Accelerating Residential Solar in the U.A.E: Innovative solutions, Cost and New Opportunities
A joint DEWA/IRENA workshop hosted by DEWA

Overview of Grid Connected Rooftop Solar PV Projects in Kuwait

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Overview of Grid Connected Rooftop Solar PV Projects in Kuwait

Presentation Outline

- Overview;
- Energy Strategy & Assessments Studies
- KISR - Research & Development in Kuwait
- Strategy Analysis and Funding Projects
- Current and Future Projects
- Challenges
Energy Strategy & Assessments Studies

1. Research & Development
   - Reference Analysis

2. Strategy & Planning
   - Comparative Analysis

3. Funding & Integration
   - Demonstration & Implementation Projects
Research & Development

Solar Resource [GHI] Kuwait Annual

Legend
Areas Available for RE Projects

GHI in kWh/m²/a
- 1888 - 1957
- 1957 - 2006
- 2006 - 2017
- 2017 - 2048
- 2048 - 2101

Wind energy field in 100m a.g.l.
Reference Analysis

Load curve for MEW network in MW (2010)

- Load > 8 GW for only 900 hrs
- 1,000 MW additional capacity needed for about 1000 hours
- Less than 10% of the total installed capacity for this 1 GW
- Expensive kWh’s!
- In Kuwait both Solar and wind energy outputs are optimum in these peak period
KISR Renewable Energy R&D Program
Technology Assessment & Demonstration Projects
Electricity Application Projects

Kuwait English School (Salwa)
- Daily Electricity Load 80 kWh<sub>e</sub>.
- No. of PV modules 630; No. of batteries 110.
- Max. Electricity Production capacity 24.2 kW<sub>e</sub>.
- Batteries Storage Capacity 200 kWh<sub>e</sub>.
- Voltage 220 Volts.
- Operated 1984.

KISR’s Solar House (Application Laboratory)
- Daily Electricity Load 2.5 kWh (variable).
- No. of PV modules 76; No. of batteries 48.
- Max. Electricity Production capacity 2.6 kW<sub>e</sub>.
- Batteries Storage Capacity 34 kWh<sub>e</sub>.
- Voltage 48 Volts.
- Operated 1984.
Comparing Fossil and Renewable Energy Costs

Levelized Cost of Energy LCOE (2015-2030)
Different electricity generation mix obtained without a RE target, with RE target, without and with Nuclear.

- To achieve the higher RE generation targets, the system requires more intermittent RE capacity.
- For the 15% and 20% cases, only 5 nuclear units are installed by 2030 rather than 6 in the Base and 10% cases.

Source: KISR AE038C report (2011)
Electricity Production

**RE10 Energy Supply Mix**

- **Electric Power Generation**: 146 Terawatthours
  - CCGT/MSF: 21.2 TWh (14%)
  - RHSPP/MSF: 24.8 TWh (17%)
  - OCGT: 1.1 TWh (1%)
  - RENEWABLE: 15.9 TWh (11%)

**RE10 / 2030**

- Wind (onshore): 7.5 TWh (5%)
- PV RT: 2.6 TWh (2%)
- PV Cent: 2.6 TWh (2%)
- Fre. Hyb: 0.6 TWh (0%)
- Tower with Storage: 2.6 TWh (2%)
RE20 Energy Supply Mix

Electric Power Generation

- CCGT/MSF: 21.2 TWh (15%)
- RHSPP/MSF: 24.8 TWh (17%)
- OCGT: 1.1 TWh (1%)
- RE20: 29.4 TWh (20%)
- Total: 146 Terawatt hours (100%)

RE20/2030

- Wind OS: 7.6 TWh (5%)
- Tower w storage: 5.4 TWh (4%)
- Trough: 5 TWh (3%)
- Fresnel: 3.3 TWh (2%)
- PVRT: 3.2 TWh (2%)
- PV Cent: 3.2 TWh (2%)
- Fk Hyb: 0.6 TWh (0%)
- Fk w storage: 1.1 TWh (1%)
RE10 Yearly Deployment and Investment Costs
REF & RE10 Installed Capacity & Electricity Production

- Solar Cooling
- Wind
- Solar Photovoltaic
- Solar Sterling
- Solar Fresnel
- Solar Parabolic Trough
- Solar Power Tower
- OCGT
- CCGT
- CCGT/MSF
- RHSPP
- RHSPP/MSF
- Peak Demand
RE20 Yearly Deployment and Investment Costs
Kuwait RE Current and Future Projects

Research and Development & Demonstration Programs at KISR
• RE R&D Demons. Park (Wind, CSP and PV Cent.) , 70 MW
• BIPV in new Administration / Centers Buildings, 1 MW
• PV Car Parking Shades with grid connection, 0.5 MW
• Thermal & PV Solar Simulators and Materials testing facilities, 15 labs

Government Sector
• BIPV & Rooftop in 100 school Buildings (MoEd.), 1 MW
• BIPV & PV Car Shades with Grid connected twin Buildings (MEW & MPW), 1 MW each
• Integrated Solar Combined Cycle (ISCC) & Gas Power Station (MEW), 280 MW

Commercial Sector
• BIPV & Rooftop in new Buildings (KPI), 1 MW
• BIPV & PV Car Shades with Grid connected Petrol Stations (KNPC), 1 MW
• PV for Remote oil & Gas fields various installations (KOC), 30 MW
• PV & Solar Thermal installations (Pan Arab & PAAET), up to 10 MW
Kuwait: New Renewable Energy Project in the works

RE R&D Demons. Park Grid connected
Al Shigaya Project (Wind, CSP, PV Cent. and Wind) , 70 MW

10 MW

1100 MW by 2030
Kuwait: New renewable energy project in the works

Project: AZDA BINT ALHARETH School PV Rooftop - Grid connected

- PV module: CSG - Model MS150GG-02
- PV module: Total number of PV modules Nb. modules 567
- Power installed: 85.0 kWp
- Total area: Module area 607 m²
- Power installed: 50.4 kWp
- Inverter: (5) SMA-Sunny Sunny Tripower17000 TL
- Produced Energy: 132.2 MWh/year
Kuwait: New renewable energy project in the works

Project: SAWDA BINT ZAMAA School PV Rooftop - Grid connected

- PV module: CSG - Model MS150GG-02
- PV module: Total number of PV 144
- Power installed 21.60 kWp
- Total area Module area 154 m²
- Inverter: (2) SMA-Sunny Tripower10000 TL
- Produced Energy 33.54 MWh/year
Kuwait: New renewable energy project in the works

Project: Al-Raqa Petrol Station PV Rooftop - Grid connected

- PV module: VBHN240SE10
- Power installed 50.4 kWp
- Total area Module area 265m²
- Total number of PV modules Nb. modules 210
- Inverter: (210) Micro-0.25-I-OUTD-230 Power-Produced Energy
- 81.3 MWh/year
Kuwait: New renewable energy project in the works

Project: Al-Zahra Petrol Station PV Rooftop - Grid connected

- PV module: VBHN240SE10
- Total number of PV modules Nb. modules 252
- Power installed 71.0 kWp
- Total area Module area 373 m²
- Inverter: (3) SMA-Sunny Tripower2000 TLEE
- Produced Energy 131.2 MWhₑ/year
- Operated May 2015
Kuwait: New Renewable Energy Project in the works

Ministry of Electricity & Water and Public Works Buildings PV Rooftop-Grid connected

8400 m² Total Power 1 MW (500 KW each)

Commissioned October 2014
Kuwait: New Renewable Energy Project in the works

Al-Zahra Co-op Parking Shades PV Rooftop- Grid connected

- PV module: SF145-S
- Total number of PV modules Nb. modules 5184
- Power installed 752 kWp
- Total area Module area 6497 m²
- Inverter: (45) SMA-Sunny Tripower
- Produced Energy 1203 MWh/year
Challenges for Renewable Energy

Resource and Power System Integration
• Intermittency, Variability & Capacity credit
• Transmission Availability & Access
• Infrastructure & Building Requirements
• Materials & Resources

Commercialization
• Technology Development, World’s Tech. / Manufacturing Forecasts
• Policy and Regulatory Requirements, codes & regulations
• Long-term Integration Targets, Government and investors
• Government Funding loan, Subsidies, Tax-Credits & Feed-in Tariffs … etc.
• Human Resources & Training

Environmental Impact
• Renewable Energy Footprint Assessments, LCA
• Land –Use, Size & Availability
Thank You