

Initiative for the Palestinian Economy

Energy



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Overview of energy sector

Hydrocarbons

- Gas field offshore (Gaza Marine). Gaza Marine license holders and various stakeholders in discussions to progress development of the field. Project could transform Palestinian energy sector and boost the economy.
- Additional hydrocarbon resources may include Oil Shale and Oil in the West Bank.

Electricity

- **West Bank**
 - No generation capacity
 - Electricity use ~860 MW annually
 - Estimated needs in 2020 ~1310 MW annually
- **Gaza**
 - 12-16 hours of daily electricity outages
 - Electricity use ~210 MW annually (sourced from one power plant in poor condition and imports from Israel/Egypt)
 - Current need ~410 MW annually
 - Need in 2020 is estimated ~855 MW annually

Hydrocarbons

Snapshot:

- Develop Gaza Marine field.
- There are potentially other hydrocarbon reserves under the West Bank and possibly offshore Gaza. In addition, there is potential for Oil Shale in the Palestinian Territories.

Enablers:

- Where necessary, approvals and permitting from the PA and GoI.
- Revision of Palestinian energy law and regulation.

Strategy:

- Facilitate the development of the Gaza Marine field (in respect of extraction, sale and transportation of the gas) and further hydrocarbon exploration.
- Support the PA on advancing sector reform.

Impact:

- Exploiting the Gaza Marine gas field could provide the PA with dozens of millions of USD of annual revenue and ensure security of supply for gas-generated power plants in the Palestinian Territories. Additional hydrocarbon commercial discoveries could provide additional sources of revenue for the PA and a cost efficient fuel supply for the Palestinian market.

Hydrocarbons landscape in the Palestinian Territories

Kind of source	Description	Enablers	Examples
Identified and uncontested	<ul style="list-style-type: none"> Resources which have been identified and are not contested 	<ul style="list-style-type: none"> Commercial and political agreements to develop the field 	<ul style="list-style-type: none"> Gaza Marine
Potential cross-border resources	<ul style="list-style-type: none"> Potential cross-border resources identified 	<ul style="list-style-type: none"> Agreement on borders Application of Oslo accord procedures on cross-border resources Comprehensive governance structure/institutions in respect of licenses on Palestinian side 	<ul style="list-style-type: none"> Rantis
Potential but unidentified resources	<ul style="list-style-type: none"> Resources which can be assumed to be in place, however have not been discovered yet 	<ul style="list-style-type: none"> Comprehensive governance structure/institutions in respect of licenses on Palestinian side 	<ul style="list-style-type: none"> Oil Shale (potential)

Enablers for creating a healthy Palestinian oil & gas sector

- Revision of energy strategy and law to enable Palestinian oil & gas sector
- Clear roles & responsibilities of PENRA and other PA governmental bodies
- Clear energy sector governance & institutions including capacity building for set-up

A healthy hydrocarbons sector has two main advantages

- Price effect (lower fuel prices)
- Revenue effect (royalties for PA, corporate taxes, VAT)

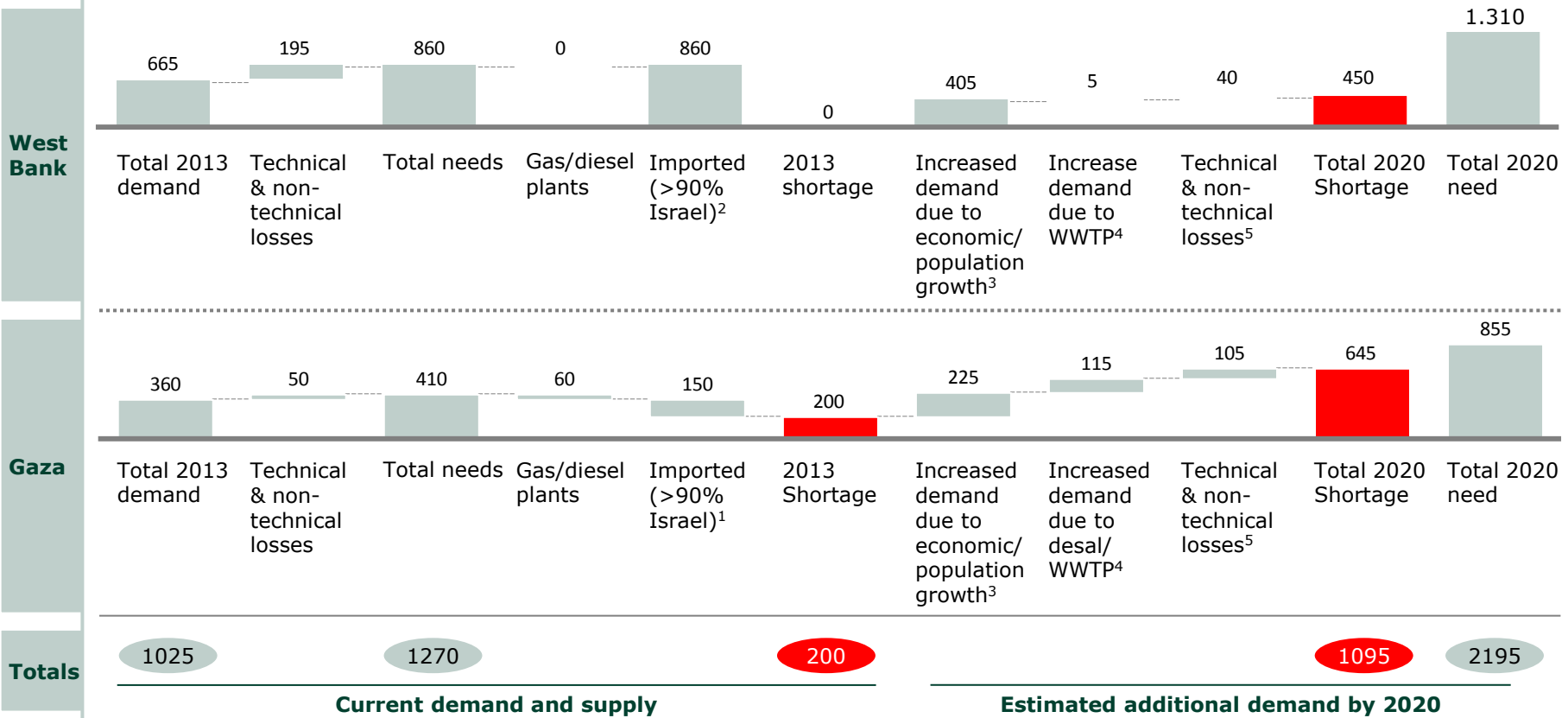
Electricity

- **Current situation:**
 - West Bank: No power shortages. Power imported through 230 low and medium voltage lines.
 - Gaza: Frequent power shortages. Nearly idle power plant.
 - Future capacity needs will increase (due to population and economic growth).
- **Strategy:**
 - Gaza: Convert the power plant to gas and increase electricity imports.
 - West Bank and Gaza: Improve the transmission grid (reducing losses). Increase large-scale domestic generation capacity with gas power plants at affordable cost (by using offshore gas). Invest in solar PV generation.
 - Palestinian transmission company (PETL) was established, which will allow for single buyer system from the electricity generators such as IEC and the independent power producers (IPPs). Resolve IEC debt and agree new commercial agreement between PETL and IEC.
 - Establishment of regional distribution companies (DISCOS) should improve distribution.
 - Improve collection of electricity fees from consumers and distribution companies.
 - Support reform of the regulatory environment (e.g. licensing and permitting).
- **Impact:**
 - Increasing domestic generation from ~60 MW (2014) to ~1600 MW (2020).
- **Financing:**
 - In order to achieve these goals, major financing needed in next few years, as well as political risk insurance for large infrastructure projects.
 - Cumulative investment needed for improving the transmission grid, increasing domestic PV production and gas powered electricity generation is ~2,690 \$USD

Based on projected GDP growth (50% in 3 years), by 2020 there could be an electricity capacity shortage of ~1000MW

Breakdown of current and potential electricity supply/demand based on projected GDP growth of 50% in 3 years

MW, peak demand



1 ~30MW capacity from Egypt, the rest from Israel;

2 ~25 MW capacity from Jordan, the rest from Israel;

3 Assumption of 0.42% electricity demand increase for every 1% in GDP growth and 1.36% electricity demand increase for every 1% in population growth, assuming 50% GDP increase by 2016 and GDP growth after 2016 correlated with population growth (3.2% per year for Gaza and 2.1% per year for the West Bank);

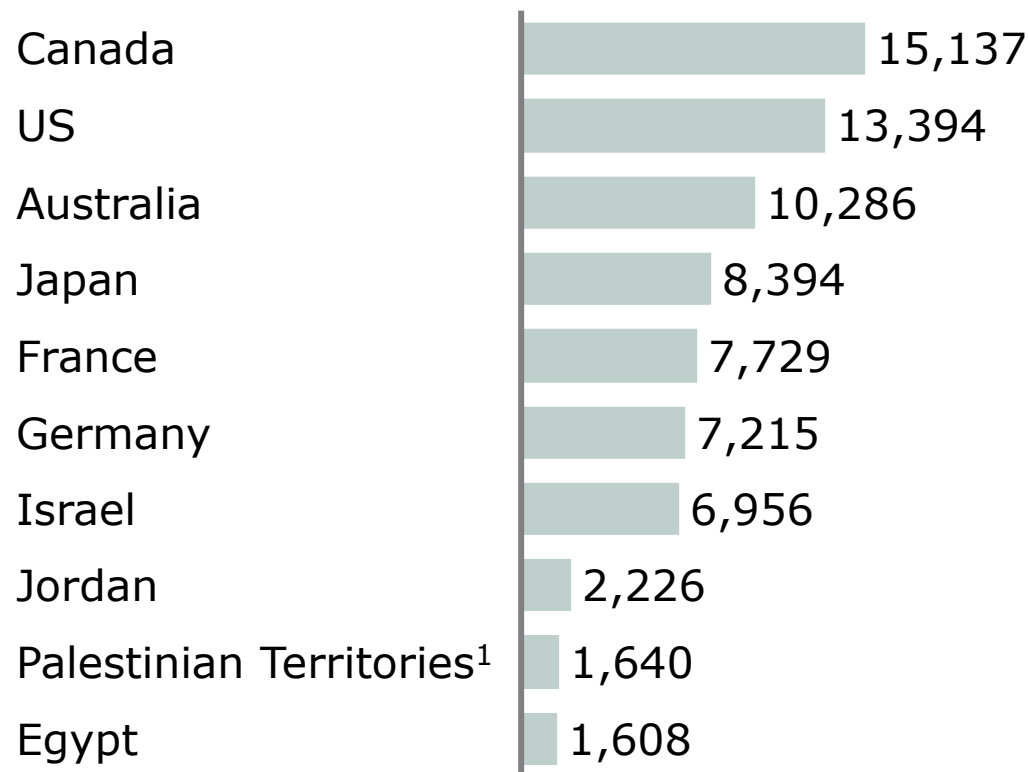
4 Assumption of 0.15MW capacity needed for 1 MCM of wastewater treatment and 0.65MW for 1 MCM of desalination capacity (81 MCM wastewater and 175 MCM desalination coming online in Gaza, 35 MCM of wastewater in West Bank); 5 Assumption for technical losses is ~0.5% reduction per year

Source: Palestinian Energy Authority, PCBS, GEDCO Proprietary: Office of the Quartet Representative

Given low per capita electricity consumption in the Palestinian Territories, there is limited potential for electricity efficiency measures

Electricity consumption per capita

KWh per capita, 2010



- Given the low electric consumption in the Palestinian Territories there is limited potential for efficiency measures
- However, energy efficiency measures should be built into any future planning (e.g. industrial parks, building code, etc.)

¹ Based on 2013 estimated consumption in Gaza and West Bank

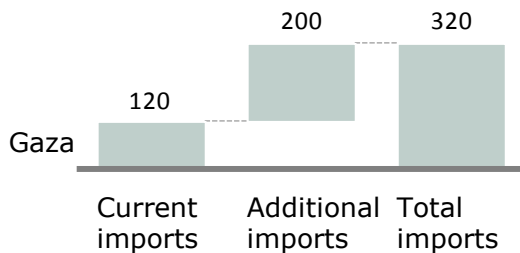
Increasing imports to Gaza

Potential

- Gaza currently imports ~120 MW capacity of electricity from the IEC through 12 low-voltage feeder lines (with technical losses & need for rehabilitation). Egypt supplies an additional 30 MW – but does not have additional export capacity at present
- Imports could be increased in the short term by IEC to meet immediate needs and by IPPs in the longer term
- Extra capacity can already be imported into West Bank in case of demand

Current and potential short term imports from Israel

MW capacity



Description

- Build extra transmission capacity – 161 high voltage line
- Increase import capacity by 200 MW from Israel to handle short-term demand



Enablers

- Agreement between PA, Gaza, UNWRA, GEDCO and IEC on payment (including payment obligations of refugees)
- Transmission capacity (161v line) from Israel to Gaza
- Agreement on who will finance transmission line

Update distribution grid and substations

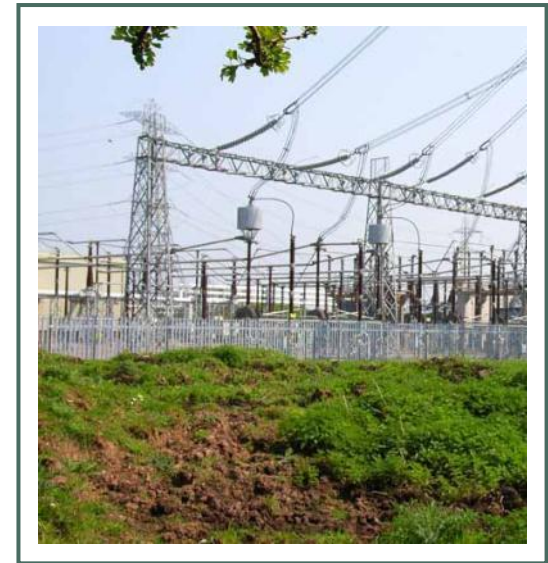
Potential

Potential for grid improvements split into three items:

- **Substations**
 - 4 substations being currently built – potential for 5 more
 - Allow the export of extra capacity
- **Update of low and medium voltage grid**
 - Reduced technical losses
 - Connection to off-grid locations
- **High voltage backbone**
 - Interconnection of Gaza grid through high-voltage backbone which will allow rerouting of power across Gaza

Enablers

- Delivery of Palestinian transmission company (PETL)
- Financing for substations
- Financing for loss reduction initiative
- Permits by GoI
- Agreement between GoI and PENRA on addressing losses in Area C
- Agreement on payment expectations for refugees



Increase collection rates

Potential

- Collection rates are very low - on average ~50% in Gaza and ~75% in the West Bank
- Causes revenue shortfalls for distribution companies
- Pre-paid meters (up to 20,000) have been rolled out to several municipalities where collection rates have increased to 100%
- AFD is financing 200,000 meters

Description

- Roll-out of pre-paid meters to 100% of households users
- Increase collection rates to 100%
- Pay-back time would be around 1 year
- Implement legal framework and capacity building to ensure proper handling of program and to further increase collection rates



Costs/price

- Price for domestic pre-paid meters¹: ~\$20m, assuming 200,000 have already been financed by AFD

Enablers

- Agreement on net lending
- Investment (possibly by pre-paid meter companies who would provide capital and then help roll-out program)
- Assurance to consumers that if they pay they are guaranteed electricity
- Clarity on electricity subsidies for refugees
- Legal framework to prosecute non-payment

¹ Price assumed for pre-paid meter is ~\$34 (single phase standard according to AfD) ~482,000 households are assumed for the West Bank and ~254,000 for Gaza

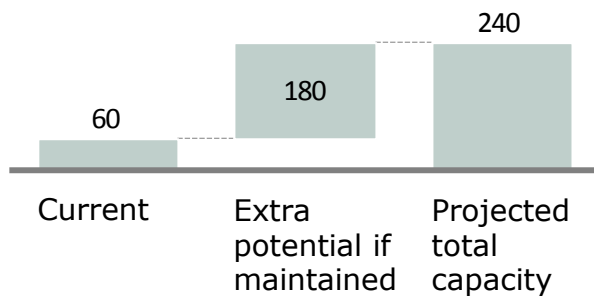
Expand and change Gaza power plant

Potential

- Gaza power plant (built in 2002 to run on gas) is running on imported Diesel Currently at 60 MW
- Major overhaul needed to avoid shutdown of plant
- Estimated potential capacity for power plant is 240 MW after conversion and extension

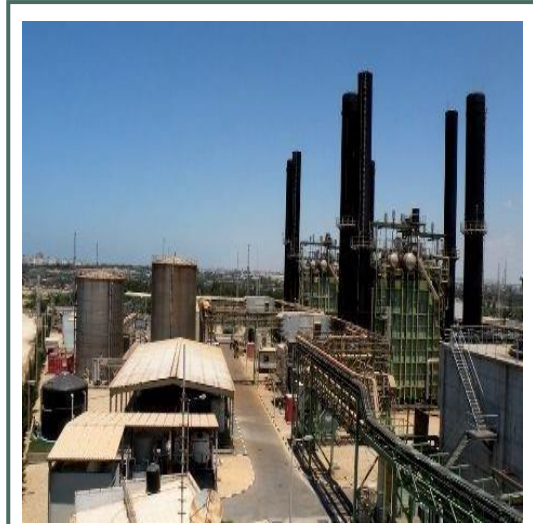
Gaza Power Plant reconversion

MW capacity



Description

- Perform essential maintenance on Gaza Power plant
- Changes to enable Gaza power plant to operate on gas
- Expand capacity to 240 MW by adding additional turbines
- Build gas pipeline to the plant



Key Enablers

- PA & GoI approvals
- Funding
- Gas Supply Agreements

Build new power plants in the West Bank

Potential

Two sites targeted for new Combined Cycle Gas Turbine (CCGT) power plants in the West Bank:

- Jenin
- South West Bank (Hebron)

Description

- Jenin power plant at 200 MW (possible future expansion)
- Construct pipeline to Jenin (~12km)
- Construct 200 MW power plant in the South West Bank (possible future expansion)
- Cost – ~250 million USD each plant

Enablers

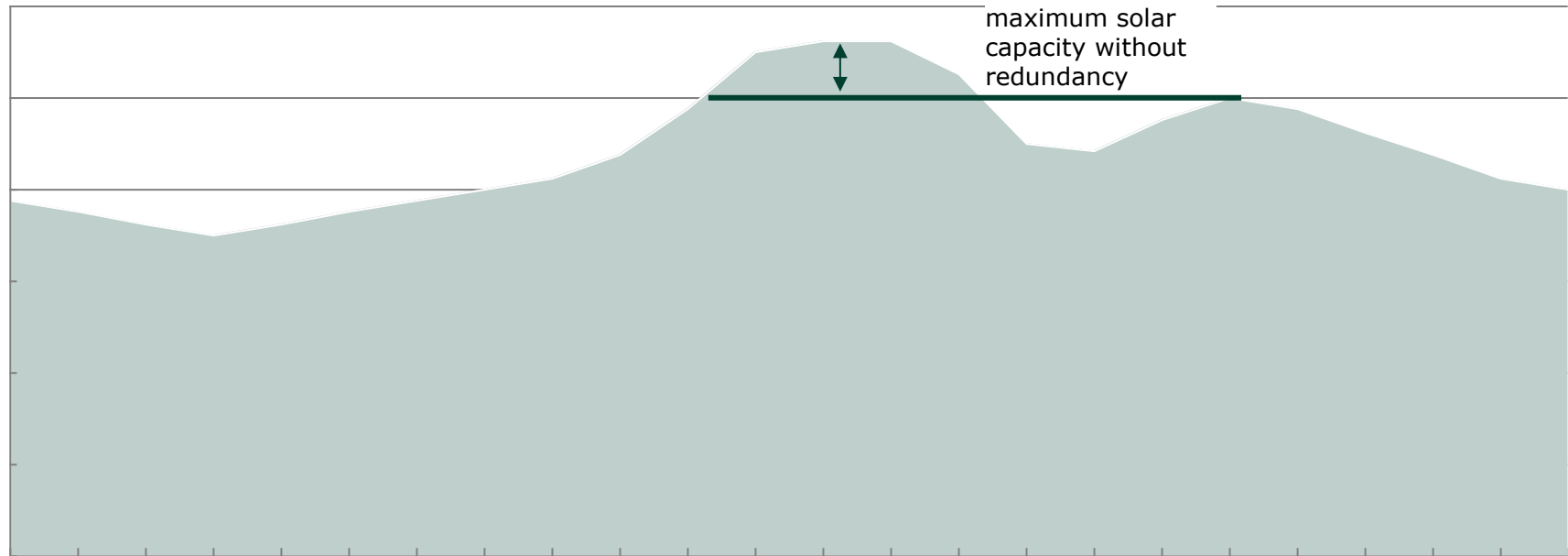
- PA and GoI permitting
- Investment
- Agreement with gas suppliers on gas imports (done for Jenin)
- Agreement on selling excess generation capacity to IEC

Solar - cannot account for a large component of the electricity mix unless there is redundancy to avoid shortages/blackouts

- Solar should not be a too large component of the electricity mix
- If there is not redundancy built into system, solar cannot exceed difference between daytime peak and evening peak
- Redundancy is advised due to chance of cloudy days (although peaks usually occur in hottest moments of the day – when solar produces at peak)

Sample load curve of Middle Eastern country

Generation



Time of day

Potential projects in the West Bank and Gaza

	West Bank	Gaza
0-3 years	Increase electricity imports	Increase electricity imports
	Grid improvements & substations	Grid improvements & substations
	Rooftop solar	Rooftop solar
	Small solar PV	Small solar PV
3-7 years	CCGT plants (Jenin, Southern West Bank)	Convert and expand Gaza power plant
	Large Solar PV	New CCGT plant
		Large Solar PV
Cross cutting initiatives	Increase collection rates, loss reduction	
	Facilitate Private Sector Involvement	

Volume mix from different sources needs to be informed based on strategic priorities

Solar rooftop initiative

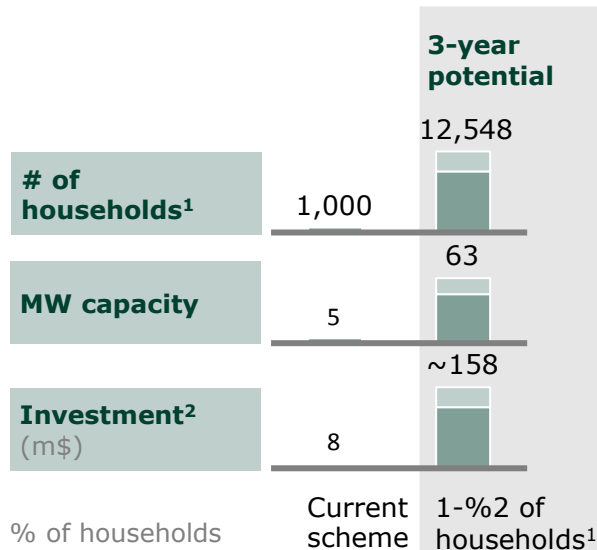
■ Gaza ■ West Bank

Potential

- Current scheme targets ~ 1,000 houses
- Households need to contribute ~\$7.5k towards costs of PV (payback for household ~8 years with feed-in tariff)
- Subject to PA budgetary constraints, household contribution scheme could be revised to expand program to ~2% of households in West Bank and 1% of Gaza households³
- Costs of solar expected to drop in next 10 years

Description

- Expand PSI to 2% of West Bank and 1% of Gaza households
- Ambition due to
 - realistic speed of ramp-up (compared to German benchmark which took 10 years to increase solar power 35x with large subsidies)
 - risk of overloading grid (important to spread out solar PVs geographically)
 - availability of rooftops



Enablers

- Funding
- Guarantee of feed-in tariff
- Functioning net-metering system
- Grid being able to carry and balance load
- Approvals from PA for solar licenses
- Availability of rooftops in densely populated urban areas
- Clear framework for Palestinian licensing

Necessity for redundancy in system to compensate for situations where peak demand not occurring during peak solar production

1 482k households in West Bank & 254k households in Gaza (PCBS); 2 Assuming PV lifetime of ~ 20 years, 5kwp per household; 3 far less potential in Gaza due to limited rooftop areas as well as higher-density population (1kwp solar needs 4-5 m2)

Small-scale solar

Potential

- Some small PV plants already exist and appear to be economical
- There is potential for small scale solar plants (under 5 MW per plant)
- Total estimated potential in Gaza ~30 MW
- Total estimated potential in West Bank ~60 MW
- Estimate based on bridging demand gap but not making electricity mix overly reliant on solar

Description

- Construct smaller scale PV plants (>5 MW) in Gaza
- Construct smaller scale PV plants (>5 MW) in the West Bank



Enablers

- Land use permission
- Investment
- Grid overload/balance
- Guarantee of feed-in tariff
- Clear framework for Palestinian licensing

Necessity for redundancy in system to compensate for situations where peak demand not occurring during peak solar production

1 Assuming PV lifetime of ~20 years

Large-scale solar

Potential

- Three potential locations for large scale solar have been identified (1 in Gaza, 2 in the West Bank).
- Required land is relatively flat (~1kmx1km).
- Capacity currently estimated at 50MW per plant.
- Prices for solar panels are expected to continue falling.

Description

- Construct 3 large scale (50MW) solar power plants
 - 2 in the West Bank
 - 1 in Gaza



Enablers

- Land use permission in specified areas
- Investment
- Grid overload/balance
- Guarantee of feed-in tariff

Necessity for redundancy in system to compensate for situations where peak demand not occurring during peak solar production

1 Assuming solar PV, lifetime of ~25 years, 1 years construction time

Summary – examples of energy opportunities

IPPs

- EPC Contractors – Jenin, Hebron
- EPC Finance – Jenin, Hebron
- Plant conversion to gas and expansion – Gaza
- Transportation infrastructure (grid, gas pipeline to IPPs)

Electric Grid

- Improve transmission and distribution grid with additional 5 substations
- Increase electricity imports from Israel
- 161 kv line to Gaza

Oil & Gas

- Develop Gaza Marine:
 - Development of field
 - Gas sales
 - Transportation infrastructure
- Further exploration in Gaza and West Bank

Solar

- Build small-scale (<5 MW) solar PV plants
- Build large-scale solar power plants
- Expand rooftop solar projects in West Bank and Gaza