

International Market Potential for Renewable Energy Hybrid Projects

Specific Market Segments

PV Days,
Halle, Germany
24.10.2017



MEMBER OF GOPA CONSULTING GROUP

Agenda



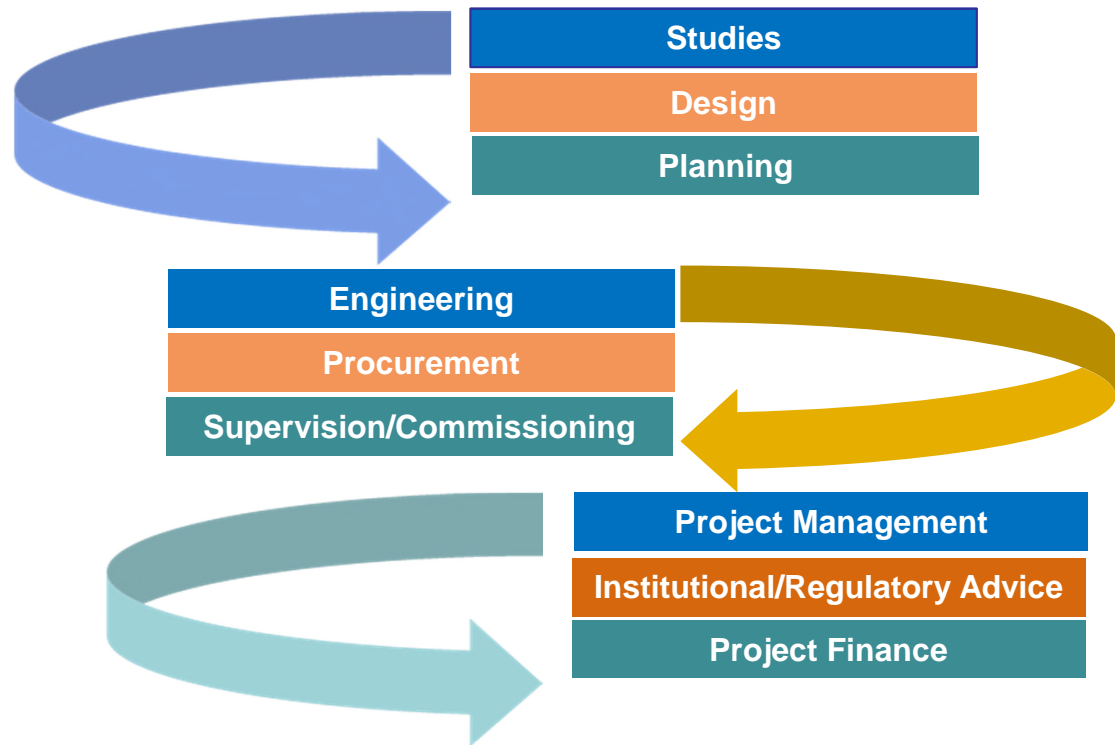
- Introduction intec
- Overall Market Potential
- Replacement/Hybridisation of Diesel Gensets
- (Rural) Electrification
- Important Influencing Factors for Hybrid Systems
- Specific Market Segments
- Areas with Potential for Technical Development

intec - The Company

An international engineering and consulting company for techniques and economics of power **supply systems**, **renewable energy** applications, and climate-relevant energy management

**160 permanent
Experts / Engineers
worldwide**

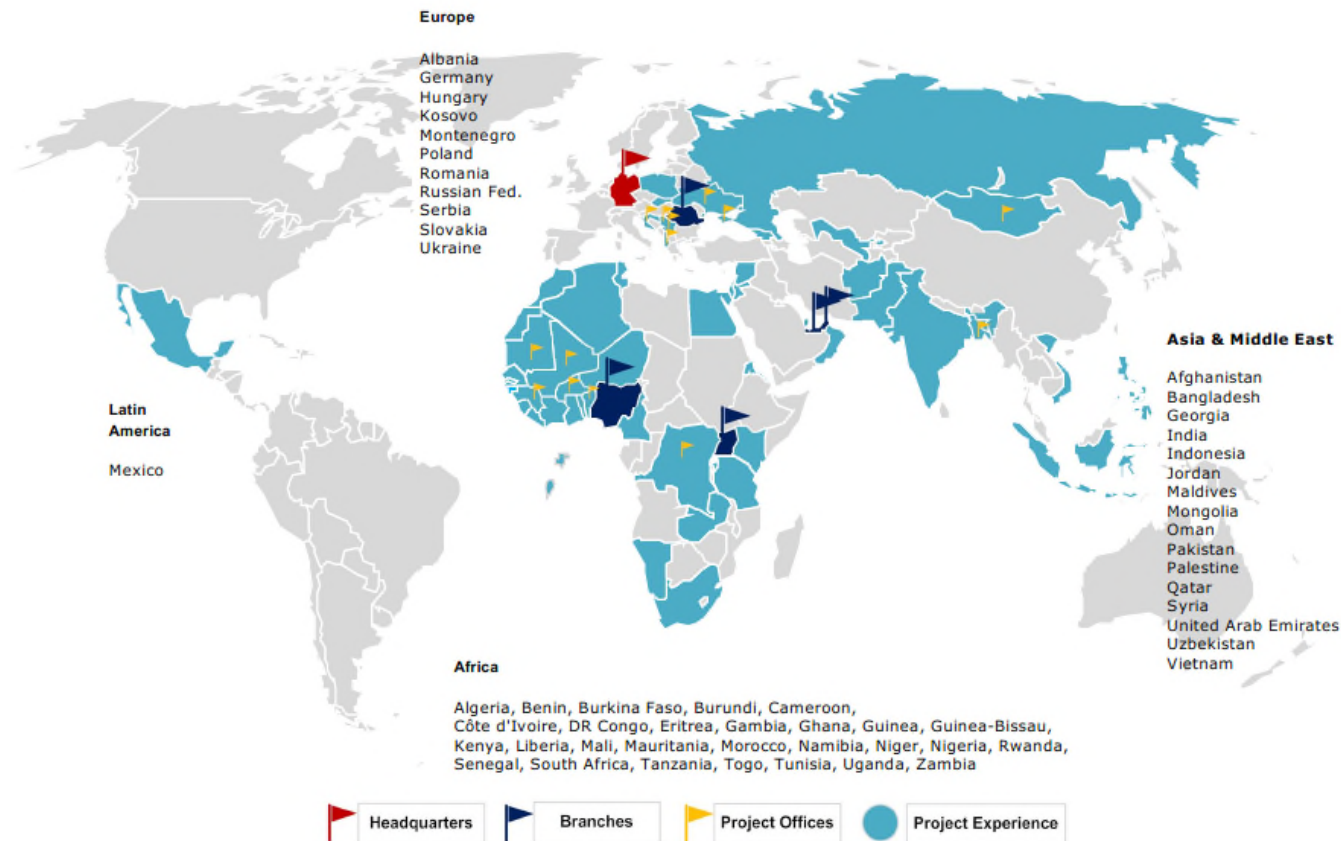
Running Projects in
**more than 30
countries** on different
continents (Africa,
Asia, Latin America,
Europe)





- Studies, Engineering and advisory services, including construction and commissioning supervision and technical assistance during O&M for:
 - Solar Photovoltaic (PV) power plants
 - Concentrated Solar Power Plants (CSP)
 - Wind turbines and wind parks
 - Biomass technologies to generate heat and power
 - Small hydro power plants
 - Geothermal heat and power plants
- Hybrid systems with combinations of different renewables and renewable / fossil-fuelled technologies including storage systems
- Application of Energy Storage Systems
- Resource analyses for all technologies including GIS mapping
- Renewable energy master planning
- Rehabilitation and repowering

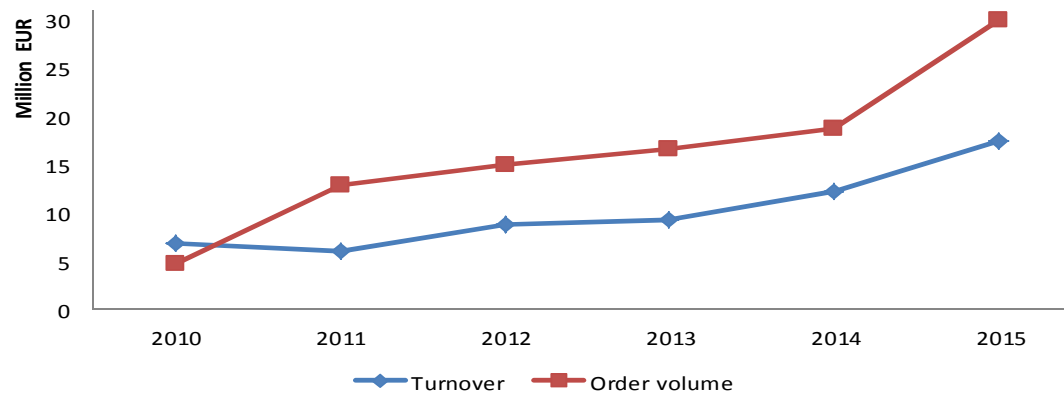
intec - International Presence



Germany Abu Dhabi Dubai Romania Nigeria Uganda Serbia

intec - Facts & Figures

intec chronicles an exceptionally dynamic development of its business since its founding

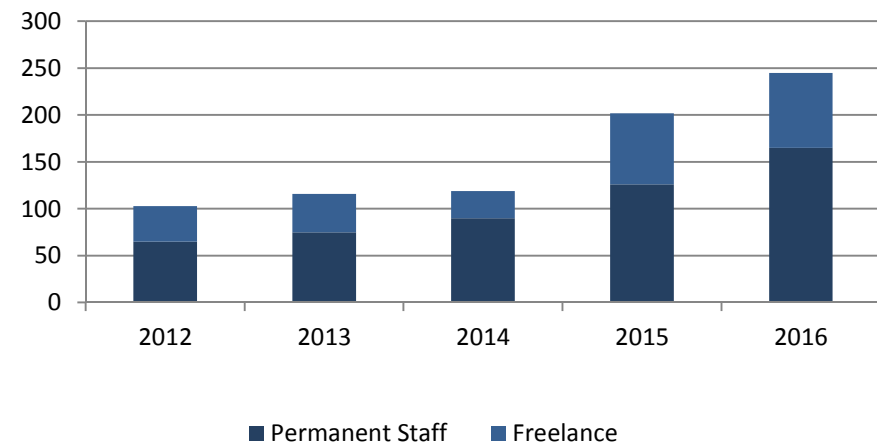


Financial capacity

600%
increase in
orders

Human resources

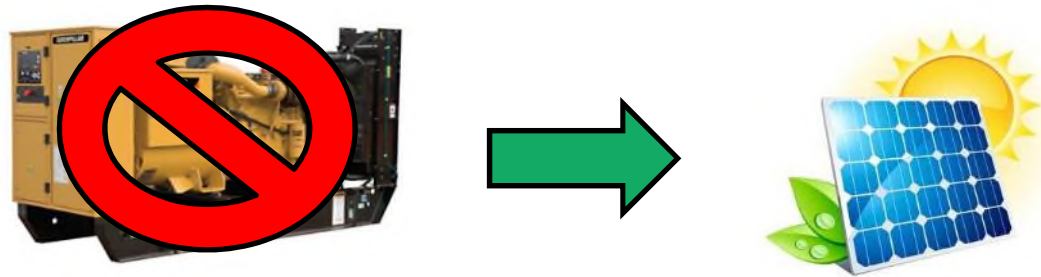
250%
personnel
increase in the
last 5 years



■ Permanent Staff ■ Freelance

Overall Market Potential

- Two large market segments:
 - Replacement and hybridisation of existing generation capacity

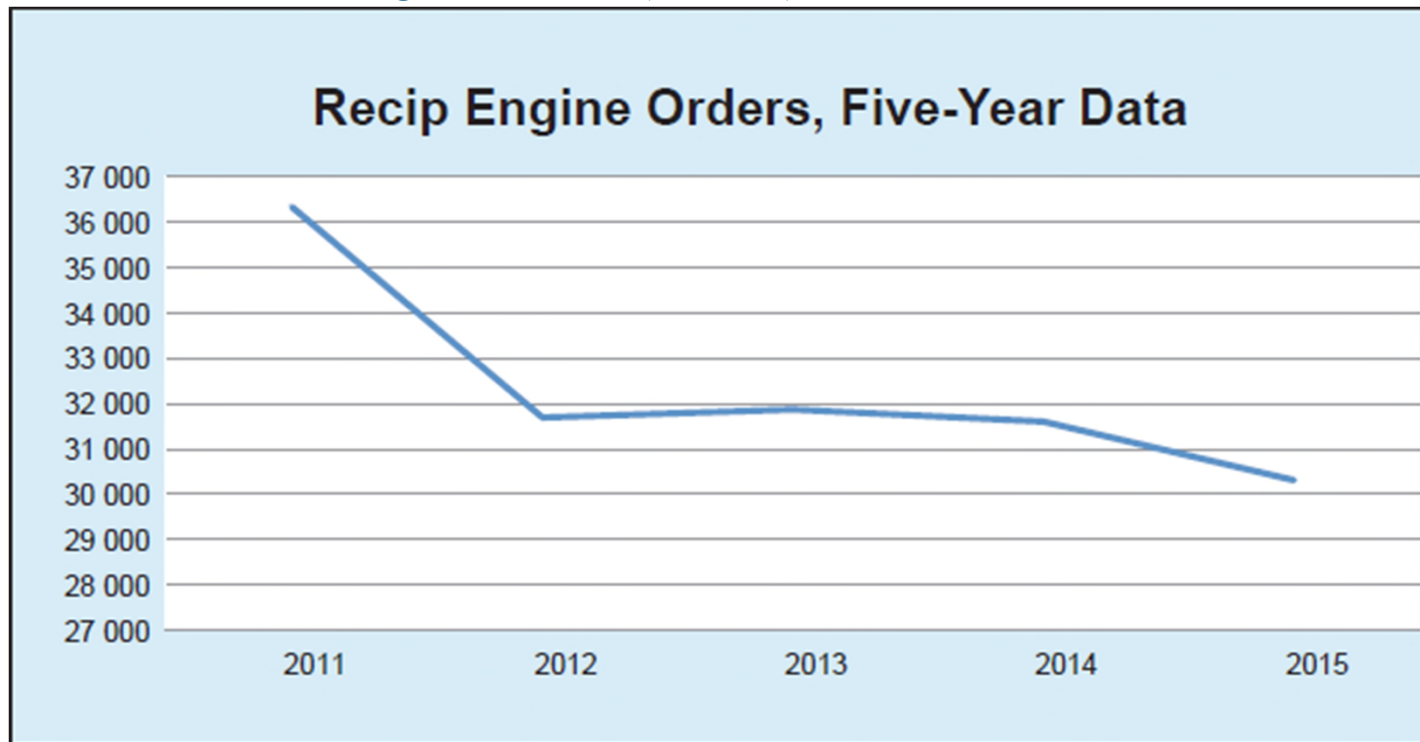


- (Rural) electrification



Replacement/Hybridisation of Diesel

- Market for diesel generators (in MW)



Source: 40th power generation order survey; Diesel & Gas Turbine Worldwide, 2016

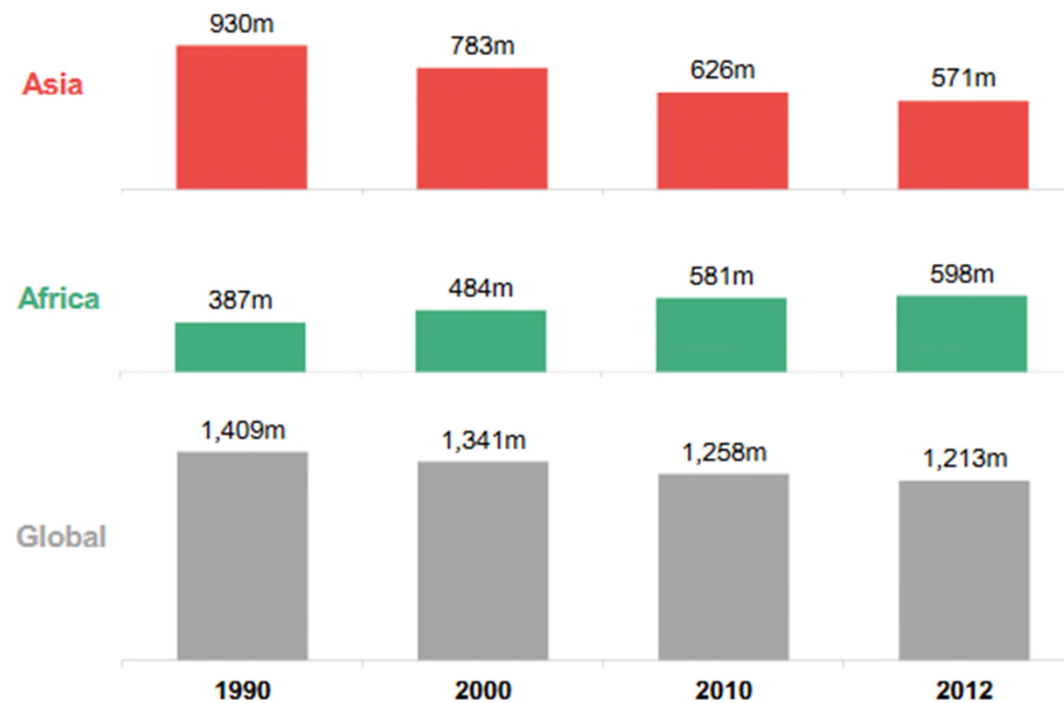
Conservative Approach: 5% with potential for hybridisation

→ 1,5 GW / year

Electrification

- Worldwide demand:

Figure 4: Off-grid population by region (millions)

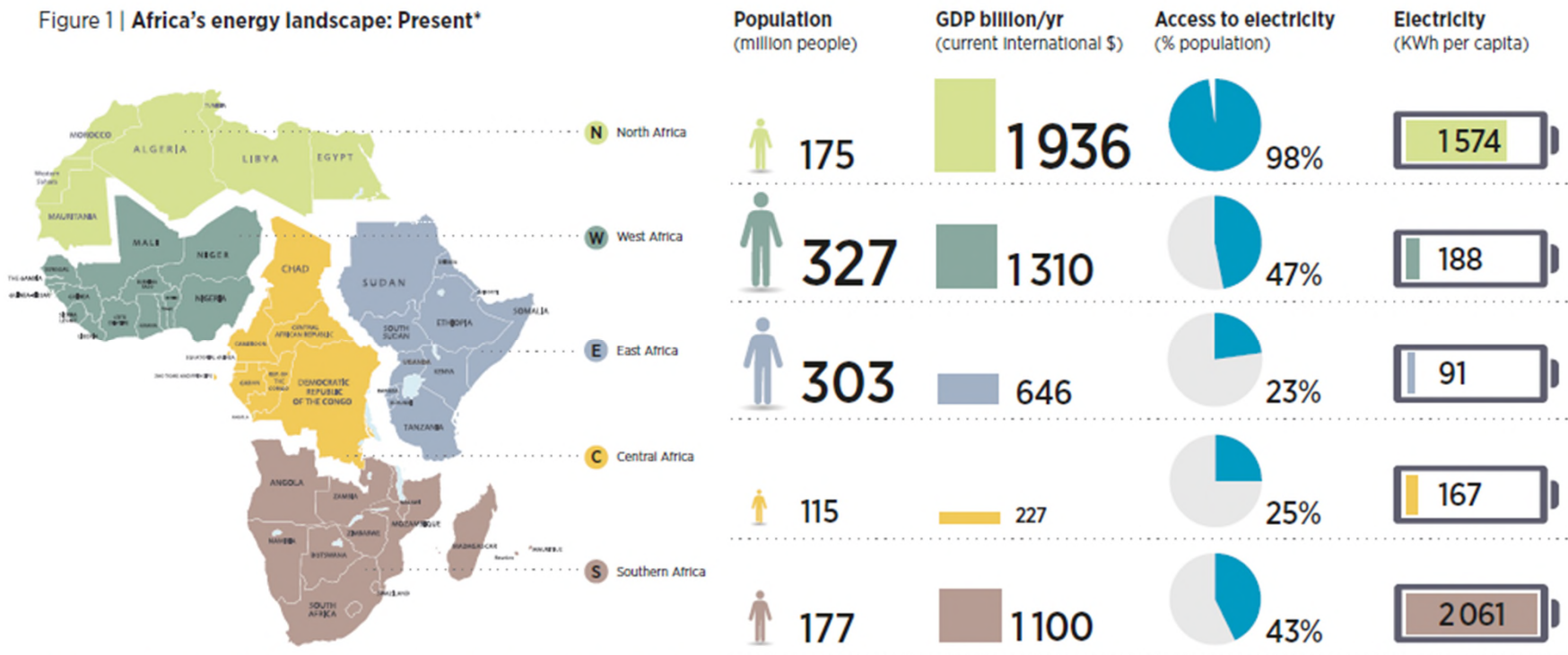


Source: World Bank, UN, Bloomberg New Energy Finance.

Electrification Africa

■ Electrification rates in Africa

Figure 1 | Africa's energy landscape: Present*

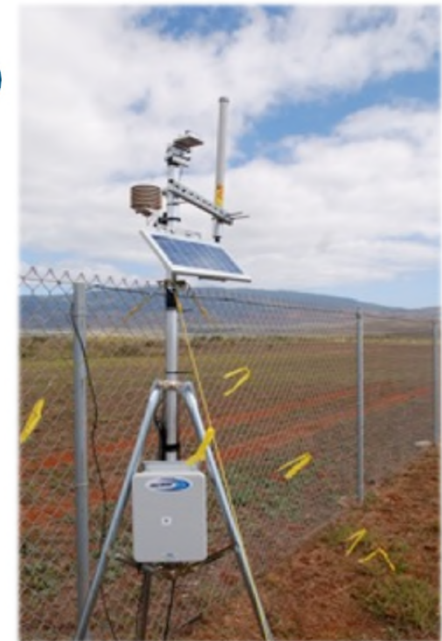


*Note: statistics refer to 2013, except for access to electricity which refers to 2012.

Source: IRENA; Africa 2030 – Roadmap for a Renewable Energy Future

Influencing Factors

- Business Case
- Expected time for amortization:
 - PV/Wind sometimes up to 20 years
 - Hybrid systems often much less (i.e. 2-5 years for mining projects)
- Accessibility of locations
- Availability of resources (wind, sun, water, biomass)
- Project-setup (Client, Stakeholders, financing)
- Fluctuating price of diesel
- Security of supply has large influence on cost
- Size of projects (usually small)



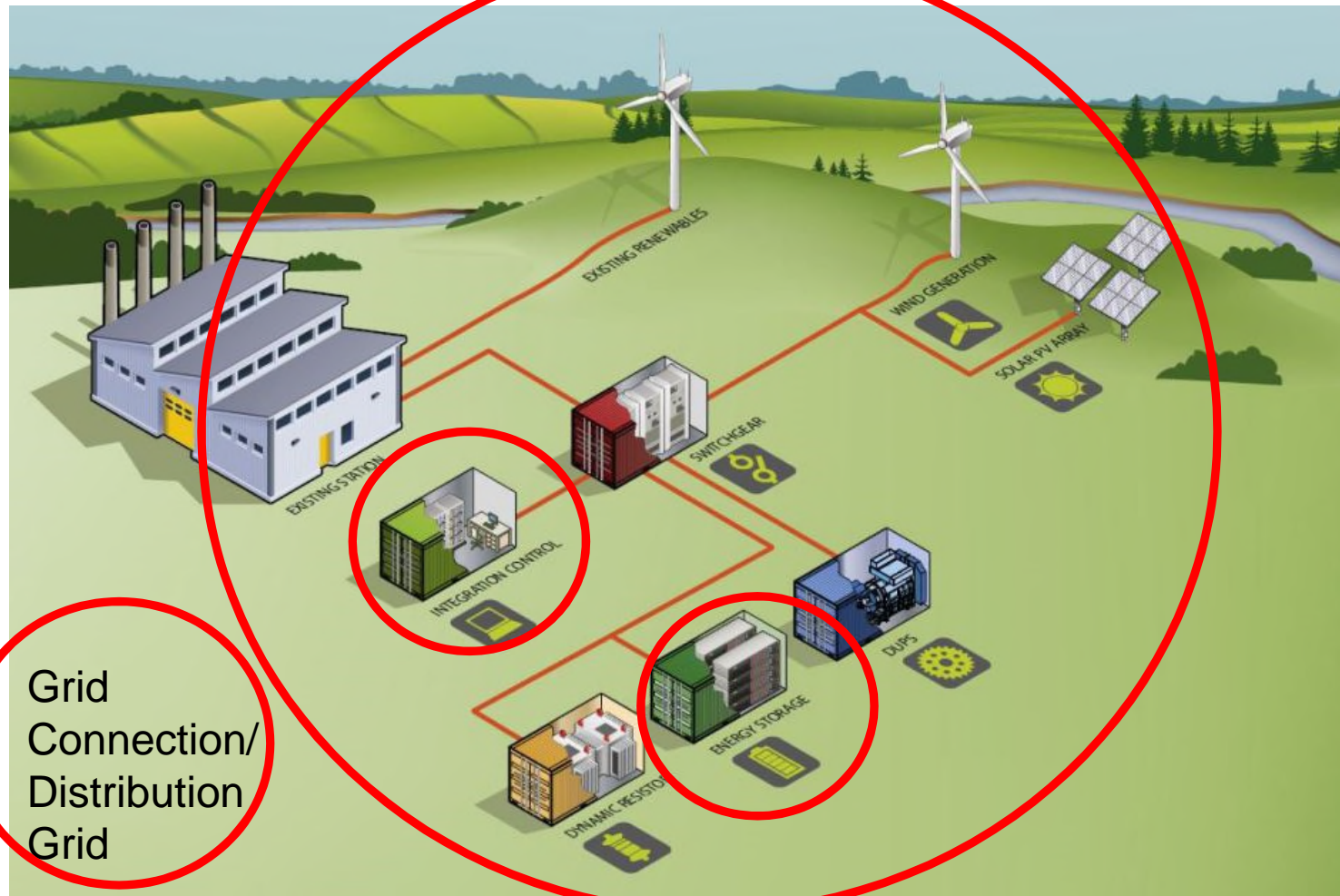
Specific Market Segments

- Multilateral development banks and development organizations (World Bank, African Development Bank, KfW, GIZ, AfD, Asian Development Bank, Inter-American Development Bank)
 - Large market and many projects in Africa and Asia
 - Other factors beside economic viability also taken into account (environment, value added locally, electrification rate etc.)
- Hotels, resorts, private islands
 - Sometimes extremely high cost of electricity (up to 3 USD/kWh)
 - Publicity with green energy possible
 - Financing mostly without banks possible (for private projects)
- Mining (and other no grid industries)
 - High energy needs
 - Remote locations



Picture: Tesla

Areas with Potential for Technical Development



Thank you for your attention!

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Highlight of Current Hybrid Projects Carried out by intec

Maldives (2015-2019)



Preparing Outer Islands for Sustainable Energy Development

Design, tendering and implementation of hybrid solar/battery/diesel mini grids on 166 islands on the Maldives; total 25 MW solar (PV) power, total 8 MWh storage capacity and total 44 MW diesel power plants; rooftop and ground mounted systems, power range between 35 kW and 1600 kW per systems

- Feasibility studies, design
- Preparation of bid documents incl. technical specifications
- Management of the bid process
- Evaluation support for award of contract
- Review and approval of project design submitted by EPC Contractors
- Project management
- Overseeing project construction and commissioning
- Quality assurance
- Contract management
- Capacity building for O&M



Client / Financing

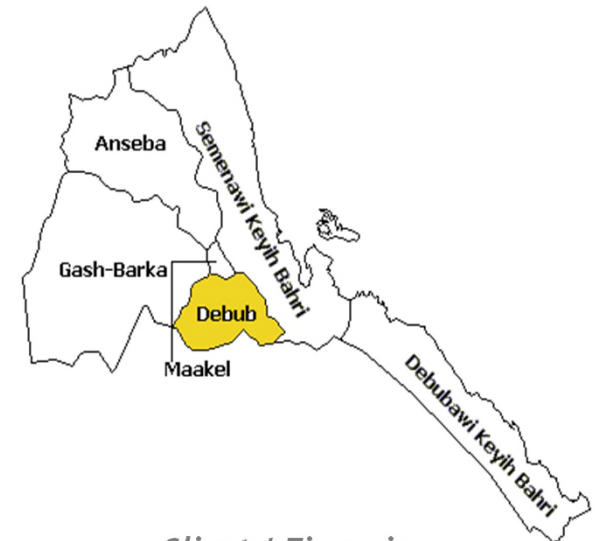
Ministry of Environment and Energy
/ Asian Development Bank (ADB)



Solar PV Mini-Grids for two Rural Towns and Sur-rounding Villages in Eritrea - Service Contract for Design of Solar PV Mini-Grid Power Generation at the Two Rural Towns of Areza and Maidma

The present project includes the design and tendering of two mini-grid PV systems in Areza (1.25 MWp) and Maidma (1.0 MWp), designed as hybrid plants with small gen-sets, a 3.4 MWh battery and a potential connection to the main grid).

- Engineering design of the two systems including their synchronisation with the distribution system and related components
- Preparation of (a) tender dossier(s) for supply and installation, in compliance with EU/EDF procurement regulations, including BoQ and detailed technical specifications
- Support during the tender period
- Assistance in bid evaluation and contract preparation



Client / Financing

Ministry of Energy and Mines /
European Commission and UN

Backup Slide: Diesel Sales



RECIPROCATING ENGINE (DIESEL, DUAL-FUEL & GASEOUS-FUEL) POWER GENERATION ORDERS, January – December 2015																									
Output Range (MW)	Units Ordered	Total Engine Output (MWe)	Type Of Generating Service			Engine Operating Speed Ranges (r/min)				Fuel					Western Europe	Eastern Europe, Russia & CIS	Middle East	Far East	Southeast Asia & Australia	Central Asia	North Africa	Central, West East & South Africa	North America	Central America & Caribbean	South America
			Standby	Peaking	Continuous	Below 300	300 - 600	720 - 1000	Above 1000	Diesel Fuel	Heavy Fuel	Dual Fuel	Liquid Biofuel	Natural Gas											
0.50 to 1.00	15 646	11 171	8442	213	6991	0	0	0	15 646	14 871	3	0	0	772	2518	558	2492	3128	1296	476	51	700	3170	462	795
1.01 to 2.00	12 335	17 538	4929	214	7192	0	5	58	12 272	10 309	0	0	0	1975	2345	373	1943	2901	1544	241	48	395	1757	342	446
2.01 to 3.50	2883	7088	1940	83	860	0	40	19	2824	2586	0	0	0	253	585	45	217	577	180	23	6	49	1007	64	130
3.51 to 5.00	159	674	30	0	129	0	0	87	72	56	1	0	0	99	61	11	26	28	1	0	4	2	12	3	0
5.01 to 7.50	64	384	24	0	40	0	2	27	34	41	13	1	0	9	5	0	7	14	17	2	0	2	7	0	8
7.51 to 10.00	137	1286	0	0	137	0	3	134	0	16	13	7	0	101	26	5	8	0	2	22	4	20	21	15	14
10.01 to 15.00	7	75	0	0	6	0	1	5	0	0	5	1	0	0	0	0	5	0	0	0	0	0	0	1	0
15.01 to 20.00	74	1339	0	0	74	0	74	0	0	0	56	3	0	15	0	0	54	0	0	0	0	9	11	0	0
20.01 to 30.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.01 and above	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	31 305	39 555	15 365	510	15 429	0	125	330	30 848	27 879	91	12	0	3224	5540	992	4752	6648	3040	764	113	1177	5985	887	1393