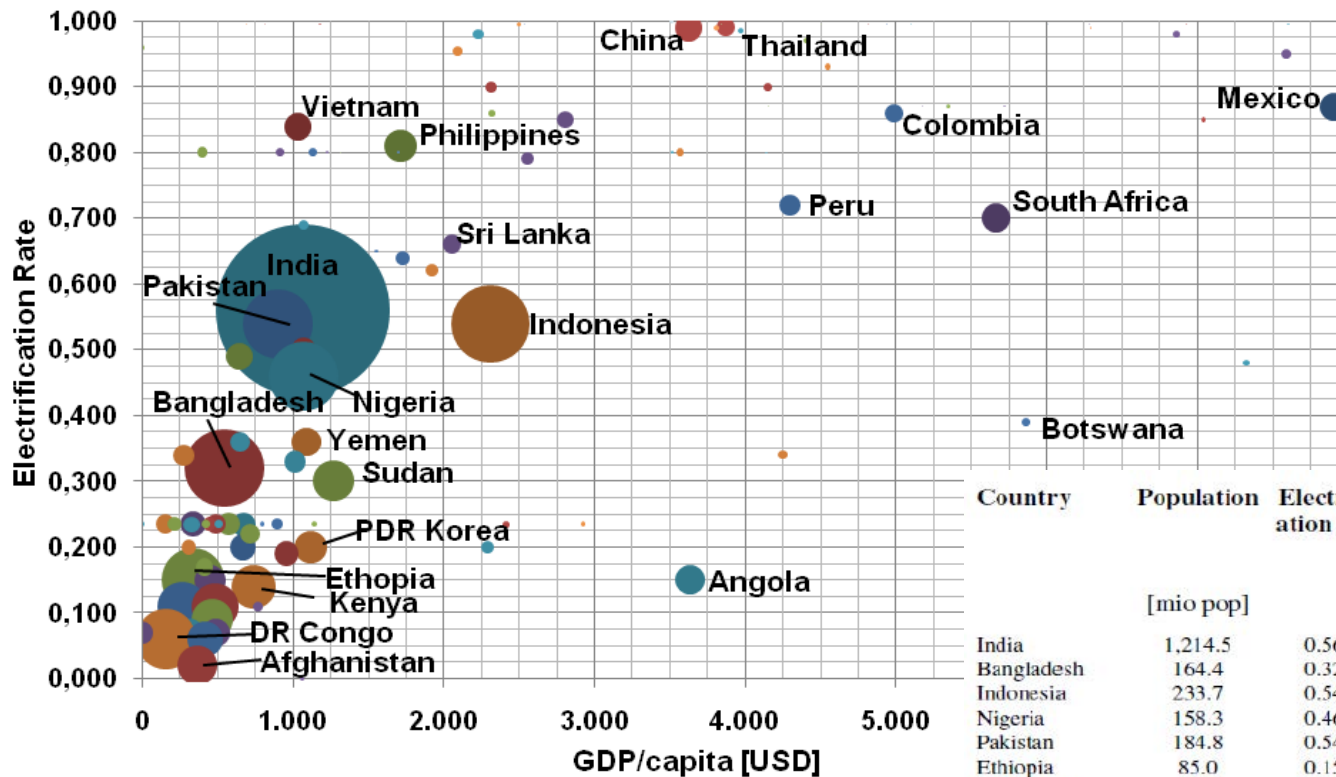
*1.3 billion people in the world live without electricity – 1/2 in Africa*

*2.7 billion live without clean cooking facilities – 1/4 in Africa*

Source: IEA WEO, 2011



# Global Scenario: Needs



STUDIES:  
IRENA  
REN21  
ECEEE  
MENA

Country	Population [mio pop]	Electrification rate	People without electricity [mio pop]	GDP/capita [USD]	population weighted irradiation optimally tilted [kWh/m <sup>2</sup> /y]
India	1,214.5	0.560	534.4	1,070	2,032
Bangladesh	164.4	0.320	111.8	540	1,908
Indonesia	233.7	0.540	107.5	2,310	1,809
Nigeria	158.3	0.460	85.5	1,070	1,978
Pakistan	184.8	0.540	85.0	900	2,135
Ethiopia	85.0	0.150	72.2	340	2,205
DR Congo	67.8	0.060	63.8	160	1,848
Burma	50.5	0.110	44.9	270	1,939
Tanzania	45.0	0.110	40.1	480	2,043
Kenya	40.9	0.140	35.1	740	2,124
Uganda	33.8	0.090	30.8	460	1,980
Sudan	43.2	0.300	30.2	1,260	2,271
Afghanistan	29.1	0.020	28.5	360	2,164
Mozambique	23.4	0.060	22.0	410	2,026
Nepal	29.9	0.330	20.0	420	2,176
PDR Korea	24.0	0.200	19.2	1,110	1,874
Philippines	93.6	0.810	17.8	1,710	1,842
Madagascar	20.1	0.150	17.1	450	2,091
Angola	19.0	0.150	16.1	3,630	2,084
Yemen	24.3	0.360	15.5	1,080	2,295
South Africa	50.5	0.700	15.1	5,660	2,166

Source: Breyer Ch., Werner C., et al., Off-Grid Photovoltaic Applications in Regions off Low Electrification: High Demand, Fast Financial Amortization and Large Market Potential, 26<sup>th</sup> EU PVSEC, Poster 5BV.1.45





# Global Scenario: Plans: SE4ALL

UN Secretary-General Ban Ki-moon has called on governments, businesses, and civil society to make commitments to action to accomplish three objectives by 2030:



**ENSURING**  
*universal access*  
**TO MODERN ENERGY SERVICES.**



**800,000 LIVES SAVED**  
*Replacing outdated cookstoves and open fires with modern energy services would save the lives of 800,000 children who die each year as a result of exposure to indoor smoke.<sup>1</sup>*




**DOUBLING THE GLOBAL RATE OF IMPROVEMENT IN**  
*energy efficiency.*



**SAVING \$900 BILLION ANNUALLY**  
*Investing \$170 billion annually in energy efficiency worldwide could generate an average internal rate of return of 17% and produce energy savings of up to \$900 billion per year.<sup>2</sup>*



**DOUBLING THE SHARE OF**  
*renewable energy*  
**IN THE GLOBAL ENERGY MIX.**



**SOLAR ENERGY POTENTIAL 25-800x CURRENT DEMAND**  
*The technical potential of solar energy alone exceeds total current global energy demand by 25 to 800 times.<sup>10</sup>*

Source: Richenda Van Leeuwen, **Achieving Universal Access to Energy by 2030**  
Executive Director, Energy and Climate, Energy Access Initiative  
United Nations Foundation



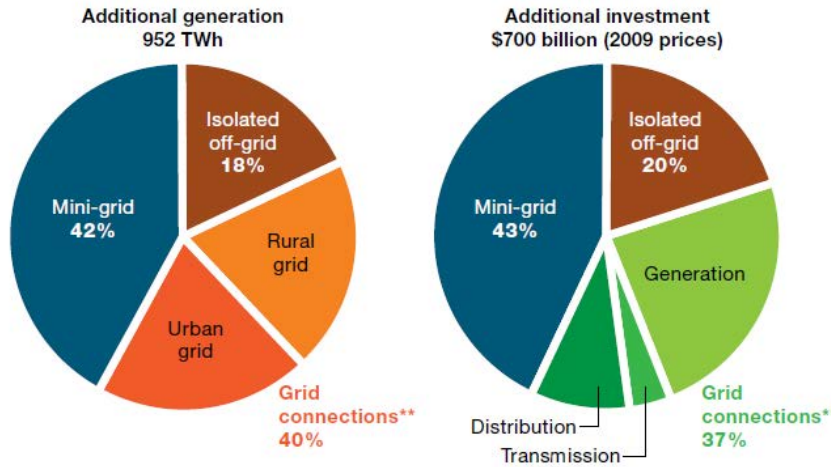
# Global Scenario: Plans: Many Other initiatives



# Global Scenario: Investments

The investments needed are huge, but relatively small if we compare with other Global figures quite popular by the International Financial Crisis.  
And the R.O.I. is enormous in all aspects.

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



\*Compared with the New Policies Scenario

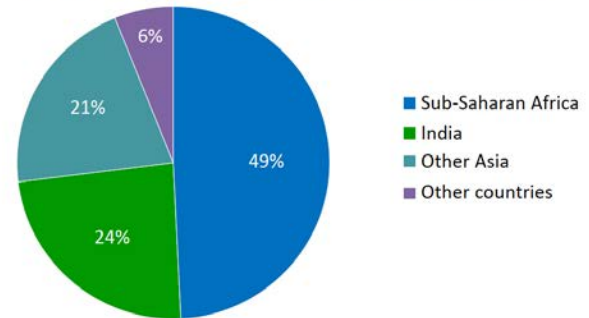
\*\*includes generation, transmission and distribution for both urban and rural grids

Source: Richenda Van Leeuwen, *Achieving Universal Access to Energy by 2030*  
Executive Director, Energy and Climate, Energy Access Initiative  
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## Where is the investment needed?



\$48 billion investment required, a 5.3-fold increase



*Nearly half of the investment is needed in sub-Saharan Africa*

Source: IEA WEO, 2011

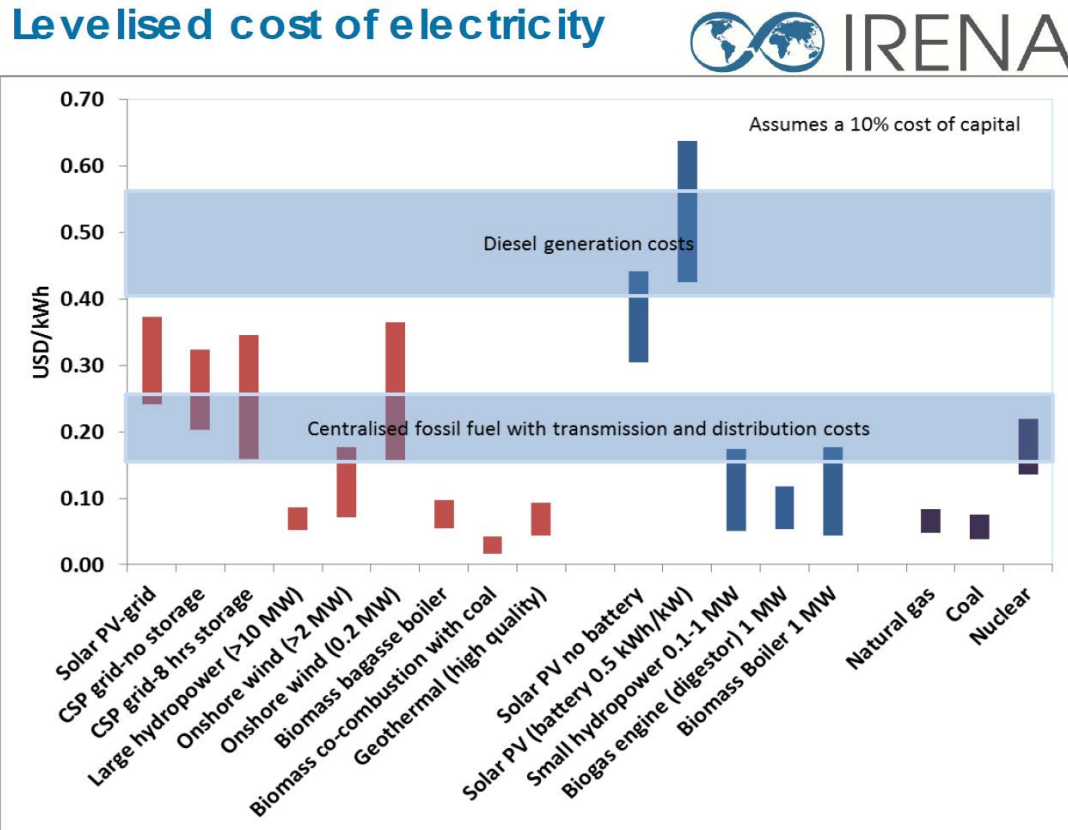
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# New Technical Solutions

R.E. Technologies are becoming fully competitive with conventional ones



# New Technical Solutions



## Rural electricity supply solutions

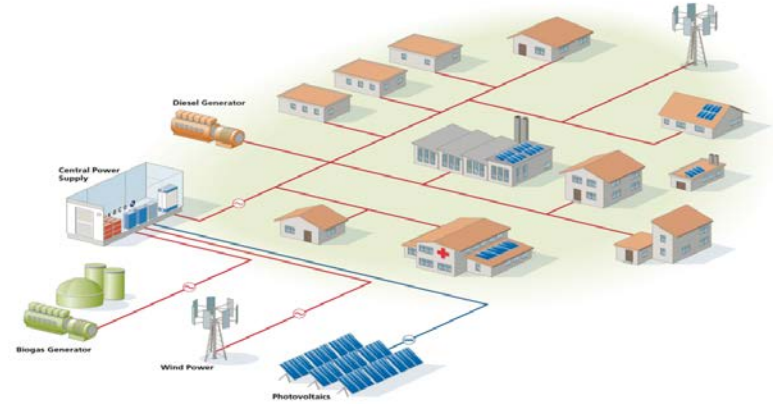
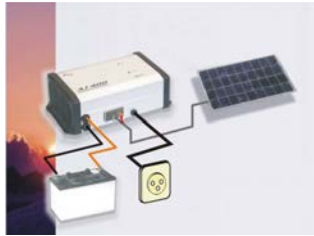
	Capital cost (USD)	Operating cost (USD/month)	Levelized monthly cost (USD/month)
Grid extension (coal/gas)	1000-3000	2-5	15-25
Mini-grids (biomass gasification, hydro, village biogas)	500-1500	2-4	10-20
Diesel generator	500-800	10-15	15-25
Biodiesel generator	500-800	10-15	15-25
Rooftop SHS incl 1 kWh battery	250-500	12-14	15-20
Solar kits (0.1 kW incl 0.5 kWh battery)	100-150	10	11-13
Solar lantern/rechargeable lanterns (0.01 kW/0.05 kWh battery)	20-40	1.5-2.5	1.75-3

23

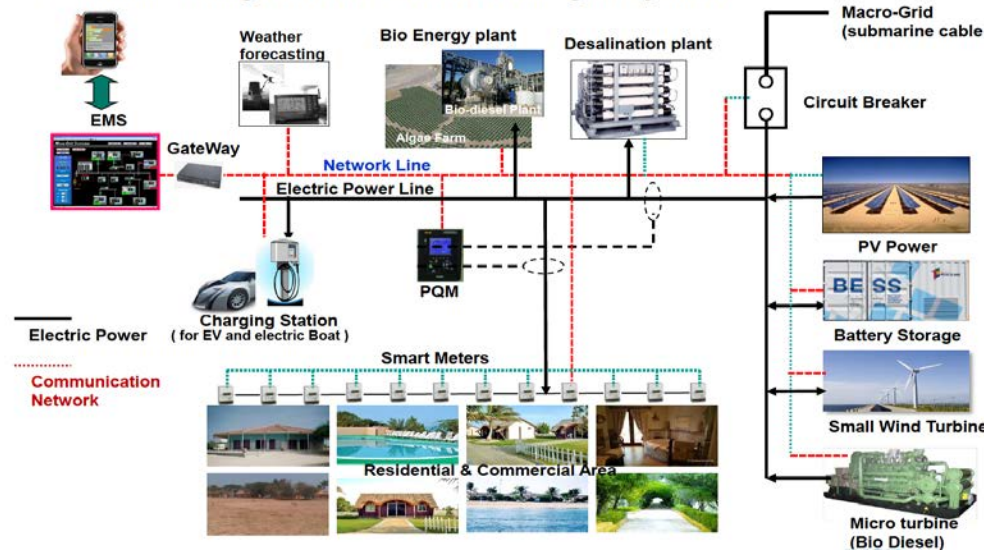


# New Technical Solutions

From small appliances and Pico Systems to sophisticated Mini Grids: Improvements are huge!



## Basic configuration of smart micro grid systems



## SOLAR SUITCASE System Overview



# New Technical Solutions

New cook stoves, solar cookers, solar thermal water heaters, biogas community installations...  
Many efficient, simple, reliable, economical, accessible and clean technologies are ready to provide a better life and facilitate economic development in remote communities





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# Conclusions

- Coordination of international development work proved to be key for the success. There is a need for aligning cooperation initiatives more strongly, to match the countries needs and interests.
- The industry has to improve communication about technology advances
- Importance of having a Ministry dedicated solely on RE, so that fossil fuel policies do not interfere with RE ones.
- Attracting private investment is essential, utilities have revealed key actors in the field of rural electrification
- Donors and financing institutions focus on establishing the necessary ecosystem that facilitates the development of the market and long term financing mechanism for project developers, but also end-users.



# Conclusions

- Policy makers have to create a levelized playing field, promoting innovations in off-grid solutions using the established incentives, such as tax incentives, grants (for risk mitigation) and smart subsidies
- Renewable energies are economically interesting, but there are still challenges to be tackled: local financing (small amount and high interest rates), limited technical knowledge, CAPEX still high so subsidies remain important. However, necessary to ensure sustainability of the project over the time as subsidies are limited in time.
- Relevance of programmes focusing on empowering poor communities through the creation of renewable energy companies which can deliver modern electricity services. Necessary to develop local content of the systems: Jobs
- Essential to have a policy and legislative framework that facilitates the development of projects. Private sector does not need grants, but rather long term soft loans.



# Conclusions

- The main challenge affecting financing of off-grid renewable energy projects is an inadequate regulation and its random application
- Once we talk about off-grid, productive uses become very important. Income generation is crucial to ensure that people are able to pay their energy costs.
- Off-grid RE is the most promising solution for combating water scarcity. Economic viability of PV pumps depends local costs of diesel and price development of PV components
- Different options for water treatment making use of solar energy (e.g. solar water pasteurization, solar still, humidification/dehumidification, membrane distillation, desalination, etc.)
- **Equity finance in mini-grids:** Large scale EU utilities have easier access to finance than the smaller off grid companies and can therefore easier invest in mini-grids.



# Conclusions: Challenges and Resolution

Challenges	Solutions
Lack of institutional and political will	Stability, long-term master plan and commitment towards RE and access to energy
<b>Inadequate legal and regulatory framework</b>	<b>Simplification, standardisation (licensing, PPAs, authorisation, access to market etc.)</b>
<b>Access to finance and support schemes</b>	<b>Credit schemes, guarantees for the banking sectors, subsidies, grants.</b>
Lack of information and need for capacity-building on technical, business, financing.	From simple end-user education to building entrepreneurial skills and technical trainings.
Policy rewarding use of fossil fuels	Level competition with RE sources, internalise positive externalities linked to RE sources.
Lack of related infrastructures	Investments in roads etc.





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