



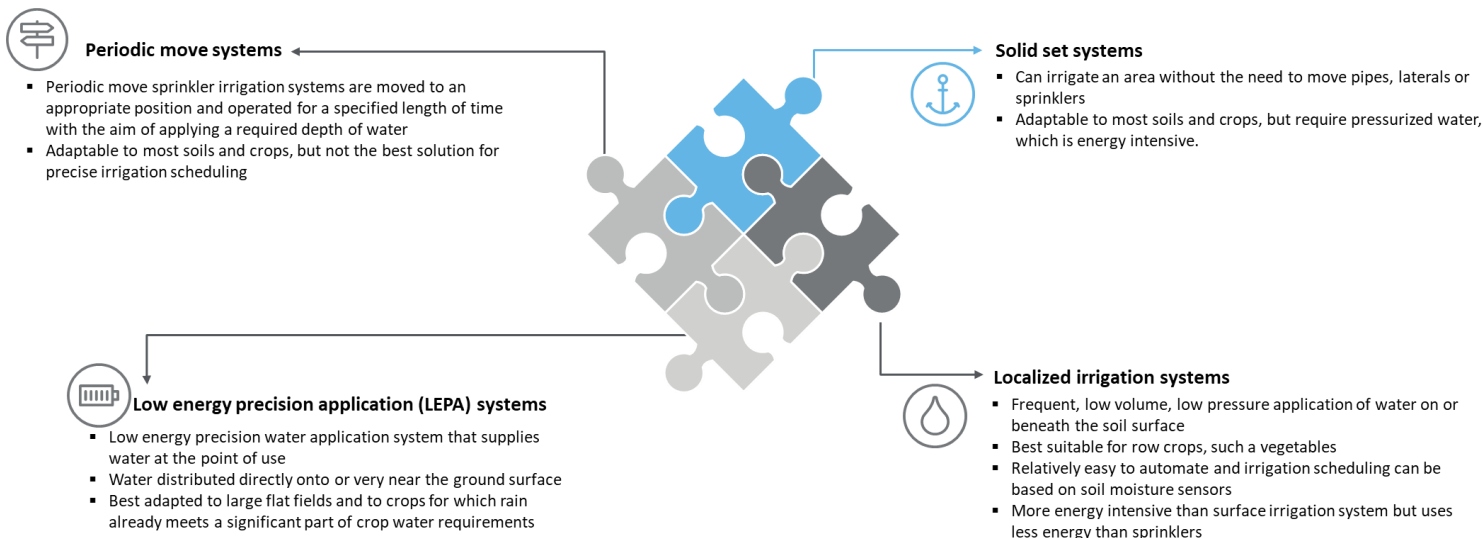
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# Technology Fact Sheet

# Efficient Irrigation

## Technologies

Irrigation is the prime means of intensification for agriculture and food production. It will remain a crucial factor in securing stable yields under climate change and in the face of added water scarcity. Improving irrigation efficiency, and therefore management, on farm is therefore crucial to secure agricultural productivity



### Challenges

### Solutions

### Outcomes

- Changing rainfall patterns, drought, flooding
- Insufficient water resources
- Increasing challenges for food security

- Dissemination of efficient irrigation technologies**
- Dissemination of technologies and practices maximizing water efficiency
  - Enabling the private sector for the introduction of the technologies

- Improved resilience to climate change
- Improved food security
- Improved water management on farms
- Improved water efficiency

## Additional resources

**Resource list:**  
FAO, Compendium, Climate smart irrigation

**For more information contact:**  
[www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.moa.pna.ps](http://www.moa.pna.ps)



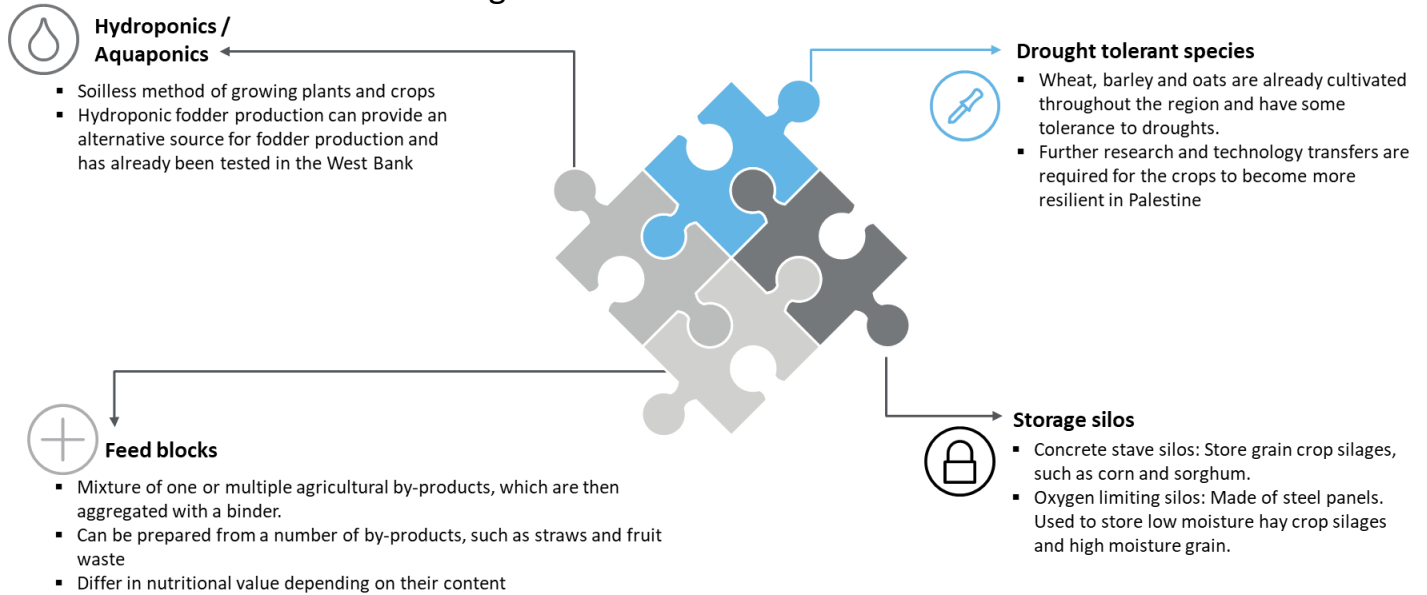
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# Technology Fact Sheet

# Resilient Animal Fodder

## Technologies

Climate change has significant impacts on livestock in the West Bank. Recurring droughts, as well as overgrazing, in addition to Occupation over large parts of the natural grazing areas, have resulted in reduced access to grazing land and increased dependency on imported fodder. It is therefore crucial for herders to gain access to sustainable and affordable animal feed.



### Challenges

### Solutions

### Outcomes

Changing rainfall patterns, drought, flooding

Reduced access to grazing land

Increased dependency on imported fodder

**Dissemination of resilient animal fodder technologies**

- Dissemination of technologies and practices improving fodder production in Palestine
- Identification of technologies which may be applicable in Palestine

**Improved resilience to climate change**

**Improved food security**

**Improved access to fodder**

**Decreased dependency on imported fodder**

## Additional resources

### Resource list:

FAO, Alternative fodder production for vulnerable herder in the West Bank, 2015

For more information contact:  
[www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/)  
and [www.moa.pna.ps](http://www.moa.pna.ps)



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# Technology Fact Sheet

# Water Harvesting

## Technologies

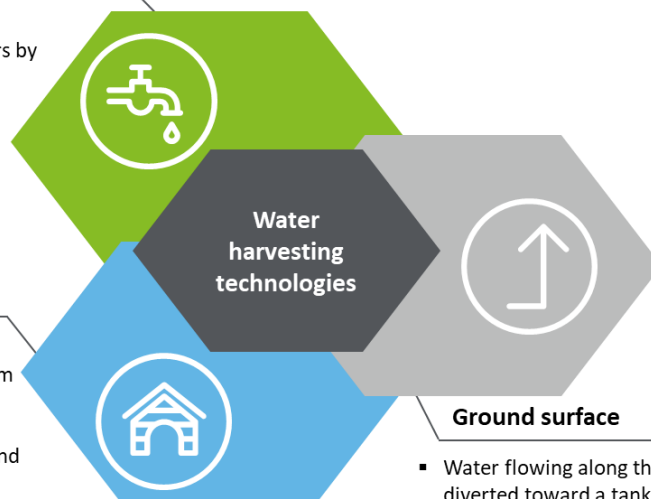
In Palestine, water supply is limited due to the control of resources placed by Israeli occupation. Water use is significantly limited, in which a large number of Palestinians suffer from shortages of drinking and agricultural water. Rainwater harvesting is a type of water harvesting techniques that induce, collect, store and conserve local surface runoff.

### Rock surface

- Bedrock surfaces often have natural hollows or valleys which can be turned into water reservoirs by building a dam
- Water is generally of lower quality than that collected directly from rainfall

### Rooftop

- Water from rainfall is collected in vessels at the edge of the roof or channeled to a storage system via gutters and pipes
- Suitable for household level application
- Can provide freshwater for domestic purposes and small-scale farming



### Ground surface

- Water flowing along the ground during the rain is diverted toward a tank below the surface.
- Greater possibility of water loss when using this method compared to the rooftop system
- Water is generally of lower quality than that collected directly from rainfall

### Challenges

- Changing rainfall patterns, droughts and floods
- Insufficient water resources and insufficient access to water resources
- Increasing challenges for food security

### Solutions

- Dissemination of water harvesting technologies
- Dissemination of technologies and practices maximizing the accumulation and storage of water / rainwater
- Combined dissemination of water management practices

### Outcomes





- Improved resilience to climate change
- Improved access to water resources
- Improved yields for agriculture
- Improved food security

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/), <http://www.pwa.ps/> and [www.moa.pna.ps](http://www.moa.pna.ps)





## Case study: Applications of rainwater harvesting in South East Asia (Philippines)

In the Philippines, the Department of Agriculture identified the development of rainwater harvesting technologies, referred to as Small Water Impounding Projects (SWIPs), as priority to support the irrigation and inland fishery programs of the government.





### Cost for one SWIP (Burgos)

	Costs: approximately USD 23,000
	30 hectares and 23 farmers beneficiaries
	Increase in mean annual crop yield: 2.14 tons per year
	Increase of gross annual income of farmers by PhP 32,113,64 (approximately USD 62,000).





### Total project overview

	2,060 SWIPs implemented
	Costs: approximately USD 57.5 million
	Approximately 84,168 hectares irrigated
	64,266 farmers benefiting from the measure

### Enabling factors

	Rainwater harvesting technologies provided opportunities to farmers to earn additional income
	Rainwater harvesting technologies are simple to install and operate, with minimum maintenance required
	Farmers were significantly aware of the challenges posed by shortage of rainfall.
	Support from international agencies and local governments are needed in the initiation of rainwater harvesting projects by providing partial funding and capacity-building activities

### Opportunities

	Food security through increased crop yields
	Investment in crop improvement
	Increased soil moisture levels and increased groundwater table
	Additional income to farmers

This case study provides an example of costs and benefits for rainwater harvesting technologies which could be further replicated in Palestine.

## Additional resources

### Resource list:

Socioeconomic Impacts of Small Water Impounding Projects in Quirino Province, Philippines, *Journal of Geoscience and Environmental Protection*, 2014

Rainwater harvesting, its prospects and challenges in the uplands of Talugtog, Nueva Ecija, Philippines, *International Soil and Water Conservation Research*, 2013

Rainwater Harvesting, *Climate Technology Centre & Network (CTCN)*



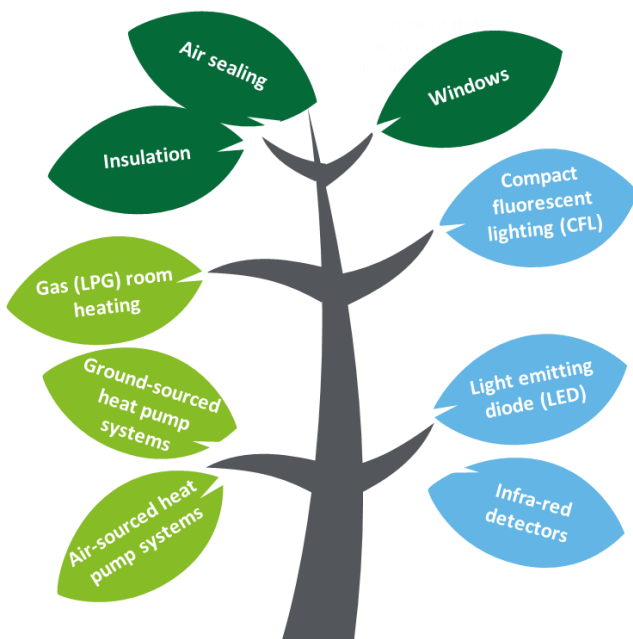
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# Technology Fact Sheet

# Energy Efficiency Technologies

## Technologies

Achieving energy efficiency in Palestine is extremely important as the country is almost completely dependent on imported energy products. Energy efficiency technologies prioritized for Palestine include the implementation of energy efficiency measures to reduce consumption.



### Efficient Heating, Ventilation and Air Conditioning (HVAC) Systems

- **Air-sourced heat pump systems:** circulates refrigerant between an outdoor unit and an indoor unit (split units) to heat rooms during winter and cool during summer
- **Ground-sourced heat pump systems:** transfers heat to or from stable, even temperature of the ground or water to provide room air-conditioning or heating
- **Gas (LPG) room heating:** use of gas (natural gas or LPG) for central heating to suppress electric room heaters

### Efficient Building Envelope

- **Insulation:** Proper insulation reduces heat loss during cold weather and prevents excess heat in hot weather maintaining comfortable indoor environment
- **Air sealing:** Tight air sealing with proper fresh air ventilation is essential in achieving higher energy savings. Air sealing solutions for buildings include sealants, membranes, spray foams and sheathings
- **Windows:** Windows can provide higher insulation by using low emissivity coating, multiple panes and glazing

### Efficient Lighting

- **Compact fluorescent lighting (CFL):** Last about 4 times longer than incandescent bulbs
- **Light emitting diode (LED):** Last about 25 times longer than incandescent bulbs
- **Infra-red detectors:** automatically detect presence in the room and correspondingly switch the lights on when in use and switch off when the room is empty

### Challenges and opportunities

### Solutions

### Outcomes

Growing demand in electricity

High dependence on imported fuel

Buildings consume approximately 43% of the total energy consumption per year

Dissemination of energy efficiency technologies and measures

- Building standards on thermal efficiency and energy efficient lighting
- Introducing measures and disseminating them for new building



Decreased energy consumption and therefore GHG emissions



Improved electricity independence

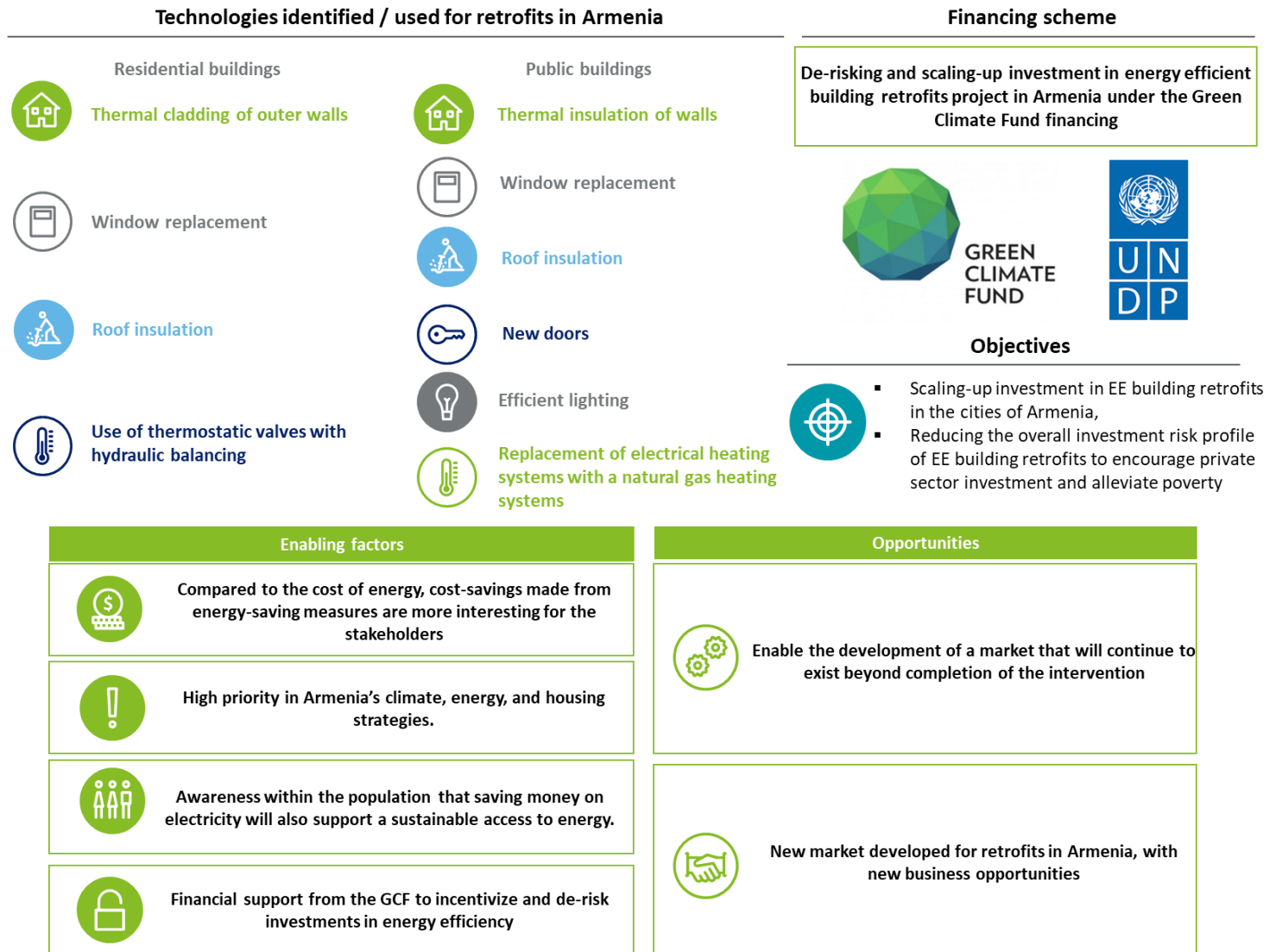


Significant savings in cost of electricity for the building implementing the technology

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.penra.gov.ps](http://www.penra.gov.ps)

## Case study: Disseminating energy efficiency in buildings in Armenia

Armenia is a small, poor, land-locked country in the heart of Eurasia, and is highly vulnerable to the impacts of climate change. The buildings sector is one of major energy consumers in Armenia. According to the 2010 GHG inventory, almost 28% of primary energy resources are consumed in buildings, mostly in the residential sector.



## Additional resources

### Resource list:

MENA Geothermal Website, Featured Projects.

<https://www.menageothermal.com/index.php?TemplatId=2&Lang=en>

Khaled Al Sabawi. First geothermal system in Palestine. 2009.

[https://www.eceee.org/static/media/uploads/site-2/library/conference\\_proceedings/eceee\\_Summer\\_Studies/2009/Panel\\_7/7.047/paper.pdf](https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2009/Panel_7/7.047/paper.pdf)

Project in Armenia: <https://www.greenclimate.fund/projects/fp010>



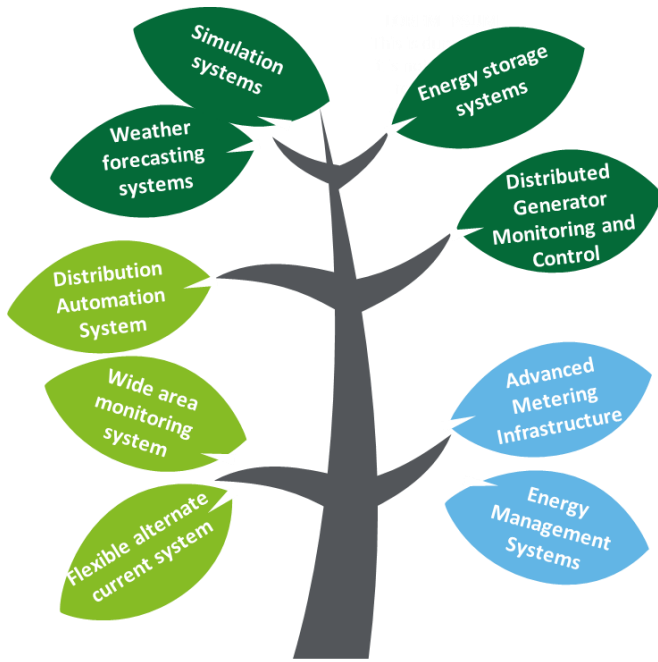
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# Technology Fact Sheet

# Grid Upgrade Technologies

## Technologies

In the Palestinian context, smart grid can be defined as integrating modern power system technologies into its electricity network.



### Smart grid components in monitoring and control

- **Distribution automation system:** Monitor distribution networks and control electrical switching remotely
- **Wide area monitoring system:** System stabilization to avoid system outages, coordinated voltage regulation, and oscillation damping
- **Flexible Alternate Current Transmission System:** Control power flow to ensure optimal flow, quality, and reliability of power supply

### Smart grid components in monitoring and control

- **Weather forecasting systems:** deploy cameras, sensors, imaging techniques, and computer-based data and analytics systems to forecast availability of renewable sources
- **Energy storage system:** Regulate power supply frequency and store renewable energy
- **Simulation systems:** Help in forecasting and controlling renewable energy generation
- **Distributed generators monitoring and control:** Minimize problems in evacuation of renewable energy by sending signals in real time

### Smart grid components in monitoring and control

- **Advanced metering infrastructure:** Enable the implementation of load reduction and energy saving programs
- **Building Energy Management Systems and Factory Management Systems:** Computer-based systems used in managing energy, the electrical appliances and equipment in buildings and factories





## Challenges

## Solutions

## Outcomes

Growing demand in electricity
Old and degrading energy infrastructure
More than 20 percent of grid electricity is being lost








<b>Upgrade the grid</b>
<ul style="list-style-type: none"> <li>• Development of transmission infrastructure</li> <li>• Rehabilitation of existing distribution networks and expansion of distribution networks</li> <li>• Advancements in grid technologies, specifically the concept of smart grid</li> </ul>

 <b>Integration of diversified energy sources such as from renewable energy</b>
 <b>Improved efficiency of delivery reducing overall losses</b>
 <b>Improved reliability in energy supply</b>
 <b>Better preparedness to respond in cases of emergencies.</b>

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.penra.gov.ps](http://www.penra.gov.ps)

## Case study: assessing and upgrading the grid in Mongolia

As part of national energy development plan, Mongolia has conducted an assessment for grid upgrade. In the case of Mongolia, undertaking of an assessment of grid upgrade in the city of Ulaanbaatar, the capital city, helped to identify the needs and potential areas suitable for infrastructure upgrade.

Technologies identified / used		Enabling factors
<p><b>Power Transmission</b></p> <ul style="list-style-type: none"> <li> Laboratory of diagnostic tests of transmission lines and substations</li> <li> Expansion of existing substations (Gas Insulated Switchgear (GIS))</li> <li> Mobile substations</li> <li> Replacement of existing transmission lines</li> </ul>	<p><b>Power Distribution</b></p> <ul style="list-style-type: none"> <li> Distribution Automation System (DAS)</li> <li> Automatic meter reading system</li> <li> 110 kV underground station (GIS substation)</li> </ul>	<p>Technical assistance support provided to assess the grid upgrade, providing professional and technical advice and support.</p> <p>Strong understanding and awareness of the need of grid upgrading from a number of power outage occurrences</p> <p>Loan package adapted to Mongolia's needs and capacities, enabling the implementation of the project.</p>

## Additional resources

### Resource list:

Asian Development Bank. ADB Sustainable Development Working Paper Series No. 42: Outlook for Increased Adoption of Smart Grid Technologies in ADB Energy Sector Operations. 2016

City of Ulaanbaatar Power Transmission & Distribution System Assessment, Japan International Cooperation Agency, 2014

## Opportunities



Cost savings



Efficient power distribution



Reduced risk of power loss from distribution and outage



Reliable supply of power



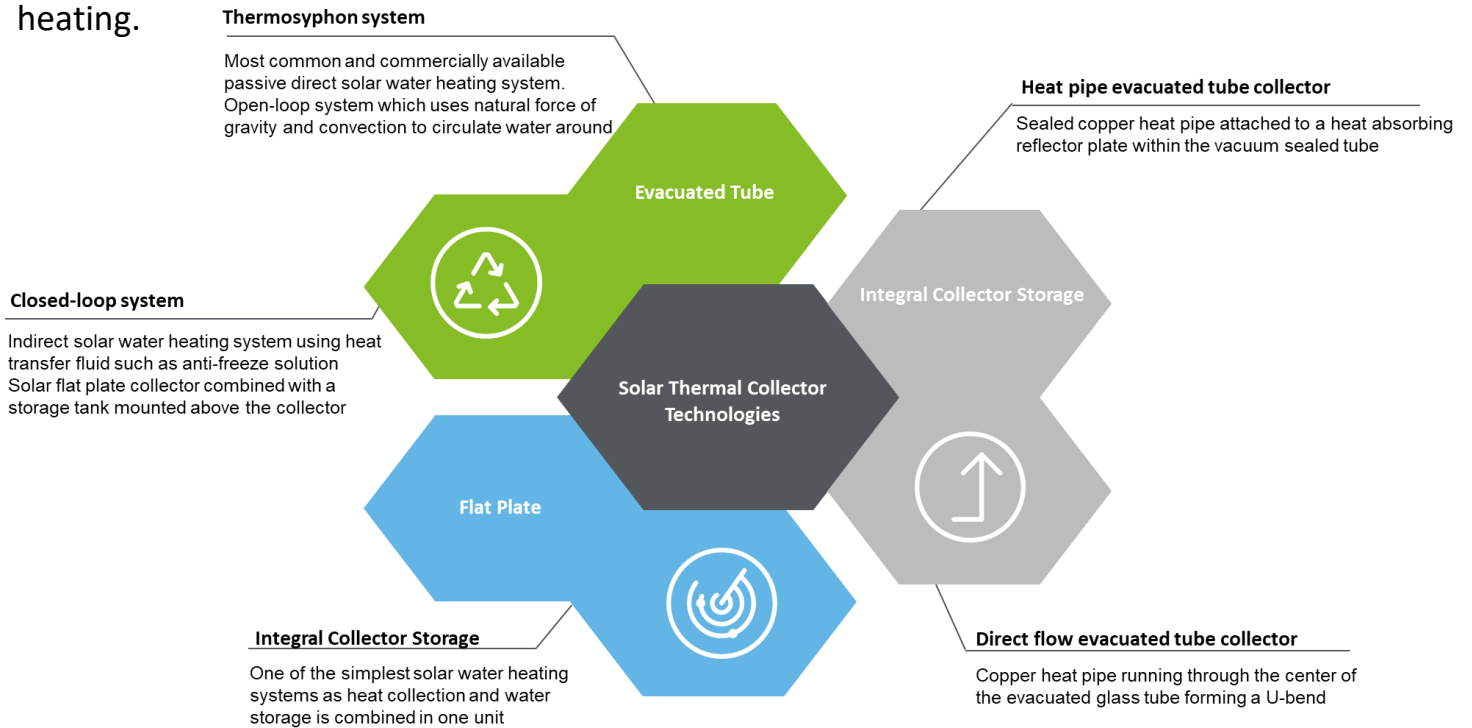
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# Technology Fact Sheet

# Solar Water Heating Technologies

## Technologies

Solar energy provides Palestine with the opportunity to achieve energy savings for solar water heating.



### Challenges and opportunities

- Growing demand in electricity
- High fuel costs and high dependence on imported fuels
- Palestine on of the world's top locations for construction of solar systems
- Significant number of heaters are out of order

### Solutions

- Dissemination of solar water heating technologies**
- Dissemination of sustainable technologies
  - Dissemination of technologies available or potentially available in Palestine

### Outcomes

- Decreased GHG emissions
- Improved electricity independence
- Significant savings in cost of electricity for the building implementing the technology

## Additional resources

The Palestinian National Energy Efficiency Action Plan for 2020 – 2030. 2016

Alternative Energy Tutorials: <http://www.alternative-energy-tutorials.com/solar-hot-water/solar-hot-water.html>

For more information contact:

[www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/)

[www.penra.gov.ps](http://www.penra.gov.ps)



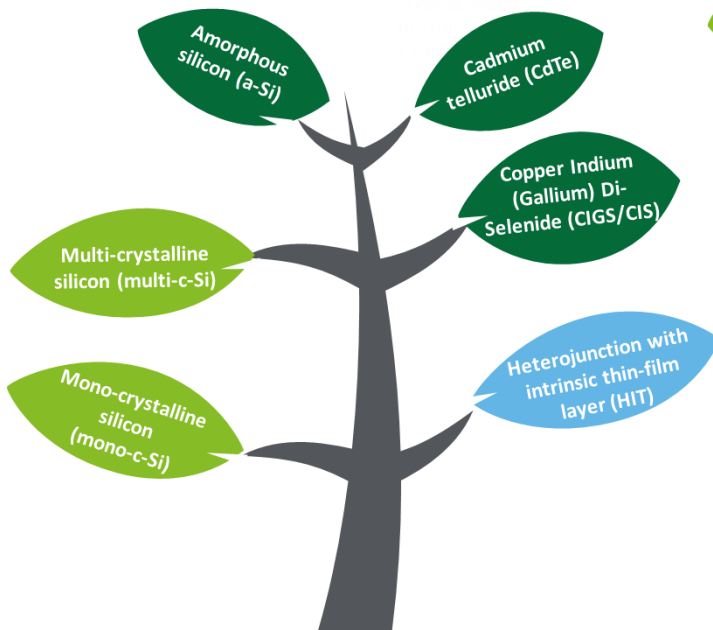
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# Technology Fact Sheet

# Various Application of Solar PV Technologies

## Technologies

Solar energy provides Palestine with the opportunity to produce electricity to enhance its energy independence, which decreases its reliance on imported fuels.



### Crystalline Silicon (c-Si) PV Modules

Modules consist of PV cells connected together and encapsulated between a transparent front (usually glass) and a backing material

- **Mono-crystalline silicon (mono-c-Si)** wafers are sliced from a large single crystal ingot in a relatively expensive process.
- **Multi-crystalline silicon (multi-c-Si)** wafers are made from a variety of methods and is currently cheaper than mono-c-Si, but is generally not as efficient.

### Thin Film PV Modules

Modules are made with thin-film deposition of a semiconductor on a substrate. Thin film cells are typically cheaper in comparison with c-Si due to both materials used and simpler manufacturing process.

- However, thin film cells are relatively less efficient than c-Si modules
- **Amorphous silicon (a-Si)** : suitable for applications where low-cost is more important than high efficiency
- **Cadmium telluride (CdTe)** : high energy output across a wide range of climatic conditions with good low light response and temperature response coefficients
- **Copper Indium (Gallium) Di-Selenide (CIGS/CIS)**: has the potential to offer the highest conversion efficiency of all the thin film PV module technologies

### Heterojunction with intrinsic thin-film layer (HIT)

Modules are composed of a mono-thin c-Si wafer surrounded by ultra-thin a-Si layers. HIT modules are more efficient than typical crystalline modules, but they are more expensive.

## Challenges and opportunities

## Solutions

## Outcomes

Growing demand in electricity

High dependence on imported fuel

Palestine on of the world's top locations for construction of solar systems

Dissemination of grid connected photovoltaic power systems

- Dissemination of small- to medium-scale grid connected photovoltaic power systems
- Rooftop solar PV systems
- Development of larger scale solar power generation plants



Decreased GHG emissions



Improved electricity independence



Significant savings in cost of electricity for the building implementing the technology



Lower cost of electricity for distribution utilities

## Additional resources

International Finance Corporation. Utility-Scale Solar Photovoltaic Power Plants: A Project Developer's Guide. 2015

International Renewable Energy Agency. End-of-life management: Solar Photovoltaic Panels. 2016

For more information contact:

[www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/)

[www.penra.gov.ps](http://www.penra.gov.ps)



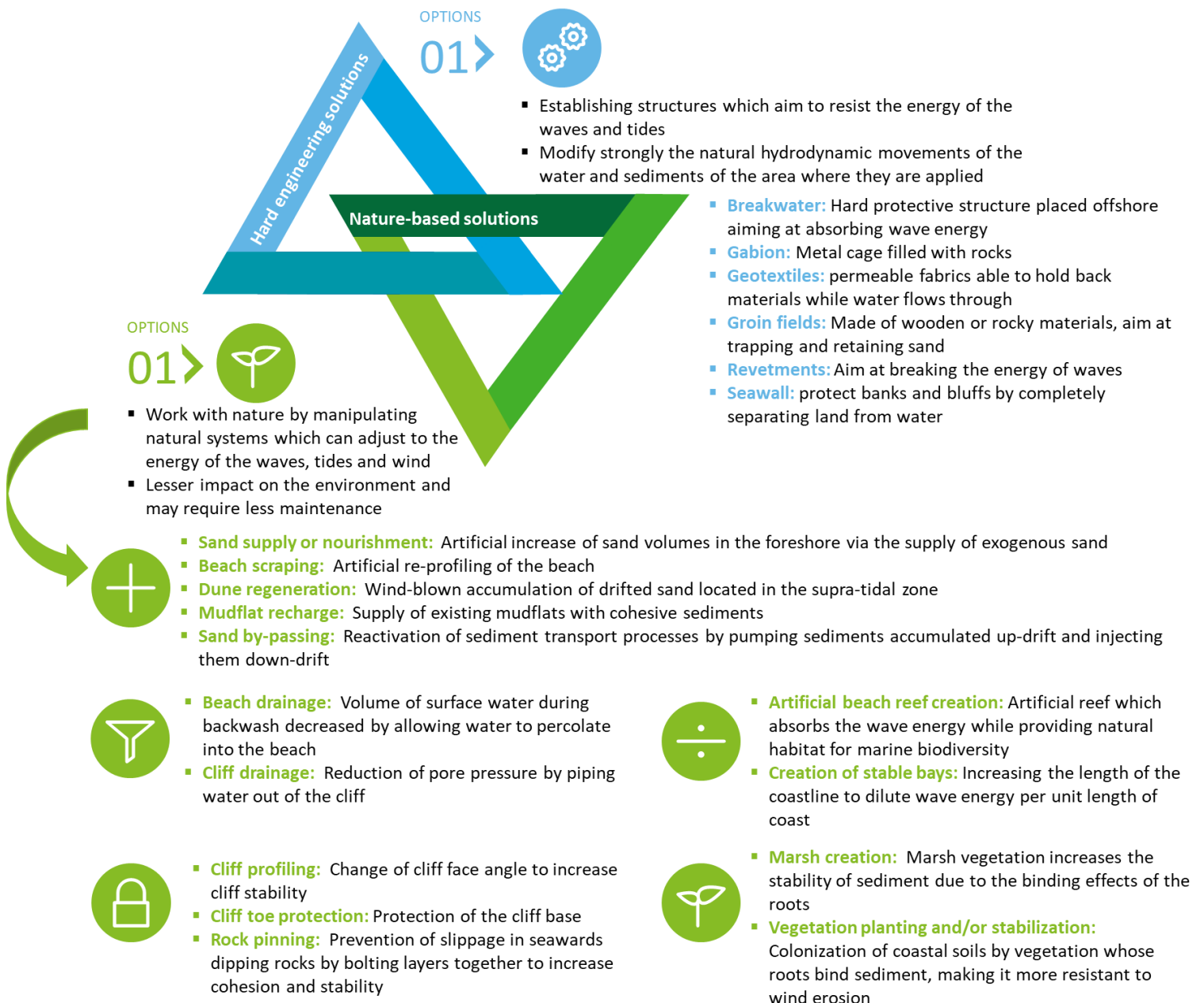
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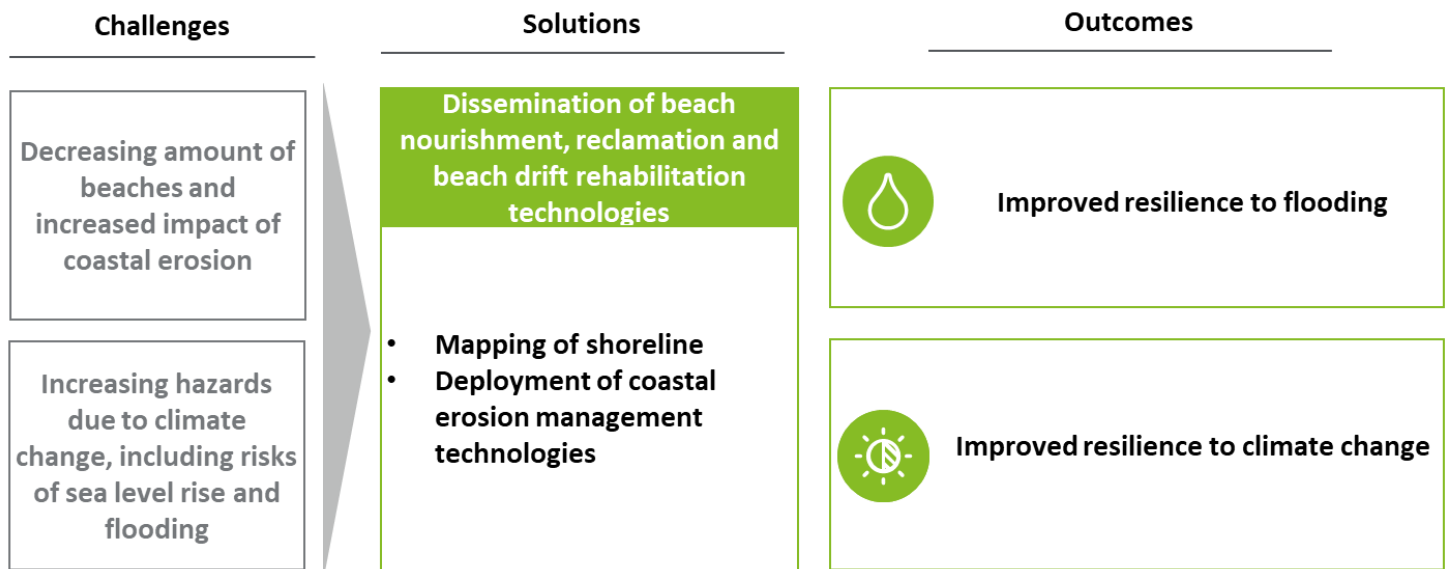
# Technology Fact Sheet

# Provision of Beach Nourishment, Reclamation and Beach Drift Rehabilitation

## Technologies

The provision of beach nourishment, reclamation and beach drift rehabilitation is a national priority for Palestine. This technology is of significance to the Gaza area as there are implications to the people living in these areas from changes in climate. Impacts include effects and risks of sea level rise and flooding.





For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/)

## Additional resources

### Resource list:

Arkema, K., Brenner, J., Faries, J., Griffin, R., Guannel, G., Guerry, A., Rosenthal, A., Ruckelshaus, M.H., Silver, J. & Verutes, G. (2016). "Evaluating the Benefits of Green Infrastructure for Coastal Areas: Location, Location, Location". *Coastal Management*, 44;5, pg. 504 – 516.

National Institute of Coastal and Marine Management of the Netherlands (2004). "A guide to coastal erosion management practices in Europe: lessons learned". [http://www.euroSION.org/shoreline/lessons\\_learned.pdf](http://www.euroSION.org/shoreline/lessons_learned.pdf)

<http://www.climatetechwiki.org/content/beach-nourishment>

McInnes, R. (2003). International Conference on Coastal Management 2003.



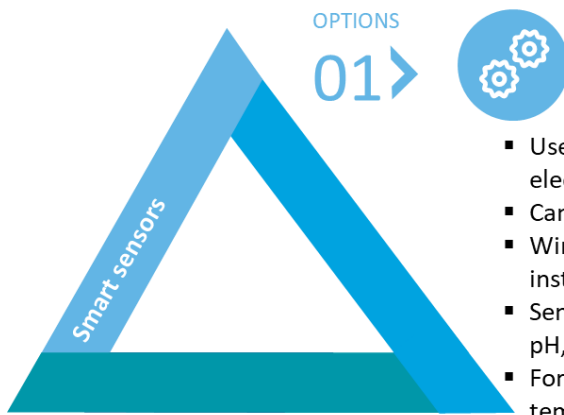
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# Technology Fact Sheet

# Water, Food and Sanitation Monitoring and Safety Systems

## Technologies

The development of water, food and sanitation monitoring and safety systems using advanced, high-end technology is essential in ensuring the health and well-being of the Palestinian population.



- Use of smart sensors is low-cost and it allow to measure and record data electronically
- Can be designed to send out real-time alerts and notifications to users
- Wireless sensors improve water quality, food safety and sanitation by providing instant access to the data.
- Sensors enable to measure physiochemical parameters of water quality such as pH, temperature, conductivity, oxidation-reduction potential and turbidity
- For food safety, this method allows for a continuous data stream of food-temperature

### Challenges


Increasing impacts of climate change on the available water resources


Increasing hazard risks due to climate change, including related to health and food security

### Solutions

Dissemination of water, food and sanitation monitoring and safety systems using high technology related to health

### Outcomes

 Improved water management

 Reduced vulnerability to major diseases related to water, food and sanitation

## Additional resources

Priya, S. K., Shenbagalakshmi, G. and Revathi, T. (2018). "Design of smart sensors for real time drinking water quality monitoring and contamination detection in water distributed mains." International Journal of Engineering & Technology 7:1.1, 47-51

"From Farm to Fork: A Wireless-Sensor Approach to Food Safety". Accessed from <https://www.mwrf.com/systems/farm-fork-wireless-sensor-approach-food-safety>

For more information contact:  
[www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/)  
[www.moh.ps](http://www.moh.ps)  
[www.pwa.ps](http://www.pwa.ps)



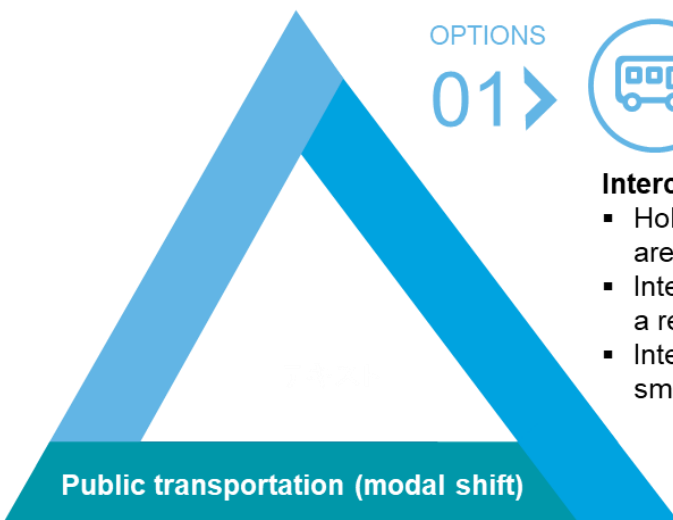
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# Technology Fact Sheet

# Public Transportation Modal Shift

## Technologies

In Palestine, the largest contributor to the energy sector’s GHG emissions is the transport subsector (47%). Transportation contributes to GHG emissions and air pollution. Modal shift will reduce GHG emissions by moving towards use of public transportation and upgrade of existing vehicles will move towards adoption of low-carbon technologies.



### Intercity bus transportation

- Holds particular importance for small communities and rural areas
- Intercity buses provide links among smaller communities within a region and to larger urban
- Intercity bus transportation provides a particularly critical role for smaller communities

### Challenges

Increasing number of vehicles on the road

Ageing vehicle fleet

Significant traffic congestion

### Solutions

Dissemination of public transportation related technologies

- Dissemination of technologies and practices related to modal shift

### Outcomes



Decreased energy consumption and therefore GHG emissions



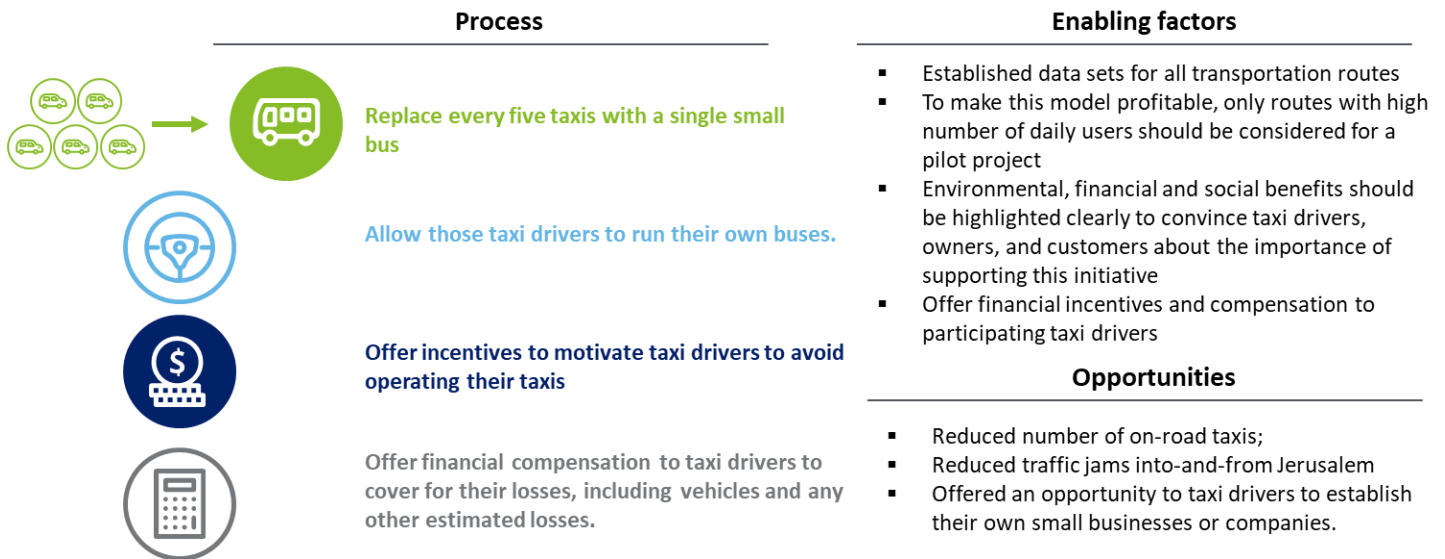
Significant savings in cost of fuel for private vehicles

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.mot.gov.ps](http://www.mot.gov.ps)

## Case study: Reducing number of on road taxis - Jerusalem

Traffic jams are one of the major challenges in Palestine's road network, both inside and outside of cities. The City of Jerusalem has a unique situation in which, due to its religious significance, thousands of Palestinians and international tourists travel to and from it every day.

The project developed an innovative model to manage the traffic by reducing the number of on-road vehicles. In 1994, the project developed a model to reduce the number of taxis operating on Jerusalem routes. The model is described as follow:



## Additional resources

### Resource list:

National Research Council (2002). *Effective Approaches to Meeting Rural Intercity Bus Transportation Needs*. Transit Cooperative Research Program. Transportation Research Board, 184.



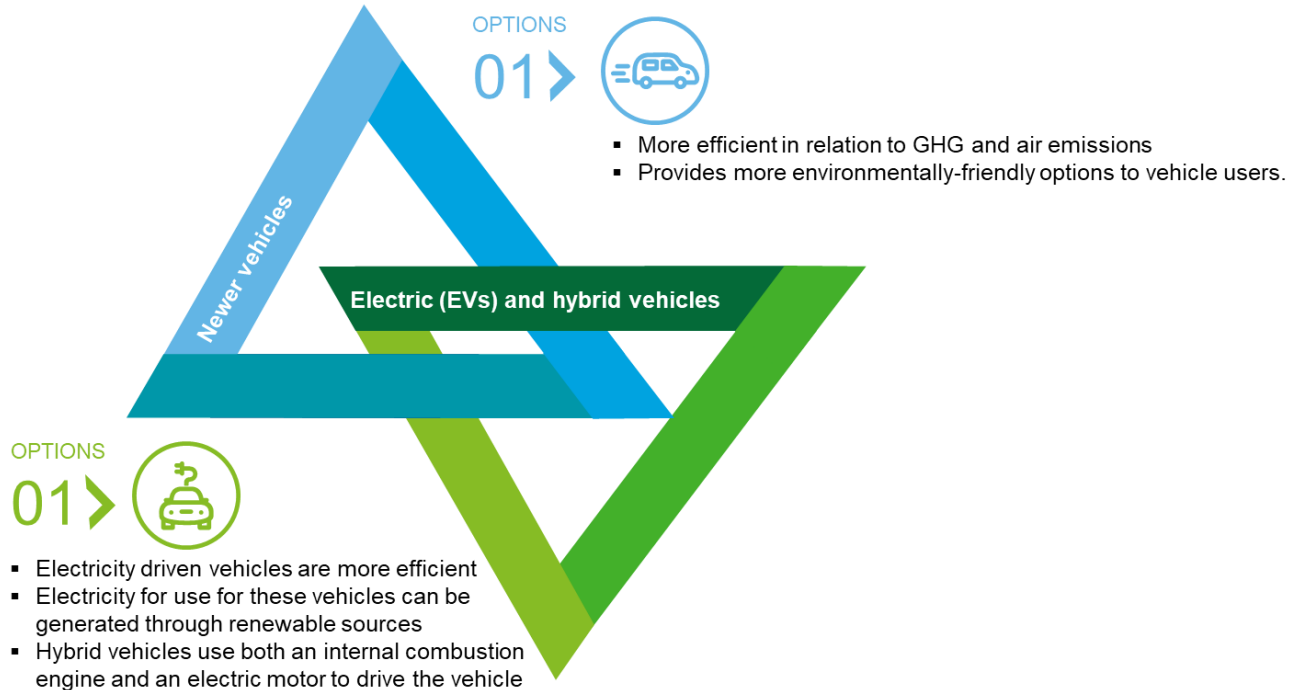
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# Technology Fact Sheet

# Upgrade of the Existing Vehicle Fleet

## Technologies

68 percent of registered vehicles in Palestine are 20-30 years old, including 11 percent above 20 years and 21 percent above ten years. Gas emissions of such old and outdated vehicles are high and cause hazardous environment pollution.





### Challenges

- Increasing number of vehicles on the road
- Ageing vehicle fleet
- High maintenance costs

### Solutions

- Dissemination of public transportation related technologies
- Dissemination of technologies and practices related to modal shift

### Outcomes

-  Decreased energy consumption and therefore GHG emissions
-  Significant savings in cost of fuel and maintenance for vehicle owners

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.mot.gov.ps](http://www.mot.gov.ps)

## Case study: Greening the Automobile Industry in Uganda

Uganda is experiencing high rates of growth of vehicle ownership, with the number of newly registered vehicles having increased by almost three times in 2014 compared to 2012 levels. Identifying the best possible response to the challenge of reducing CO<sub>2</sub> emissions from road transport is a major priority for Uganda.

The Nationally Appropriate Mitigation Actions on green transport in Uganda, which emphasizes the need of standards in improving and enforcing fuel efficient initiatives and vehicle strategies.

### Processes



#### Import vehicle inspection

Establishment of domestic import vehicle inspection sites in Uganda to confirm compliance with domestic standards



#### Labeling

All imported vehicles are labelled for compliance upon completion of vehicle import inspection



#### Periodic vehicle inspection

Guarantee that only vehicles emitting GHGs within prescribed limits are on the road



#### Introduction of fuel standards

By improving fuel standards, significant emission reductions can be achieved



#### Introduction of a vehicle age limit

A vehicle age limit is a good proxy for vehicle emission level control

### Enabling factors

- New employment and business opportunities through establishment of vehicle assembly plants, production of electric bikes, and vehicle recycling facilities
- Vehicle recycling would provide another option to purchasing an old vehicle, by reusing parts from old vehicles and improving maintenance of the vehicle

### Opportunities

- Creation of business opportunities and job
- Reduction in GHG emissions
- Access to alternative option to purchasing a vehicle through repair and reuse of parts

## Additional resources

#### Resource list:

Masrur, M.A. & Mi, C. (2017). *Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives*. John Wiley & Sons.



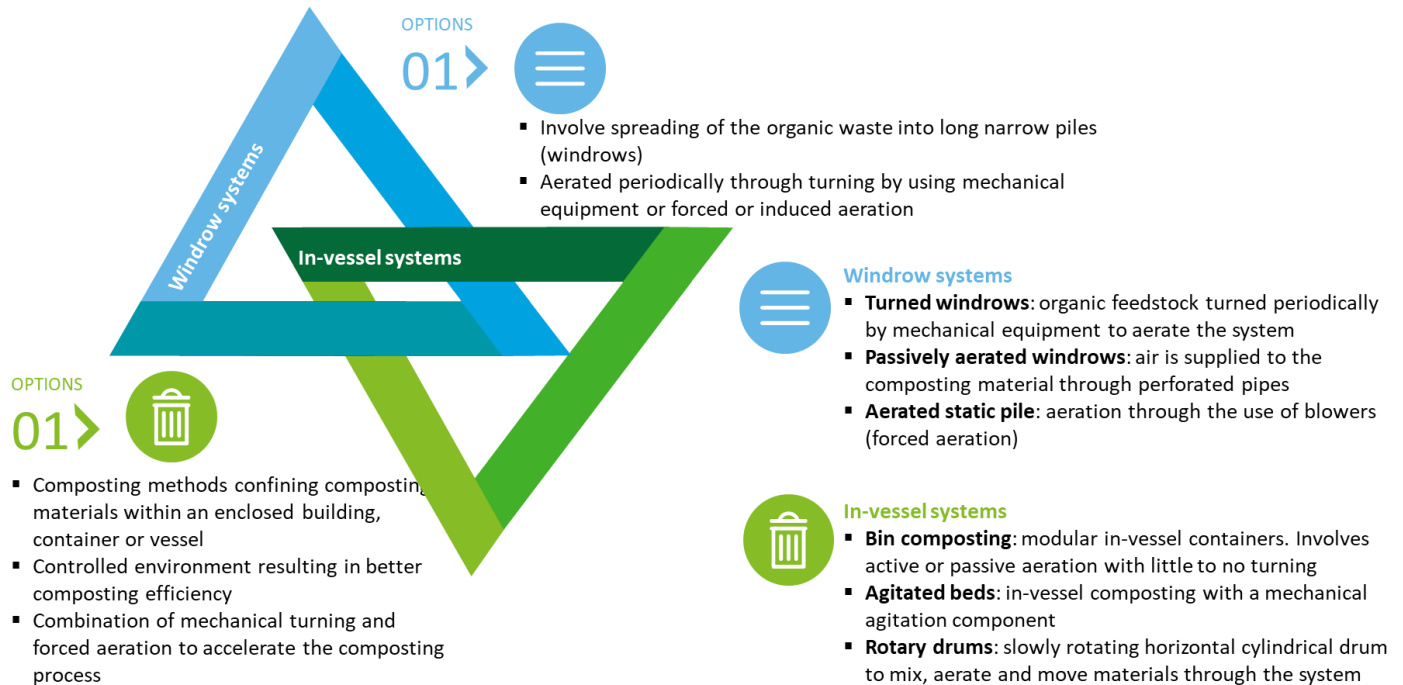
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# Technology Fact Sheet

# Solid Waste Composting Technologies

## Technologies

Composting effectively reduces the overall waste volume that ends up in landfills. As waste material required for the production of compost is organic, this consequently reduces the decomposition of organic waste in landfills thereby reducing GHG emissions.



Challenges	Solutions	Outcomes
Increasing amount of waste ending up in landfills; limited number of landfills	<b>Dissemination of composting technologies</b> <ul style="list-style-type: none"> <li>Dissemination of composting technologies, enabling the implementation of the 6Rs and opening new market opportunities</li> </ul>	 <b>Decreased waste in landfills</b>
Economic opportunities lost by not producing and selling compost		 <b>Improved capability to compost</b>
Increasing hazards due to climate change		 <b>Decreased methane emissions from landfills</b>
		 <b>Improved resilience to climate change</b>
		 <b>Additional income streams and business opportunities</b>

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.molg.pna.ps](http://www.molg.pna.ps)



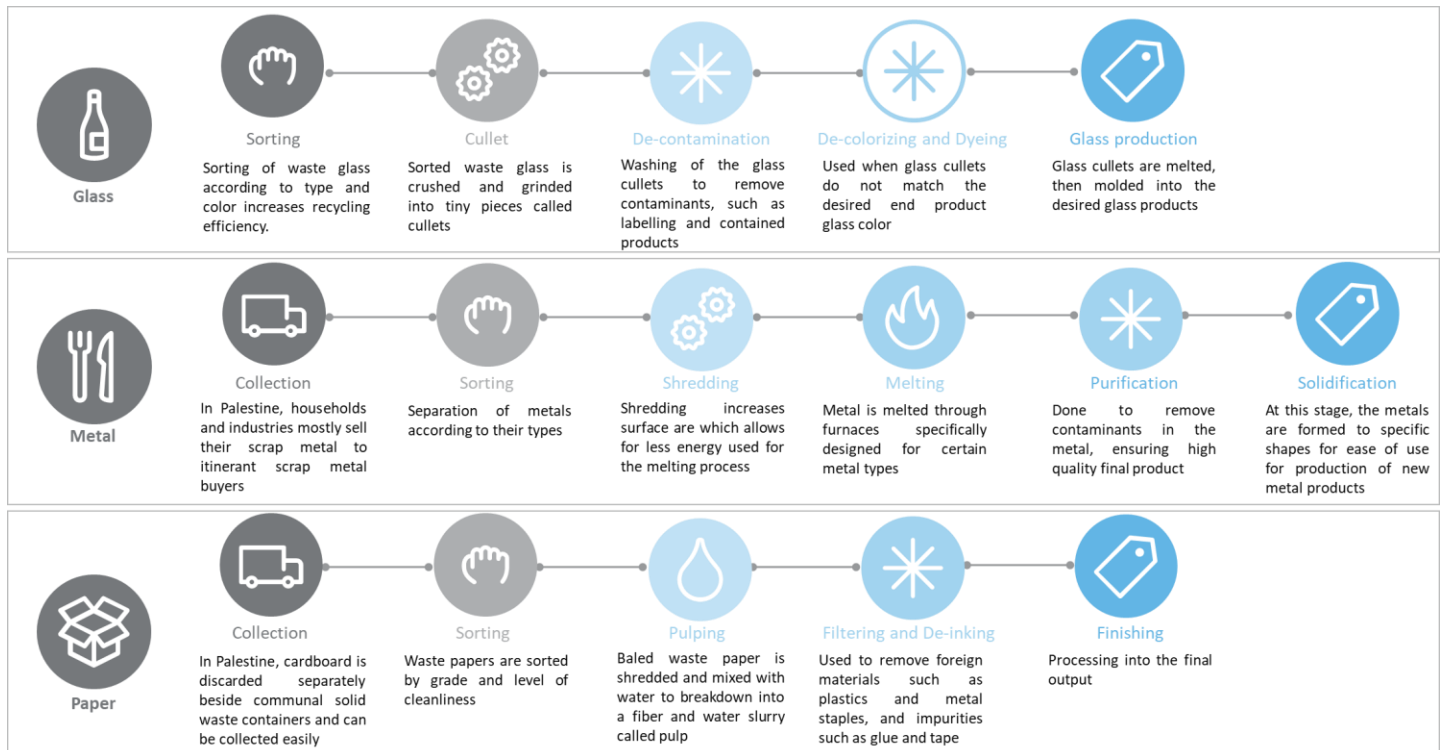
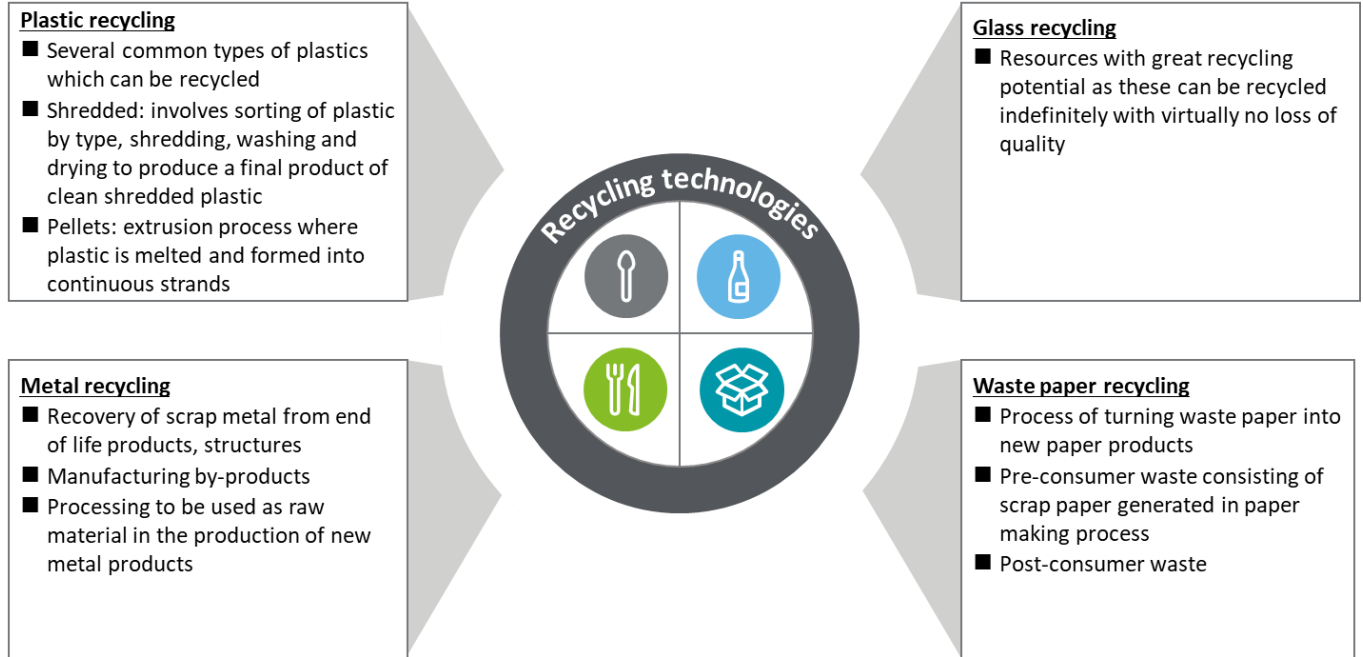
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# Technology Fact Sheet

# Recycling Technologies

## Technologies

Recycling of reusable materials such as plastic, paper, metal, glass, among others, is a proven solution to reduce the amount of waste that is finally disposed of in landfills.





For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.molg.pna.ps](http://www.molg.pna.ps)



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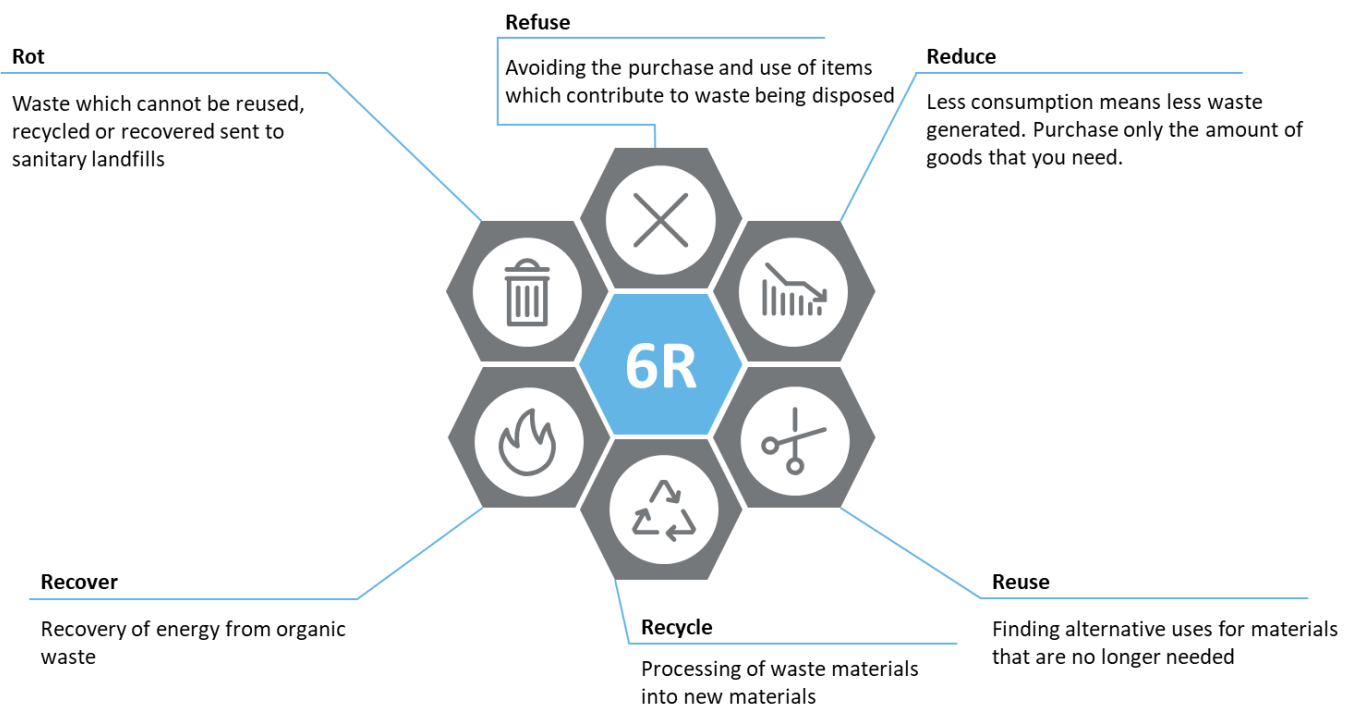
# Technology Fact Sheet

# Waste Sorting Technologies

## Technologies

A holistic solid waste management approach takes into account the management of waste throughout the solid waste value chain from source to its final disposal. As such, waste sorting, including the concept of 6Rs, will help reduce its overall environmental impact.

### The 6R concept



### Waste sorting technologies



#### Waste Screening

Based on size classifications using screens

- Trommel screen
- Disk screen
- Oscillating screen



#### Ballistic Separation

- Steeply inclined bed with a perforated plate screen deck, with alternate vibrating elements



#### Magnetic Separation

Magnets either lift ferrous metal from the waste, or hold ferrous metal to the conveyor while other waste is allowed to drop



#### Air Separation

Use of air flow to separate different waste materials based on weight.

- Zigzag air
- Rotary air
- Cross-current air classifier
- Suction hood



#### Film Grabber

- Waste is accelerated onto a rotating drum with spikes.
- These hook plastic film and let other waste drop.



#### Eddy Current Separation

Eddy currents are used to push non-ferrous metals with magnets into separate collection points



#### Manual Sorting

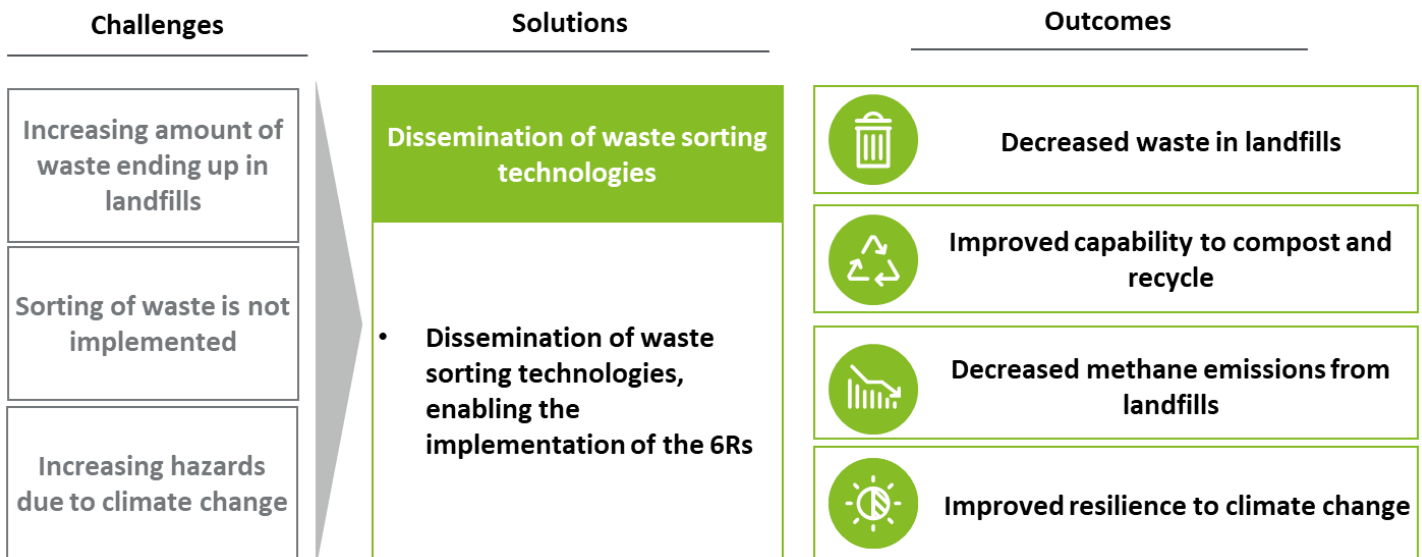
Employees are positioned beside the conveyor and manually remove materials either in positive or negative sorting



#### Sensor Technology

- Near infrared (NIR)
- Visual spectrometry (VIS)
- X-ray fluorescence (XRF)
- X-ray transmission
- Electromagnetic sensor (EMS)

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.molg.pna.ps](http://www.molg.pna.ps)



### Case study: Waste management in Nairobi – a private sector experience

TakaTaka Solutions (“TakaTaka”) is a waste management enterprise based in Nairobi and founded in 2011, which operates a successful a circular economy model. It provides an innovative solution to Nairobi’s waste management challenges.

TakaTaka collects source-separated waste from its clients (organic and recyclable waste). After collection, its trucks take the waste to sorting points, called “TakaTaka Points”.

There, the waste is manually sorted into different recyclable materials (see figure on the right).



### Additional resources

**Resource list:**

McKinnon D, Fazakerley J, Hultermans R, International Solid Waste Association. Waste sorting plants: Extracting value from waste. An Introduction. 2017

Takataka: <http://takatakasolutions.com/>

**The circular economy applied to waste in Nairobi (UNDP):**

<https://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMAs/nama-on-circular-economy-solid-waste-management-approach-for-urb.html>



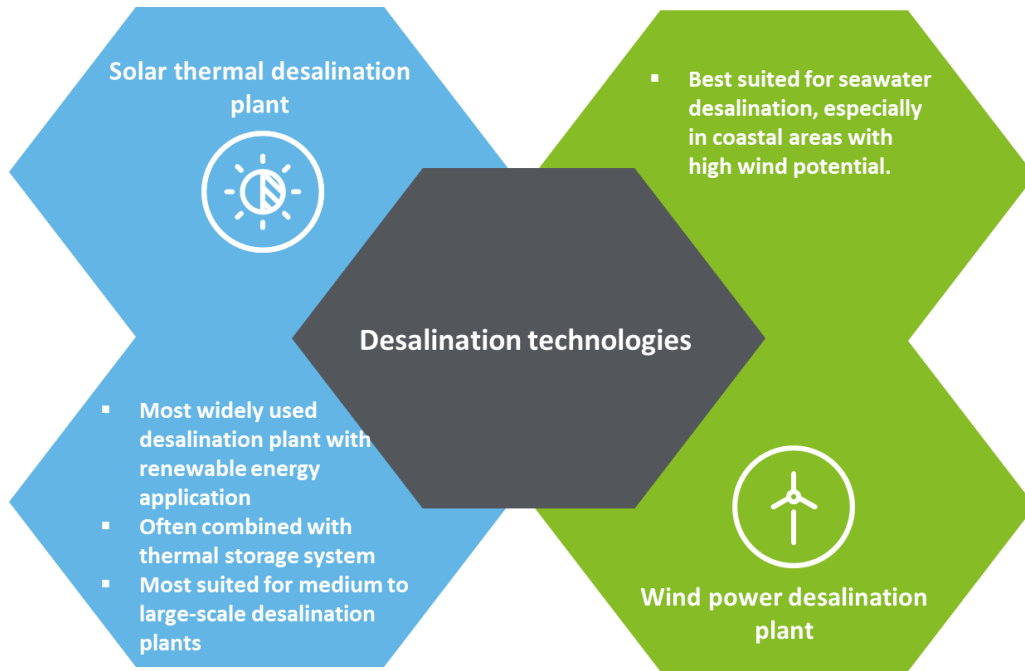
State of Palestine

# Technology Fact Sheet

# Desalination

## Technologies

As one of the options to increase alternative sources of potable water in Palestine, especially in Gaza, use of desalination is recognized as a suitable solution. Conventional desalination plants require a considerable amount of energy, but can include renewable energy application in the form of solar PV and wind turbines.



### Challenges and Opportunities

### Solutions

### Outcomes

High dependence on imported fuel

Insufficient water resources and insufficient access to water resources

Palestine one of the world's top locations for construction of solar systems

Dissemination of desalination technologies with renewable energy application



Improved resilience to climate change



Improved access to water resources



Decreased GHG emissions

For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and <http://www.pwa.ps/>

## Case study: Masdar Initiative in the United Arab Emirates

Masdar, a commercially driven enterprise established in 2006 and mandated to expand UAE's energy portfolio, launched a Renewable Energy Seawater Desalination program, including five pilot plants located in Abu Dhabi. This has high potential to be applied in Palestine.

### Project overview



Total capacity of 1,500 to 2,500m<sup>3</sup>/day of water production



Sponsored by the Abu Dhabi Government and co-funded by industry partners



Power generated by solar power plants



500 households benefiting from the measure

### Enabling factors

- Providing price signals to consumers by gradually removing subsidies on fossil fuels encourages being energy efficient on the demand side and using the more competitive renewable energy technologies
- Creation of a transitional incentive scheme until development and cost reduction of renewable energy technologies

### Opportunities

- Diversification and strengthening of energy and water security
- A step toward energy independence (for fossil fuel importing countries)
- Job creation through the emergence of a new economic sector

## Additional resources

### Resource list:

Gaza Central Desalination Plant and Associated Works Program: Donor Information Handbook. Palestinian Water Authority (2018)

Assaf, S.A. (2001). "Existing and the future planned desalination facilities in the Gaza Strip of Palestine and their socio-economic and environmental impact." *Desalination* 138 (1-3), pg. 17 – 28

United Nations Office for the Coordination of Human Affairs (2017). "Largest seawater desalination plant opened in Gaza". *The Monthly Humanitarian Bulletin*. Accessed from: <

<https://www.ochaopt.org/content/largest-seawater-desalination-plant-opened-gaza>>



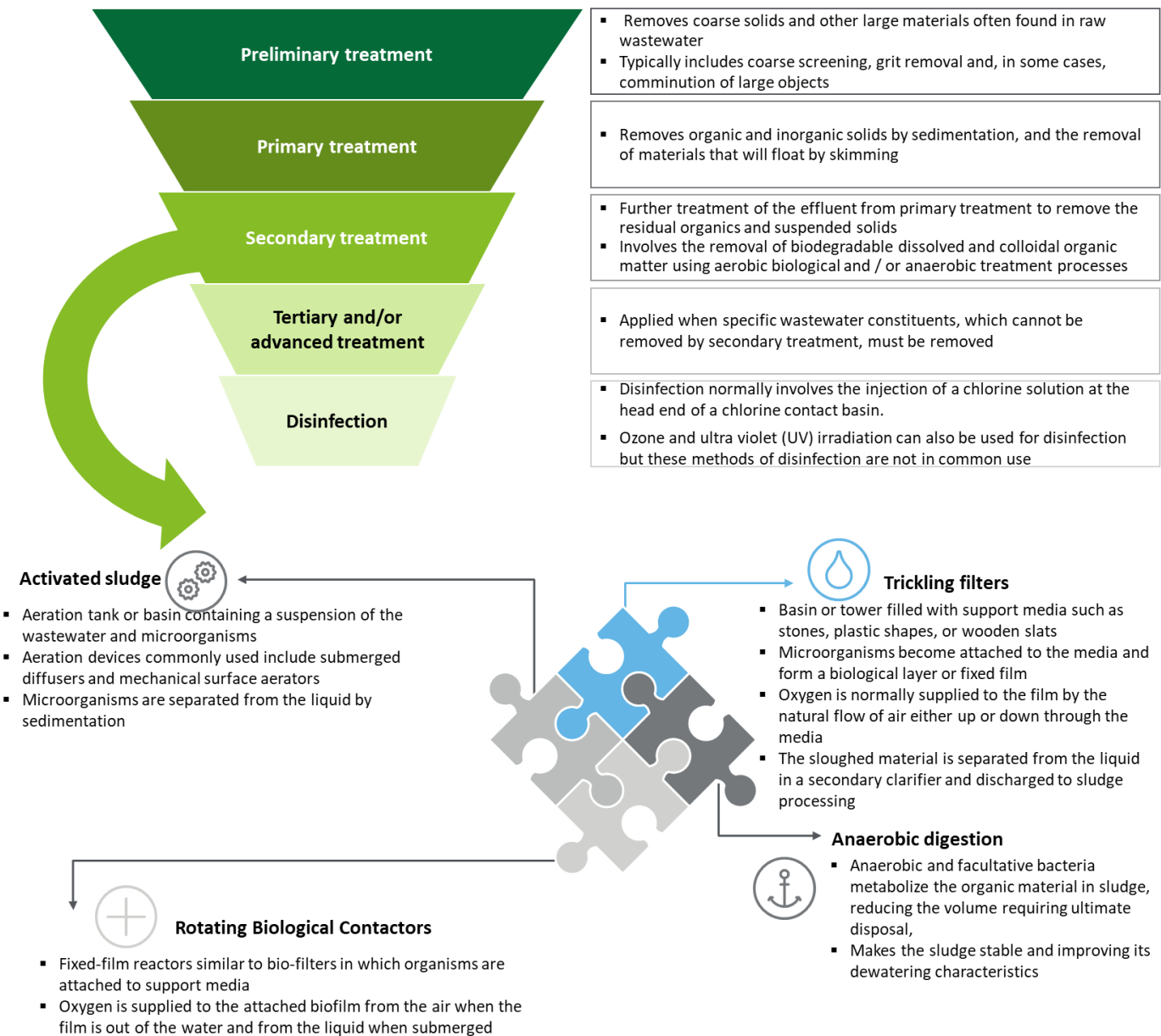
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# Technology Fact Sheet

# Wastewater Collection and Treatment

## Technologies

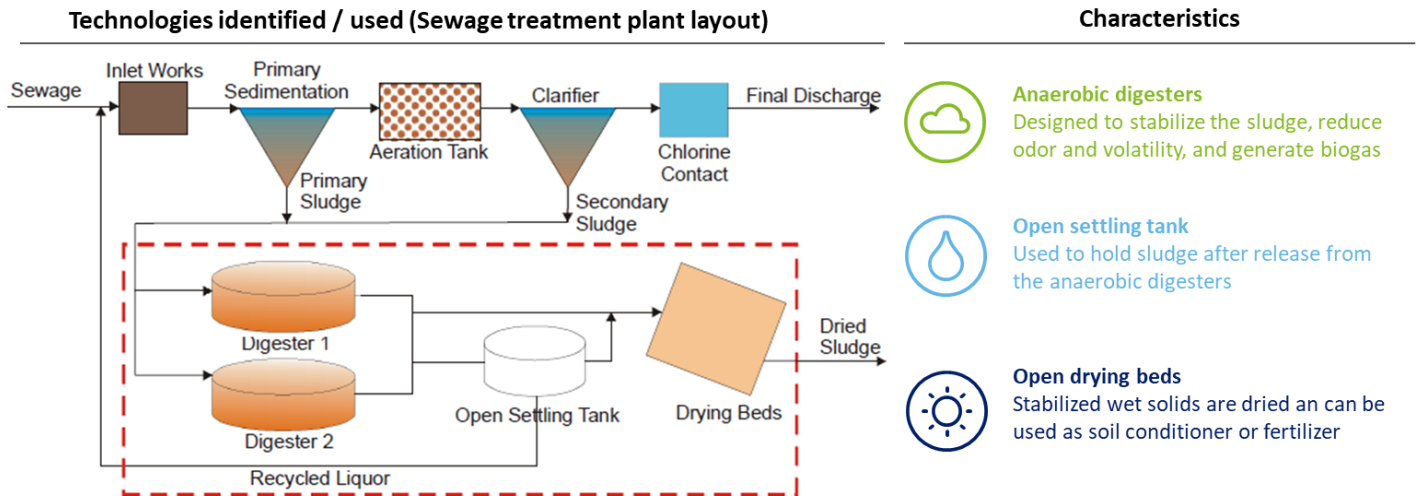
Palestine experiences severe limitation to access water. Wastewater collection and treatment technologies provide opportunities to increase the amount of water available for use by Palestinians and are important adaptation measures for Palestine.









For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.pwa.ps](http://www.pwa.ps)

## Case study: Makati South Sewage Treatment Plant Upgrade with On-site Power (Philippines)

Wastewater management is a major challenge in Philippines. Innovative models for anaerobic treatment of wastewater, optional production of energy, and reuse of treated waste water have been proposed as a solution to this issue.



Enabling factors	Opportunities
 Manila Water Co., Inc., operator of the sewage treatment plant, was aware of the issues related to malodor and air pollution caused by the sewage treatment plant	 Improved environmental protection by the capture of fugitive GHG, including methane
 The participation of companies technically qualified made the project possible	 Development of a healthier and safer work place, with local air quality, odor, and control of combustible methane emissions being controlled
 The project was only possible due to incentive created by the CDM, which allowed the operator to conduct the whole project without any risks or financial commitment	 Increase of energy self-sufficiency due to the use of renewable and indigenous energy resources

## Additional resources

### Resource list:

Food and Agriculture Organization of the United Nations. "3. Wastewater treatment". Accessed from <http://www.fao.org/3/t0551e/t0551e05.htm>



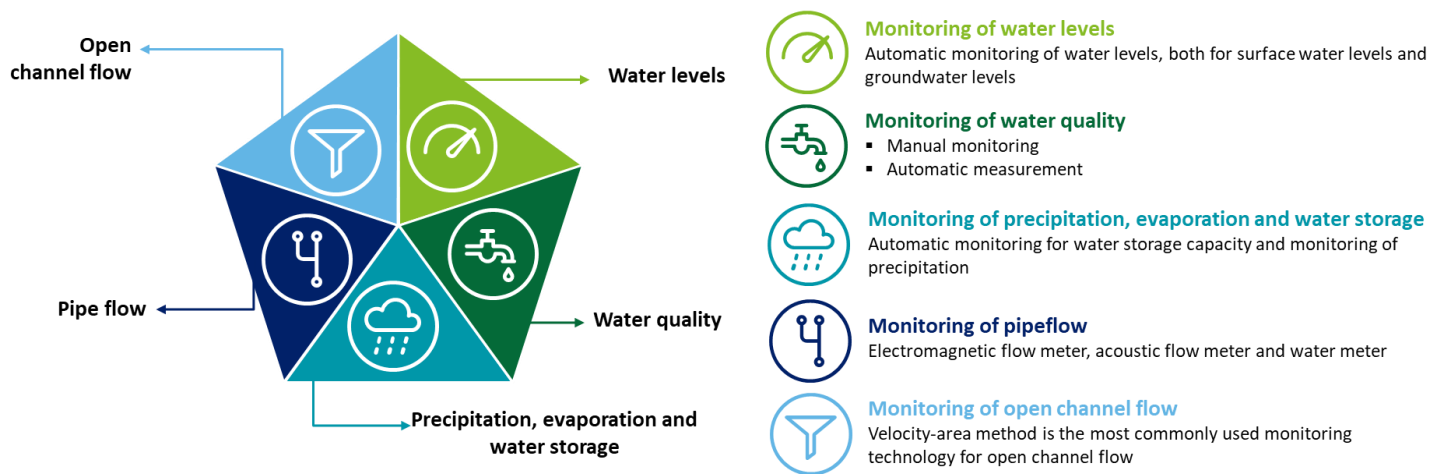
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# Technology Fact Sheet

# Water Resources Monitoring Technologies

## Technologies

With growing population, coupled with expected impacts of climate change, securing water as a resource is an important adaptation action for Palestine. Implementing water resources monitoring systems will allow Palestine to effectively manage freshwater resources, collect essential information in characterizing the status of water resources.



### Challenges

- Changing rainfall patterns due to climate change
- No control over water resources
- Limited information related to water quality and availability

### Solutions

- Dissemination of water resources monitoring technologies**
- Pilot project on wells within the currently Palestinian territory using the identified water monitoring technology
- Once tested and proven deployment follows

### Outcomes

- Improved resilience to climate change
- Improved knowledge of water quality and availability
- Better planning for water usage

## Additional resources

Ning, D., Wang, G., Wu, M. & Yang J. (2016). "A tentative discussion on the monitoring of water resources in China." *Water Resources Assessment and Seasonal Prediction*, International Association of Hydrological Sciences

For more information contact:  
[www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and  
<http://www.pwa.ps/>



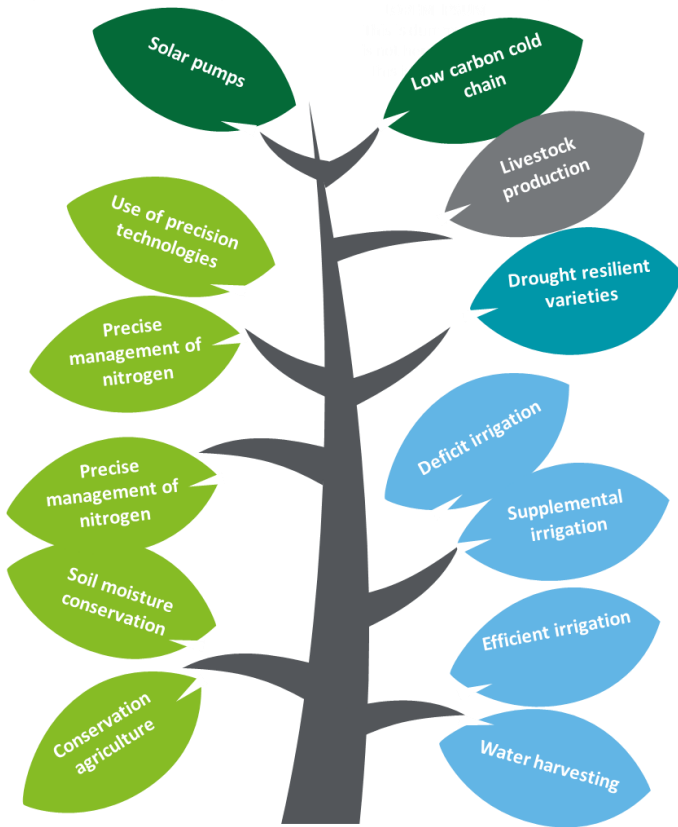
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# Technology Fact Sheet

# Climate Smart Agriculture

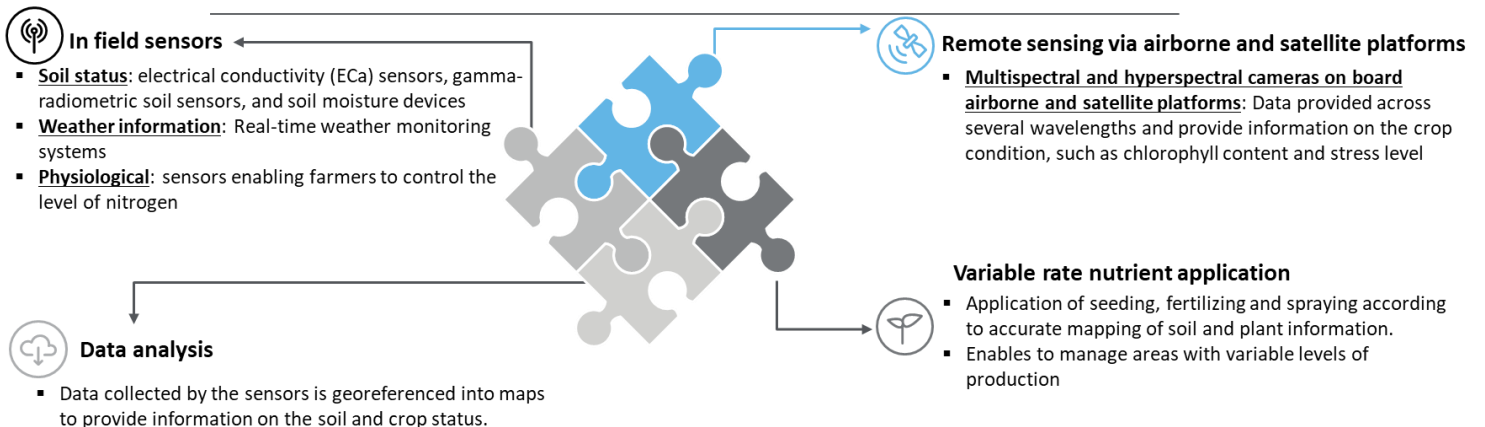
## Technologies

Climate smart agriculture aims to contribute to sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

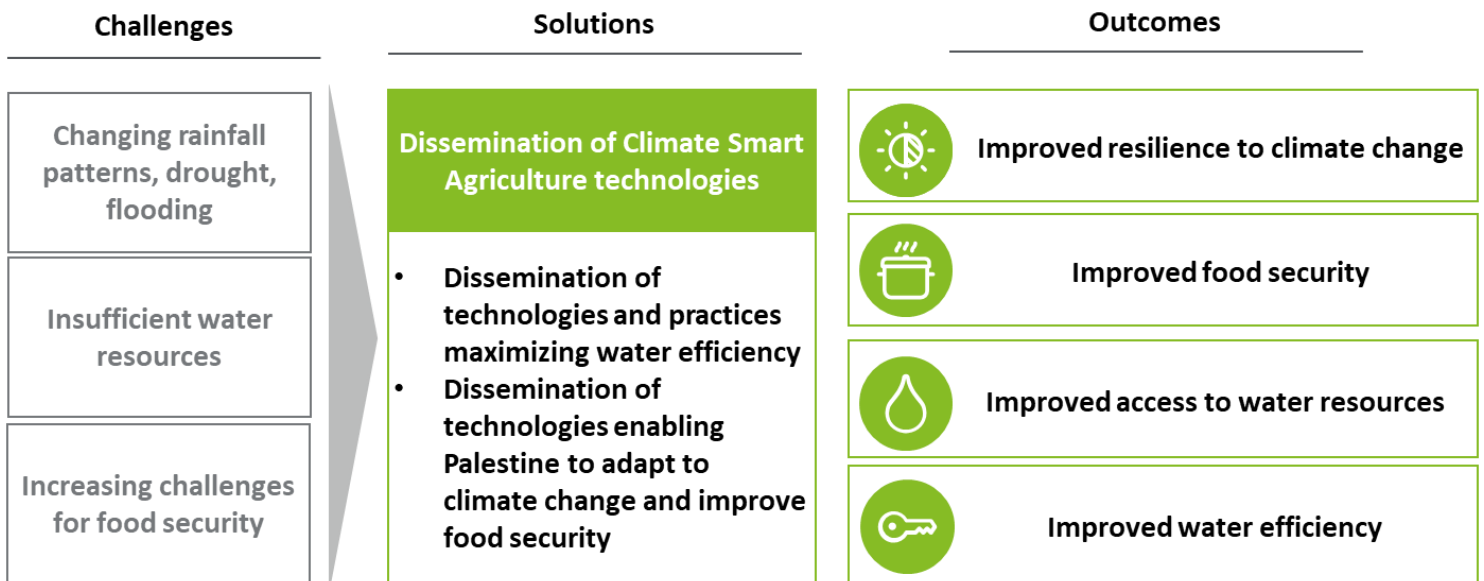


- Crop production and soil management**
  - Soil moisture conservation:** Enhances the productive capacity by minimizing the amount of water lost from the soils (Mulching, conservation tillage)
  - Precise management of nitrogen:** to deliver nutrients to the plant in times of peak demand, in order to avoid using too much mineral fertilizers, which will reduce productivity of the soils
  - Crop diversification:** Growing different types of crops by season. Good practices include the rotation of deep-rooted and shallow-rooted crops.
  - Use of precision technologies for crop management:** Moisture and yield management can be supported by remote sensing technologies, enabling mapping and application of inputs at variable rates
  - Conservation agriculture:** Refer to additional factsheet
- Water Management**
  - Water harvesting:** Refer to additional factsheet
  - Efficient irrigation technologies:** Refer to additional factsheet
  - Supplemental irrigation:** Adding limited amounts of water to rain-fed crops to stabilize yields when rainfall is not sufficient, especially adapted to drylands
  - Deficit / supplemental irrigation:** Practice where water supply is reduced below maximum levels and mild stress is allowed with minimal effects on yield
- Use of genetic resources for food production**
  - Development of drought resilient varieties (seeds):** May allow for a sustained production, even in the context of decreasing rainfalls
- Energy management**
  - Solar pumps:** Replace fossil fuel based generators with solar generation based generators
  - Low carbon cold chain:** Low-carbon technologies include the combination of refrigerant plates and insulation boxes
  - Low carbon value chains**
- Livestock production**  
Refer to additional factsheet

### Focus on : Precision Agriculture Technologies

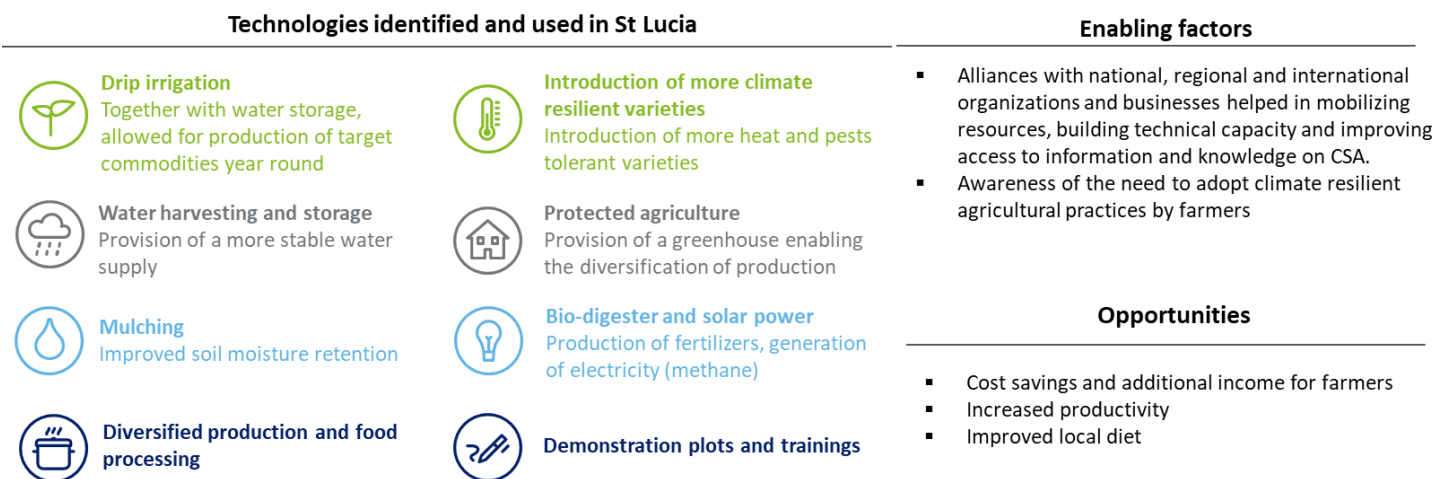


For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.moa.pna.ps](http://www.moa.pna.ps)



### Case study: Application of Climate Smart Agriculture in St Lucia

In order to overcome unusual heavy rains and longer dry periods and water scarcity, the Belle Vue Farmers' Cooperative, a local farmers' cooperative in St. Lucia, applied a combination of CSA technologies and practices.



This case study provides an example of a set of technologies used in another climate context. The concept of climate smart agriculture could be replicated in Palestine.

### Additional resources

#### Resource list:

FAO, Compendium, Climate smart irrigation

Climate Smart Agriculture in the Eastern Caribbean States: the Path to Sustainability and Stability of Growth in a Changing Climate, Inter-American Institute for Cooperation on Agriculture



State of Palestine

# Technology Fact Sheet

# Conservation Agriculture

## Technologies

Conservation agriculture is a response to sustainable land management, environmental protection and climate change adaptation and mitigation. As defined by the FAO in 2008, conservation agriculture has three main principles:

### 01



#### Minimum soil disturbance:

- No-till seeding and weeding.
- Under this type of practice, no soil distortion and mechanical tilling is done.
- Sowing is done with equipment enabled to plant on the residues on the previous cropping season.

### 02



#### Soil protection by vegetation cover

- Maintain crop residues and stubble in arable crops and to preserve groundcovers between rows of trees in permanent crops.

### 03



#### Crop rotation and plant association

- Can be done through rotations, sequences and associations of crops.

## Technologies

### Large scale no-till drills

Answer to the needs of larger farms  
Design considerations such as the operation width, surface smoothness, power requirements, downforce application and transport, need to be taken into account



### Hand-jab planters

Do not require access to power and low-cost  
Easy to operate and often used in small scale farms  
Suitable for hilly, stony and stumpy areas as well as for intercropping



**Direct seeders, or no-till drills:**  
Allow farmers to plant the crops successfully without tilling

### Planters adapted from power tillers

Power tillers of which some powered blades have been eliminated to till narrow strips  
Leaves the ground between the rows untilled

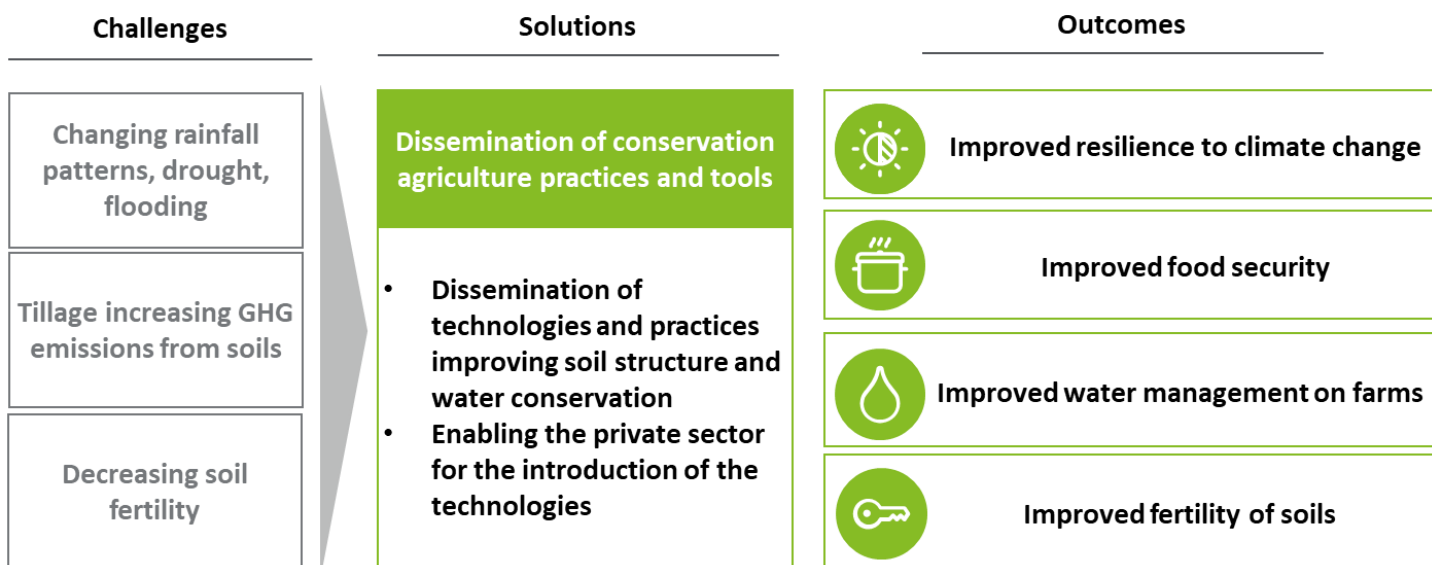


### Row-type planters

Operation similar to larger machines  
Most of them use discs, applied with downforce



For more information contact: [www.environment.pna.ps/ar/](http://www.environment.pna.ps/ar/) and [www.moa.pna.ps](http://www.moa.pna.ps)



## Additional resources

### Resource list:

FAO, No-tillage Seeding in Conservation Agriculture, 2007