ΕΜΠΟΡΙΚΟ ΚΑΙ ΒΙΟΜΗΧΑΝΙΚΟ ΕΠΙΜΕΛΗΤΗΡΙΟ ΑΘΗΝΩΝ
ΕΛΛΗΝΟ-ΑΦΡΙΚΑΝΙΚΟ ΕΠΙΜΕΛΗΤΗΡΙΟ ΕΜΠΟΡΙΟΥ ΚΑΙ ΑΝΑΠΤΥΞΗΣ

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«The Electricity Sector main driver for Economic and Social Development of Sub-Saharan Africa:

Investment opportunities for European electricity companies and energy investors»

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The European electricity sector in deep crisis…

- Plunge in profits and new investments due to loss-making power plants and over-capacity after a prolonged period of weak energy demand and very low wholesale power prices…
- Electricity demand: In first semester 2014 about 8% below the peak reached in 2008…
- Switch off new gas-fired, coal-fired and nuclear power plants… while spending billions on subsidised renewables out of the market, when the European electricity system is oversupplied…
- RWE: Since the start of 2013 has closed 12,600 MW of capacity, nearly a quarter of its European portfolio…
- Market Capitalization: The top 20 European energy utilities have lost almost half a trillion euros from the peak in 2008 (worth of €1 trillion)…
- Write-offs from assets (2010 – 2012): 16 European power and utility companies wrote in total €30.6b of value.
- In 2013 GDF Suez wrote down €14.9 billion …

Sub-Saharan Africa: The new emerging region

- The European Electricity Market is very competitive, too narrow and in deep crisis, while the growth will be limited or stagnant during the next decade…
- Europe has limited energy resources and remains dependent from energy imports…
- The **future** of the European power and utility companies lies in emerging markets. They must expand in new emerging regions with strong growth and electricity demand during the coming decades…

BUSINESS SOLUTION ?

- ***Sub-Saharan markets are poised for "explosive growth"…***
- ***Very good prospects for power projects under the pressures of economic growth, social development and a desperate lack of capacity…***

A new dynamic electricity market

- In sub-Saharan Africa an average of 1.000 MW/year had been commissioned in recent years, **but**…

  … **with huge new capital investments it is possible to commission about 7.000 MW of new capacity annually and to reach universal access to electricity, even by 2050**.

- The national markets are opening up and maturing very fast… They are all going to be opening up in the next few years.
- All the countries of the region are adjusting their policy and regulations to lead in developing new generation capacity with foreign technology and investments.
- More and more governments are trying to reform the energy sector and they understand that the best way of achieving this goal is by utilizing the private sector.

Investment opportunities for European Energy Investors

The electricity market of Sub-Saharan Africa offers a lot of investment opportunities for European electricity industries and companies, Transmission and Distribution System Operators, constructors, energy investors, private energy funds, banks, etc.

The European Energy investors can benefit from:

- **Predicted annual economic growth rates above 5%,** sub-Saharan Africa offers an appealing market for power generation companies, TSOs, energy funds etc willing to face a notoriously challenging investment context.
- The underdeveloped and fragmented Electricity System of Sub-Saharan Africa is in the process of moving from local and closed systems to a gradually emerging and open **pan African electricity market.**

Faster growth rates for electricity demand

- The rapid growth of new power generation will be the key determinant for the Economic Development of Sub-Saharan Africa, due to the strong positive correlation between GDP growth rates and electricity demand growth rates.
- ***A population of 800 million – and over 1.750 million by 2040… - is the basis for a strong electricity demand…***
  During the next decades ***t***he ***c***ountries in Sub-Saharan Africa are expected to register faster growth rates of electricity demand among different regions of the World – and especialy the rates of growth of the European Union.
- More and more governments cooperate for an expansion in regional wholesale trade in electricity that will drive comparability of prices and minimize the subsidization of state owned utilities by central governments.
- **Four regional power pools** have been established to promote cross-border trade in electricity and capacity investment.

Economic growth to accelerate in 2015 to 5,8%

International Monetary Fund (IMF) – *(October 24, 2014):*

- ***Economic growth for sub-Saharan Africa to accelerate in 2015 to 5,8% compared to 5% in 2013-14 due to a demand in infrastructure boom.***
- ***The growth would be strong in agriculture and infrastructure in the region.***
- ***Sub-Saharan Africa remained the second fastest region in the world.***
- ***Policies should continue to emphasise on growth-enhancing measures: boosting fiscal revenue mobilisation, targeting public spending toward infrastructure investment and other development spending…***

World gross domestic product (GDP) by region/ country
(in purchasing power parity)

Growth by Region/Country	Av. Annual Growth Rate (2011-2040)
United States	**2.4%**
OECD Europe	**2.0%**
TOTAL OECD	***2.1%***
Russia	**2.5%**
China	**5.4%**
India	**5.4%**
Middle East	**3.9%**
AFRICA	***4.8%***
Cen. - South America	**3.2%**
Brazil	**3.2%**
TOTAL Non-OECD	***4.6%***
TOTAL WORLD	***3.5%***

Sources: Oxford Economic Model & EIA, May 2014

Average annual growth of sub-Saharan Africa at least three times faster than that of the developed European countries during the next decades…

Electricity Demand for the EU-27 is estimated to grow from 3.081 TWh in 2010 to 3.250 TWh in 2020 at an annual growth rate of only 0.5%.

World total installed generating capacity (Gigawatts)

Projections: Region/ Country	**2010**	**2040**	**Av. annual % change 2040/2010**	**Total change 2010-2040 (%)**
United States	1.033	1.293	0,8	25
OECD Europe	946	1.211	0,8	28
TOTAL OECD	***2.635***	***3.403***	***0,9***	***29***
Russia	229	325	1,2	42
China	988	2.265	2,8	129
India	208	510	3,0	145
Middle East	185	280	1,4	52
AFRICA	***134***	***283***	***2,5***	***112***
Central & South America	247	447	2,0	81
Brazil	114	256	2,8	125
TOTAL Non-OECD	***2.426***	***4.850***	***2,3***	***100***
TOTAL WORLD	***5.061***	***8.254***	***1,6***	***63***
Source: EIA 2013				

World total net electricity generation, 2010-2040
(Billion kilowatthours)

Projections: Region/ Country	**2010**	**2040**	**Av. annual % change 2010-2040**	**Total change 2010-2040 (%)**
United States	4.110	5.212	0,8	27
OECD Europe	3.496	4.765	1,0	36
TOTAL OECD	***10.306***	***14.240***	***1,1***	***38***
Russia	985	1.729	1,9	76
China	3.904	11.595	3,7	197
India	904	2.736	3,8	203
Middle East	758	1.405	2,1	85
AFRICA	***632***	***1.537***	***3,0***	***143***
C. & S. America	1.039	2.023	2,2	95
Brazil	507	1.217	3,0	140
TOTAL Non-OECD	***9.934***	***24.794***	***3,1***	***150***
TOTAL WORLD	***20.240***	***39.034***	***2,2***	***93***

Source: EIA 2013

Sub-Saharan Africa: Energy Reserves & Resources

- **Region's energy resources are more than sufficient to meet the needs of its population…**
- **…but they are largely under-developed** *(source IEA).*
- **The region accounted for almost 30% of global oil and gas discoveries made over the last five years…**
- **… and it disposes several major energy producers: Nigeria, South Africa and Angola.**
- **Sub-Saharan Africa (SSA) is endowed with huge renewable energy resources, including excellent and widespread solar and hydro potential, as well as wind and geothermal.**

Significant reserves for thermal generation

Fossil Fuel Resources:

- While sub-Saharan nations are not, as a whole, as richly endowed in energy resources as some of the nations to the North, several countries have significant reserves for thermal generation.

Coal:

- *BP Statistical Review:* **South Africa 30 bt, Zimbabwe 500 mt**
- **New reserves: Botswana, Nigeria** (three coal fired plants of 9 GW capacity by 2015)**, Zimbabwe** (two new plants of 4.400 MW), **Tanzania** is turning to coal to diversify from hydropower.

Natural gas:

- **Nigeria leading player** (reserves of 5.3 trillion m3 of gas, 80% of the SSA ' gas deposits). Goal: 40 GW by 2020 – up from a current figure of about 4 GW**.**
- At least 16 of the 42 countries in the region have reserves, which organizations (World Bank etc) are eager to see exploited.

World installed coal-fired generating capacity, 2010-2040 (Gigawatts)

Projections: Region/ Country	2010	2040	Av. annual % change 2010-2040	Total change 2010-2040 (%)
United States	317	278	-0,4	-12
OECD Europe	204	169	-0,6	-17
TOTAL OECD	***658***	***571***	***-0,5***	***-13***
Russia	51	57	0,4	11
China	659	1.187	2,0	80
India	120	234	2,3	95
Middle East	0	0	--	-
AFRICA	***39***	***64***	***1,7***	***66***
Cen. & S. America	6	9	1,1	40
Brazil	4	6	1,6	62
TOTAL Non-OECD	***991***	***1.729***	***1,9***	***75***
TOTAL WORLD	***1.649***	***2.300***	***1,1***	***40***

Sources: EIA 2013

World installed natural-gas-fired generating capacity, 2010-2040 (Gigawatts)

Projections: Region/ Country	**2010**	**2040**	**Av. annual % change 2010-2040**	**Total change 2010-2040 (%)**
United States	350	566	1,6	62
OECD Europe	217	252	0,5	16
TOTAL OECD	***746***	***1.112***	***1,3***	***49***
Russia	100	137	1,1	37
China	33	105	4,0	220
India	23	45	2,2	92
Middle East	136	197	1,3	46
AFRICA	***50***	***113***	***2,7***	***125***
Cen. & S. America	59	102	1,9	73
Brazil	12	38	3,9	215
TOTAL Non-OECD	***553***	***945***	***1,8***	***71***
TOTAL WORLD	***1.299***	***2.057***	***1,5***	***58***

Source: EIA 2013

Five countries with large uranium reserves…

Uranium:

Top 15 countries with large U reserves: 5 countries are in the region of SSA …

World Nuclear Association (2013):

Known Recoverable Resources of Uranium 2013 (tonnes & % of world):

- **Niger** (404,900 & 7%)
- **Namibia** (382,800 & 6%)
- **South Africa** (338,100 & 6%)
- **Botswana** (68,800 & 1%)
- **Tanzania** (58,500 & 1%)

Nuclear generation:

- **South Africa**: The planned nuclear plants are due to eventually provide 9.600 MW, or about a quarter of the country's current supply.
- **Nigeria**: First nuclear power station will be online by 2020.

World installed nuclear generating capacity, 2010-2040 (Gigawatts)

Projections: Region/ Country	2010	2040	Av. annual % change 2010-2040	Total change 2010-2040 (%)
United States	101	113	0,4	12
OECD Europe	132	142	0,3	8
TOTAL OECD	***314***	***359***	***0,5***	*15*
Russia	24	55	2,8	128
China	11	160	9,5	1.400
India	5	52	8,5	1.040
Middle East	0	15		
AFRICA	***2***	***12***	***6,5***	***554***
C. & S. America	3	10	4,1	237
Brazil	2	7	4,4	264
TOTAL Non-OECD	***67***	***358***	***5,7***	*432*
TOTAL WORLD	***381***	***717***	***2,1***	*88*

Source: EIA 2013

Fast growth or …Boom of the Renewables

Boom of the Renewables (*Bloomberg New Energy Finance*):

- Sub-Saharan Africa to add more Renewables in 2014 than past 14 years…
- Growing demand for electricity and falling costs for wind and solar power mean more renewable-energy projects and investments…
- About 1.8 gigawatts of capacity – excluding large hydroelectric power plants – will be added in 2014 and investmets are estimated at $5.9 billion this year, and may reach $7.7 billion in 2016…
- **Solar has by far the largest renewable resource potential in Africa, with high-quality solar resources available everywhere,** other than in equatorial rainforest areas.

Investment opportunities for RES in small-scale projects

African wind potential is virtually untapped , but..

- …the full use of Africa's wind potential would require significant investment in the **transmission system** to connect resources to demand centres.
- Average annual investment from 2006 through 2011 was $1 billion.
- About 3.9 gigawatts (GW) of RES – mostly wind and solar - is estimated to be installed in South Africa from 2014 through 2016.
- During the same period: Kenya is expected to add 1.4 gigawatts while Ethiopia will install 570 megawatts of primarily geothermal and wind capacity.
- Vast investment opportunities for RES in small-scale and local projects that could reach the 92% of the region's rural populations still without electricity…

Enormous potential for hydropower, but… unexploited

Hydropower potential:

- With 60 international river basins, new huge investments for dams and increased water storage; it would be possible to twofold the agricultural GDP and to increase cereal production by 70%-80% over the next 25-30 years.
- The region could generate 1.750 GWh per year from hydropower, of which only 7% are exploited Key rivers could offer: **Congo** 100 GW, **Zambezi** 10 GW.
- Hydro potential: **Ethiopia** 30 GW and **Nigeria** 20 GW.
- Ethiopia as the leading African country for current hydro development, with more than 7.000 MW of hydro capacity currently under construction.
- **CHINA: projects into the region's hydro sector are totaling $9.3 billion in value** *(Bloomberg and International Rivers).*

World installed hydroelectric generating capacity, 2010-2040 (Gigawatts)

Projections: Region/ Country	**2010**	**2040**	**Av. annual % change 2010-2040**	**Total change 2010-2040 (%)**
United States	78	81	0,1	3
OECD Europe	151	195	0,9	*29*
TOTAL OECD	***358***	***464***	***0,9***	***30***
Russia	47	69	1,3	47
China	219	409	2,1	87
India	41	133	4,0	227
Middle East	12	16	1,0	35
AFRICA	***24***	***59***	***3,0***	***144***
C. & S. America	136	280	2,5	107
Brazil	81	185	2,8	129
TOTAL Non-OECD	***559***	***1.155***	***2,5***	***107***
TOTAL WORLD	***917***	***1.619***	***1,9***	***77***

Source: EIA 2013

Wind resources are in the order of 1.750 GW…

Wind energy:

- Africa's onshore wind resources are in the order of 1.750 GW, far more than total African demand for the foreseeable future.
- West coast offers abundant wind resources.
- **Kenya**: sub-Saharan Africa's largest windfarm (300 MW) – providing reliable, low-cost wind power to the national grid – reducing the dependency on hydroelectric power - adding 30% to the country's installed capacity.
- The **African Development Bank** is funding wind development across the continent.

World installed wind-powered generating capacity, 2010-2040 (Gigawatts)

Projections: Region/ Country	2010	2040	Av. annual % change 2010-2040	Total change 2010-2040 (%)
United States	40	88	2,7	123
OECD Europe	86	250	3,6	192
TOTAL OECD	***135***	***391***	***3,6***	***190***
Russia	0	0		
China	31	277	7,6	790
India	13	28	2,6	114
Middle East	0	1	--	1.169
AFRICA	***1***	***10***	***8,4***	***1.019***
C. & S. America	1	7	5,6	417
Brazil	1	4	5,3	371
TOTAL Non-OECD	***48***	***335***	***6,7***	***595***
TOTAL WORLD	***183***	***726***	***4,7***	***296***

Sources: EIA 2013

Solar Energy: Development or revolution?

National Solar Power Research Institute (NSPRI):

- **Most African countries receive 325 days of sunlight a year and daily solar radiation between 4 kWh and 6 kWh per square meter.**
- This high amount of insolation correlates to a high generating capacity potential.
- With solar costs falling nearly 80% between 2008 and 2012, the price of PV is nearing grid parity for traditional electricity sources.
- Demand for renewable energy should increase rapidly. This is one of the primary reasons many are predicting a solar energy boom in coming years.

Solar Energy: Advantages for the rural communities

The decentralized nature of solar power and other renewable energy technologies makes them particularly suitable for:

- ✓ small grids or
- ✓ off-grid communities.

When…

- Nearly **66%** of the population in sub-Saharan Africa lives in areas where connection to the grid is too expensive or too difficult for other reasons…
- More than **70%** of sub-Saharan Africa has no access to electricity…
- In rural areas this often exceeds **95%…**

Solar Energy can be:

- **specifically advantageous in these situations to electrify many of sub-Saharan Africa's rural communities…**
- **"key driver" for social and regional development…**

World installed solar generating capacity, 2010-2040 (Gigawatts)

Projections: Region/ Country	2010	2040	Av. annual % change 2010-2040	Total change 2010-2040 (%)
United States	2,70	51	10,3	1.789
OECD Europe	28,26	80	3,5	183
TOTAL OECD	35,87	165	5,2	360
Russia	0,00	0	--	
China	0,89	56	14,8	6.127
India	0,01	10	--	95.180
Middle East	0,01	22	--	223.980
AFRICA	**0,02**	**10**	**--**	**50.445**
C. & S. America	0,00	1	--	
Brazil	0,00	0	--	
TOTAL Non-OECD	***1,02***	***101***	***16,6***	***9.820***
TOTAL WORLD	***36,89***	***266***	***6,8***	***622***
Source: EIA 2013				

High-quality geothermal resources

Geothermal energy:

- Sub-Saharan African has high-quality geothermal resources, an excellent energy source of low-cost.
- East Africa's Great Rift Valley is estimated to offer a potential **15 GW** available for large-scale geothermal projects.
- **Kenya:** Projects for development of eight 100 MW geothermal plants.

Biomass:

- **Sierra Leone:** Establishment of a sugarcane plantation and ethanol refinery along with a biomass fuelled power plant that would supply about 20% of the country's grid power.

Current situation of the African electricity sector

- **Around 600 million of Africans have no access to electricity**, despite the fact that Africa possesses some of the world's largest hydropower, geothermal, wind and solar potential, as well as significant oil, coal and natural gas reserves.
- **In 18% of African countries, energy access for the population is still less than 10%.**
- Nearly 730 million people rely on dangerous, inefficient forms of cooking.
- **Per capita consumption of electricity in Sub-Saharan Africa (excluding South Africa) averages only 124 kWh a year – European Union, Greece >5.000 kWh…**

Less than 5% of potential cropland is under irrigation

- The continuous power crisis forces families and communities to spend significant amounts of their income on costly and unhealthy forms of energy (diesel generators, wood for indoor cooking fires etc).
- Inefficient investments for water infrastructure, construction of dams and water reservoirs.
- While SSA has huge potential in terms of water resources and land, **less than 5% of potential cropland is under irrigation.**
- The **insufficient generation capacity** has limited electricity supply, resulting in low access.
- Electricity blackouts and reliance on expensive diesel power generation costs some African economies between 1% and 5% of GDP annually.

Energy sector, Economic & Social Development

- **The energy sector is not acting as a "brake" on Economic and Social development, and potential European energy investors can benefit from public infrastructure investments and support.**

- **Economic and social development of SSA depends from the volume investment in the energy sector:**

  each additional dollar invested in the power sector is a key for boosting the overall economy by $15…

- Sub-Saharan Africa's demographic indicators are improving: infant mortality rates are falling, while life expectancy is on the rise. Over the next decades the working-age population will grow faster than total population.

- **Rising middle-income class**: tripling of middle-class households in 11 leading sub-Saharan African economies (excluding South Africa) between 2000 and 2014, and they are set to balloon to about 40 million by 2030. ***(Standard Bank)***

$300 billion in investment to achieve electricity access?

International Energy Agency (central scenario):

- Sub-Saharan Africa will require more than $300 billion in investment to achieve universal electricity access by 2030.

- Only with greater private sector investment can the promise of Power Africa be realized…

- The sub-Saharan economy quadruples in size by 2040, the population nearly doubles (to over 1,75 billion) and energy demand grows by around 80%.

- **Power generation capacity quadruples……and Renewables grow strongly to account for nearly 45% of total sub-Saharan capacity**.

Projections for Natural Gas and Oil production

- **Natural gas production** reaches 230 billion cubic metres (bcm) in 2040, led by **Nigeria** (the largest producer), and increasing output from **Mozambique, Tanzania** and **Angola**. LNG exports onto the global market triple to around 95 bcm.
- **Oil production** exceeds 6 million barrels per day (mb/d) in 2020 before falling back to 5.3 mb/d in 2040.
- **Nigeria** and **Angola** continue to be the largest oil producers by far, but with a host of other producers supplying smaller volumes.
- Sub-Saharan demand for oil products doubles to 4 mb/d in 2040, squeezing the region's net contribution to the global oil balance. Coal supply grows by 50%, and continues to be focused on South Africa, but it is joined increasingly by Mozambique and others.

Projections for energy conumption per capita

- The capacity and efficiency of the sub-Saharan energy system increases, but so do the Total Demand placed upon it, and many of the existing energy challenges are only partly overcome.
- In 2040, energy consumption per capita remains very low, and the widespread use of fuelwood and charcoal persists.
  - ***Nearly one billion people gain access to electricity by 2040 because of rapid population growth, but …more than half a billion people remain without it.***
- Sub-Saharan Africa also stands on the front line when it comes to the impacts of climate change, even though it continues to make only a small contribution to global energy-related carbon dioxide emissions.
- More regional electricity supply and transmission projects also advance, helping to keep down the average cost of supply.

Achieving complete electricity access in urban areas

IEA report:

Three actions could boost the sub-Saharan economy by a further **30%** in 2040:

- **An additional $450 billion in power sector investment, reducing power outages by half and achieving universal electricity access in urban areas.**
- **Deeper regional co-operation and integration**, facilitating new large-scale generation and transmission projects and enabling a further expansion in cross-border trade.
- **Better management of energy resources and revenues**, adopting robust and transparent processes that allow for more effective use of oil and gas revenues.

The role of Africa-EU Energy Partnership (AEEP)

The **Africa-EU Energy Partnership (AEEP)** must become the main driver to facilitate and support vast energy investments of European electricity companies, banks, constructors, energy investors etc in the fields of:

- *power generation,*
- *renewable energy,*
- *transportation and distribution of electricity,*
- *large and small-scale energy works,*
- *retail and wholesale electricity markets etc.*

It is crucial to **eliminate barriers** for increased investment, technical and development assistance, effective implementation of projects etc.

Mutually beneficial energy cooperation

Sub-Saharan Africa and European Union share common interests in the field of energy:

- **European Union's countries benefit from S-S African energy exports and investment cooperation,**

and

- **S-S Africa's countries benefit from European investments, technical and financial support in the electricity sector.**

Thank you very much for your attention…