




Annual Conference RES4MED

Rome, May 19th 2016

Modesto Gabrieli Francescato - Strategy and Development, Terna

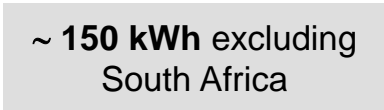


Enhancing investments for clean tech solutions, beyond MENA towards Africa: challenges and opportunities

Legend:

- LOW (LESS THAN 30%)
- MEDIUM (BETWEEN 30 AND 60%)
- HIGH (MORE THAN 60%)

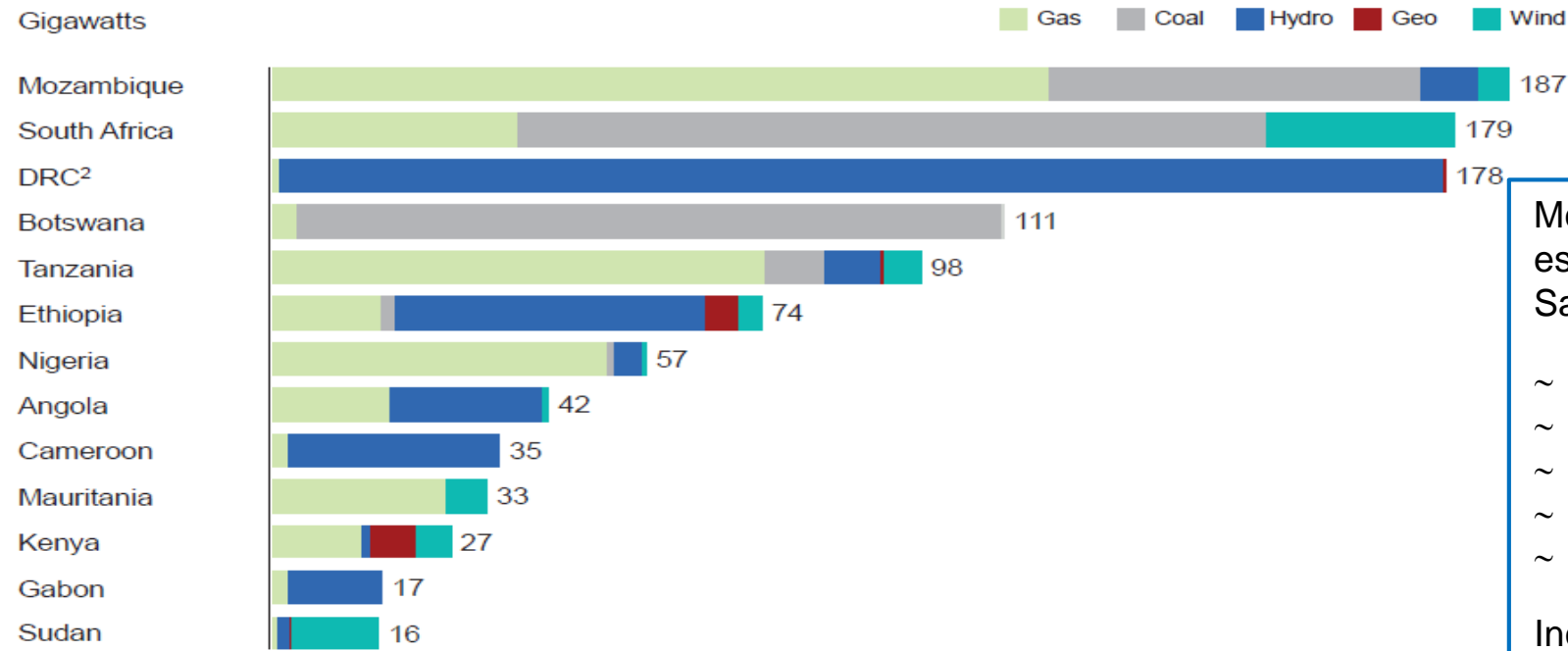
1. Mauritania 21%	11. Liberia 2%	19. Uganda 15%	29. Nigeria 45%	39. Mozambique 39%
2. Mali 27%	12. Togo 27%	20. Tanzania 24%	30. Cameroon 54%	40. Senegal 55%
3. Niger 14%	13. Benin 28%	21. Zambia 26%	31. Republic of the Congo 42%	41. Sao Tome and Principe 59%
4. Chad 4%	14. Central African Republic 3%	22. Malawi 9%	32. Sudan 35%	42. Ghana 72%
5. Burkina 16%	15. South Sudan 1%	23. Rwanda 17%	33. Eritrea 32%	43. Gabon 60%
6. Cote d'Ivoire 9%	16. Ethiopia 23%	24. Burundi 10%	34. Djibouti 50%	44. Equatorial Guinea 66%
7. Gambia 35%	17. Somalia 15%	25. Madagascar 15%	35. Kenya 40%	45. Botswana 66%
8. Guinea Bissau 21%	18. Democratic Republic of Congo 9%	26. Swaziland 27%	36. Angola 30%	46. South Africa 85%
9. Guinea 26%		27. Lesotho 28%	37. Namibia 30%	47. Comoros 69%
10. Sierra Leone 5%		28. Cabo Verde 3%	38. Zimbabwe 40%	48. Seychelles 97%
			49. Mauritius 100%	



Sources: IEA - Africa Energy Outlook 2014, McKinsey - Brighter Africa 2015, Power Africa – The roadmap, Entso-E, Terna analysis

Sub-Saharan Africa - Power generation potential

Power-generation potential for select sub-Saharan African countries by technology¹:



McKinsey report “Brighter Africa” (2015) estimates **1,2 TW** of potential capacity in sub-Saharan Africa excluding solar:

- ~ 400 GW of gas-generated power,
- ~ 350 GW of hydro,
- ~ 300 GW of coal,
- ~ 109 GW of wind,
- ~ 15 GW of geothermal

Including solar, McKinsey estimates even **10 TW** of potential capacity or more.

¹ Potential from domestic resources only; gas includes all conventional proven/speculative reserves, and hydro includes all technically exploitable potential.

² Democratic Republic of the Congo.

Source: *Geothermal: International Market Overview Report*, Geothermal Energy Association, May 2012, geo-energy.org; *International Energy Statistics*, US Energy Information Administration, 2013, eia.gov; *National-Scale Wind Resource Assessment for Power Generation*, National Renewable Energy Laboratory, June 2013, nrel.gov; Rystad Energy database, rystadenergy.com; *World Energy Resources: 2013 Survey*, World Energy Council, October 2013, worldenergy.org

The **huge gap between potential capacity and effective energy deployment** represents a **heavy burden** for African progress. **The path from theoretical potential to harnessed supply is likely to be long and complicated**, and requires a development program which involves the whole supply chain (production, transmission and distribution).

Filling the gap between potential capacity and effective deployment

Evolution in electricity demand in sub-Saharan Africa (IEA estimates)¹:

There is no doubt there will be a **growth in sub-Saharan Africa electricity demand during** the next years together with growth of population and economy, as Africa's rates are far below other emerging markets. The main research agencies estimate a **3-4 times increase in demand by 2040**.

Evolution in electricity generation by fuel in sub-Saharan Africa (IEA estimates)¹:

At the same time, **total power generation capacity will expand to meet the growing demand**. Analysis by International Energy Agency foresees a **quadrupled installed capacity by 2040**, with a new generation mix. Fossil-fuelled capacity will reduce to 54% of 2040 mix (vs 77% of 2012), while **renewables will increase to 44%** (more than double)

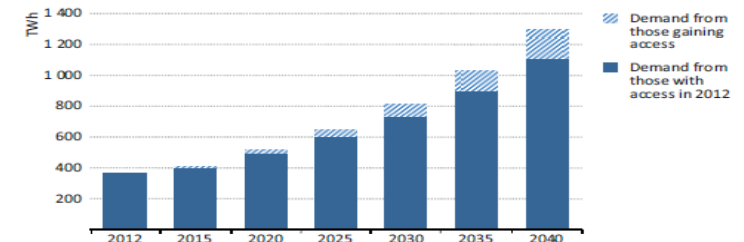
In order to supply Sub-Saharan Africa's growing electricity demand, and to efficaciously deploy energy, **the power sector will need huge capital investment for generation capacity and wires infrastructures, comprising transmission and distribution**.

With particular reference to **grids investments**, it is necessary to follow a dual approach:

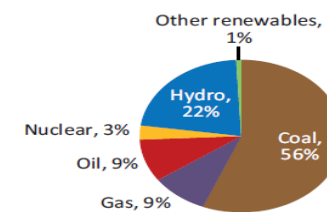
HARDWARE



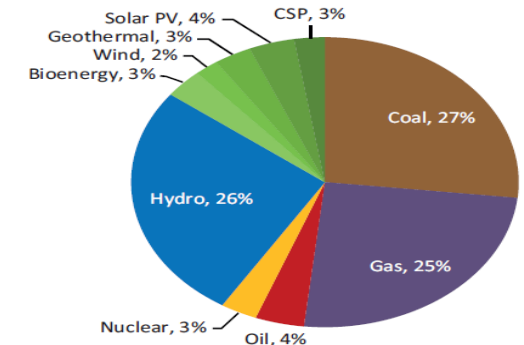
- Physical interconnections
- Regional / National transmission
- Storage
- Rural electrification



2012 total generation: 440 TWh



2040 total generation: 1 540 TWh

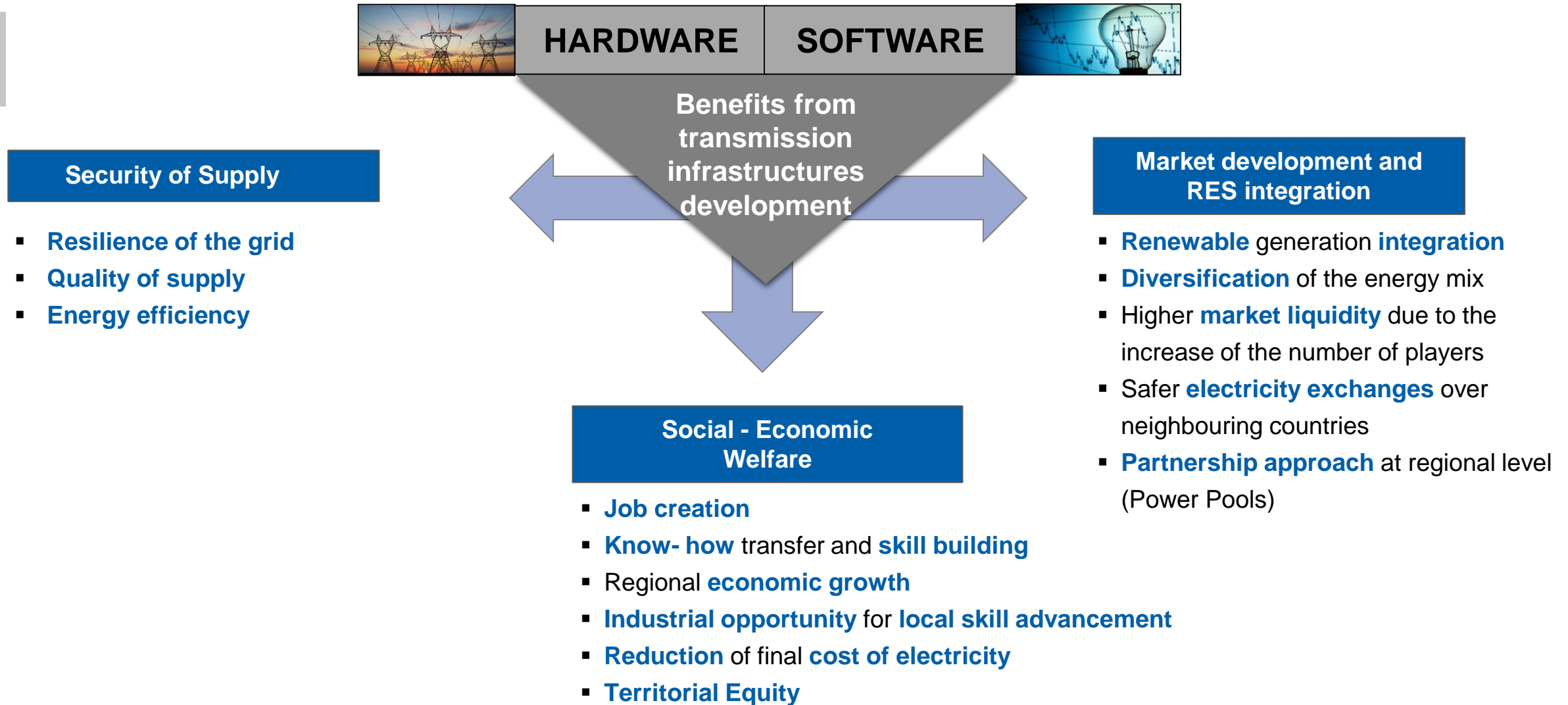


SOFTWARE

- Markets integration
- Flexible dispatching
- Non-discriminatory access

¹: Analysis based upon the central scenario of the World Energy Outlook 2014 (WEO-2014).

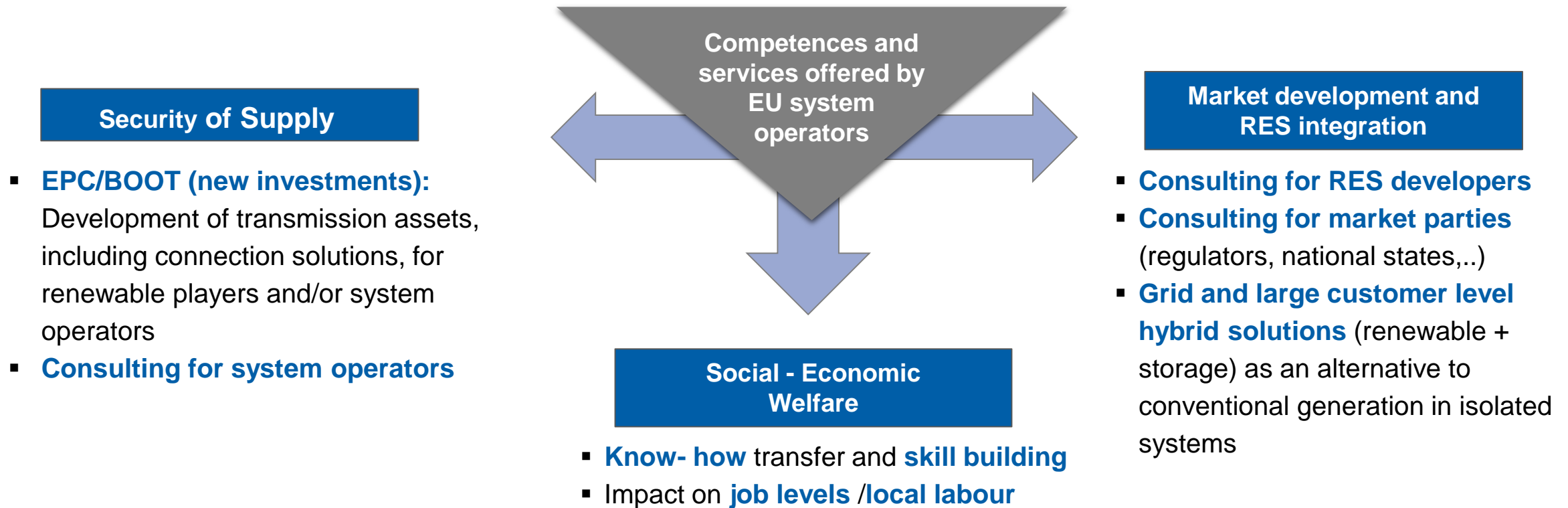
Transmission infrastructures and interconnections: long term benefits



Investments in infrastructure represent a *conditio sine qua non* for effectively contributing to **economic growth**, through **security of supply, integration** and **optimization of energy flows**, also via a diversification of sources and routes.

A possible role for European system operators

European utilities, and **electricity system operators** in particular, might be crucial in helping local authorities and companies in **managing the change**. Best practices and methodologies may be a common ground for training programs (in order to setup experts) and technical assistance (in order to perform technical studies).



European System Operator's experience and skills may represent solid fundamentals to rely on to drive the African energy transition in concert with local authorities and market players.

Annual Conference RES4MED

Rome, May 19th 2016

Modesto Gabrieli Francescato - Strategy and Development, Terna