



State of Palestine

Environmental Quality Authority (EQA)

Climate Technology Centre & Network (CTCN)

*“Technology Roadmap for the Implementation of Climate
Action Plans in Palestine”*

Identification and Prioritization report

Version 1

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Acronyms

CSA	Climate smart agriculture
CTCN	Climate Technology Center and Network
EV	Electric vehicle
GBV	Gender-Based Violence
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Greenhouse gas
GHI	Global Horizontal Irradiance
GPP	Gaza Power Plant
INCR	Initial National Communication Report
JICA	Japan International Cooperation Agency
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOLG	Ministry of Local Government
MONE	Ministry of National Economy
MOT	Ministry of Transportation
MW	Megawatt
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NGO	Non-Governmental Organization
NPA	National Policy Agenda
NREAP	National Renewable Energy Action Plan
O&M	Operation and maintenance
PETL	Palestinian Electricity Transmission Company Ltd.
PV	Photovoltaic
PWA	Palestinian Water Authority
SMART	Specific, Measurable, Achievable/Attributable, Relevant, Timely
SUNREF	Sustainable Use of Natural Resources and Energy Finance

UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNRWA	United Nations Relief and Works Agency
WASH	Water, Sanitation and Hygiene

1. Introduction

The State of Palestine is vulnerable to the impacts of climate change with severe implications for its economy and livelihood of its people. Impacts significant to the region include decreased precipitation, significant warming, more frequent and more intense extreme weather events, and rise in sea level. These could lead to greater water scarcity, decreased agricultural productivity, and saline water intrusion.

The Palestinian Government is committed to addressing these climate change vulnerabilities while, at the same time, achieving its national development and policy objectives. This is reflected in its submissions to the United Nations Framework Convention on Climate Change (UNFCCC) namely, Initial National Communication Report (INCR), National Adaptation Plan (NAP) and Nationally Determined Contribution (NDC).

Within this context, the State of Palestine has requested Climate Technology Center and Network (CTCN)'s assistance to develop a gender responsive technology roadmap, which will be used for the implementation of climate change action plans, as defined in its INCR and NDC.

The technology roadmap will identify relevant technologies to achieve objectives determined in climate change action plans, and technical, financial, regulatory and other barriers for implementation, replicability or scalability. The roadmap will, then, propose solutions to remove these barriers through policy and other derisking instruments, as well as capacity building and creation of an enabling environment. It is particularly important to identify practical and feasible funding modalities for these actions, including through the Green Climate Fund (GCF) and other sources.

This report summarizes the identification and prioritization process applied in determining the final list of prioritized technologies for the roadmap. This is the first output for the technology roadmap development, which will be further built on to prepare efficient implementation plan. The consulting team has conducted two missions to the State of Palestine and prepared all deliverables that are part of this first output.

2. Overall approach and methodology

The overall objective of the assignment is to develop a comprehensive gender responsive climate technology roadmap for the implementation of climate actions in the State of Palestine. This will be achieved through the delivery of three outputs, namely, (1) the identification and prioritization of climate mitigation and adaptation technologies and inclusive businesses for transfer to Palestine; (2) development of the roadmap for the implementation of the gender responsive climate mitigation and adaptation technologies and businesses transfer as prioritized; and (3) development of a gender responsive capacity development programme to strengthen the policy, regulatory, institutional, technical, financial, business and social capacity of the key stakeholders.

This report details the activities carried out in completing the identification and prioritization of technologies. Table 1 presents the summary of activities and steps undertaken for the identification and prioritization process.

Table 1 Activities and steps for identification and prioritization of technologies

Step	Details
1.1	Assess key success factors and best practices and suitability in national, regional and international mitigation and adaptation technologies and businesses that could be adapted and adopted in Palestine.
	<ul style="list-style-type: none"> ➤ Analyze climate change action documents developed by the State of Palestine; ➤ Identify priority sectors where climate mitigation and adaptation technologies can be used; and ➤ Highlight success factors for each technology identified (financing, capacity, regulatory, and social and gender considerations).
1.2	Evaluate gaps, needs, challenges and opportunities to scale up the proven and viable adaptation and mitigation solutions and inclusive businesses for various sectors for long term and sustainable impact beyond the one-off project
	<ul style="list-style-type: none"> ➤ Analyze gaps, needs, challenges and opportunities to scale technologies up (financing, capacity, regulatory, and social and gender gaps).
1.3	Develop methods to diagnose and design range of climate technology transfer projects, accessibility and acceptability from the prioritized technology portfolio
	<ul style="list-style-type: none"> ➤ Develop a methodology to screen mitigation and adaptation technologies, as well as inclusive business; ➤ Understand which projects are accessible and acceptable by the State of Palestine
1.4	Identification and assessment of key barriers for each prioritized technology
	<ul style="list-style-type: none"> ➤ Identify key barriers for each prioritized strategy in step 1.3; ➤ Assess risks to identify the impact of risk categories on the difficulty to introduce them in the West Bank or in the Gaza Strip
1.5	Assess the enabling environment for each action
	<ul style="list-style-type: none"> ➤ Assess policies and the regulatory framework related to each prioritized technology or inclusive business.

1.6	Understand the mix of financial and non-financial measures required to successfully implement each action
	<ul style="list-style-type: none"> ➤ Identify institutional barriers and support schemes; and ➤ Explore a mix of derisking arrangements related to private, public and financial derisking.
1.7	Develop a toolkit for making informed decisions on the choice of the technology
	<ul style="list-style-type: none"> ➤ Develop a toolkit to support the State of Palestine in identifying prioritized technologies for the roadmap; and ➤ Assess each technology according to a set of criteria (market barrier, (availability and cost of the technology), technical barriers, capacity barriers, availability of financial resources, legal barriers, social acceptability and the contribution of the technology to achieving climate action plans)
1.8	Ranking of mitigation and adaptation technologies and develop a prioritized pipeline of fundable climate adaptation and mitigation solutions and businesses aligned with NDC and GCF Strategic Impact Areas
	<ul style="list-style-type: none"> ➤ Rank mitigation and adaptation technologies, and develop a pipeline of fundable climate adaptation and mitigation technologies and businesses; and ➤ Organize a workshop with Palestinian stakeholders to identify the most relevant technologies.
1.9	Gender mainstreaming
	<ul style="list-style-type: none"> ➤ Highlight the difference between women, men, girls and boys in terms of resources, opportunities, constraints and power.

Step 1.1 Assess key success factors and best practices and suitability in national, regional and international mitigation and adaptation technologies and businesses that could be adapted and adopted in Palestine (including currently used technologies in the country)

To identify relevant technologies for the Palestinian context, all climate change action documents were analyzed and priority sectors were identified. Additional review through desktop analysis was performed that identified potential national, regional and international mitigation and adaptation technologies. A total of 13 case studies were prepared and provided overview on the best practices for the selected technologies, and analyzed their applicability and suitability in the Palestinian context. The case studies highlighted success and enabling factors in the aspect of finance, capacity, regulatory, social and gender considerations. These findings are presented in each of the case study prepared.

Step 1.2 Evaluate gaps, needs, challenges and opportunities to scale up the proven and viable adaptation and mitigation solutions and inclusive businesses for various sectors for long term and sustainable impact beyond the one-off project

After identifying potential technologies and inclusive businesses, along with their enabling factors from the case studies, the gaps, needs, challenges and opportunities for scaling up these technologies were analyzed and presented in each case study prepared. This analysis also informed whether these technologies could be applied under the status quo or independence scenario of the State of Palestine. Findings from this assessment are also presented in each of the case study.

Step 1.3 Develop methods to diagnose and design range of climate technology transfer projects, accessibility and acceptability from the prioritized technology portfolio

Once relevant technologies were identified and case studies were prepared for identification of applicability in Palestine, a methodology was developed to screen and prioritize mitigation and adaptation technologies. The long list of technologies was developed based on technologies identified in Palestine's climate change action documents and supported by sectoral stakeholder consultations during the first mission. These technologies were scored by relevant stakeholders on a set of six criteria, namely, relevance to Palestinian context, linkage to the NDC, co-benefits, acceptability, transferability to the country, and possible occupational related challenges. The top 50 percent of the technologies for each sector were identified as the initial prioritized technologies (shortlisted technologies).

Step 1.4 Identification and assessment of key barriers for each prioritized technology

Key barriers which may hinder the implementation of each of the shortlisted technologies in Palestine were then identified. These barriers included market, financial, access, technical, and regulatory, among others. Findings from this assessment are presented in the key barriers assessment report. The report identified different levels of risks related to introducing shortlisted technologies in Palestine.

Step 1.5 Assess the enabling environment for each action

Under this step, relevant policies and regulatory framework were assessed for each shortlisted technology. Findings from this assessment are presented in the policy assessment report.

Step 1.6 Understand the mix of financial and non-financial measures required to successfully implement each action

Based on results of the analysis conducted in previous steps, institutional barriers and support schemes were identified to understand which actions are required to introduce the shortlisted technologies in Palestine. The United Nations Development Programme's (UNDP) Renewable Energy Investment Framework approach was applied and adopted for the assessment process. Findings from this assessment are presented in the financial and non-financial measures identification report.

Step 1.7 Develop toolkits for making informed decisions on the choice of the technology

Once all assessments were completed, a toolkit was developed to identify and finalize prioritization of technologies for the Technology Roadmap. The toolkit incorporated the set of six criteria in step 1.3 in assessing each of the shortlisted technology. To further assess the technologies to take into account its potential for short-term, medium-term and/or long-term implementation, level of derisking measures for its introduction, and the level of external support required, an additional set of three criteria were included in the toolkit.

Step 1.8 Ranking of mitigation and adaptation technologies and develop a prioritized pipeline of fundable climate adaptation and mitigation solutions and businesses aligned with NDC and GCF Strategic Impact Areas

Based on the toolkit developed in the previous step, technologies were ranked. Targeted consultations with sectoral working groups were conducted to discuss and obtain scores for each of the relevant technology in the list. A workshop was also organized with key stakeholders from the National Climate Change Committee to identify the prioritized technologies in achieving each sector's climate change action objectives. Findings from this assessment are presented in this report.

Step 1.9 Gender mainstreaming

A gender analysis was conducted by a gender and social inclusion specialist and highlighted vulnerabilities to climate change in terms of gender, challenges some technologies may present to women, and the lack of access to some technologies of women. Findings from this analysis are presented in the gender mainstreaming report.

3. The long list of technologies

All available and relevant documents related to climate change action developed by the State of Palestine were reviewed and analyzed to identify priority sectors where climate change mitigation and adaptation technologies could be used. This was further refined based on extensive desktop review and interviews with relevant stakeholders during the first mission in January 2019. The list of documents reviewed is presented in Table 2.

Table 2 Relevant climate change policies, strategies and objectives for Palestine

Type of document	Document title
Policies and strategies related to climate change	➤ Nationally Determined Contribution (NDC)
	➤ National Adaptation Plan (NAP)
	➤ Initial National Communication Report (INRC)
Policies and strategies related to development objectives	➤ National Policy Agenda (2017 – 2022)
	➤ National Agricultural Sector Strategy (2017 – 2022)
	➤ Environment Sectoral Strategy 2014-2016
	➤ Water Sector Reform Plan (2016-2018)
	➤ Water Strategy (2016-2018)
	➤ Palestinian Water Authority Strategic Plan (2016-2018)
	➤ Energy Sector Strategy (2011-2013)
	➤ National Strategy for Solid Waste Management in the Palestinian Territory (2010-2014)
	➤ National Policy and Legislation for Promoting the Conservation of Agro-biodiversity in the Palestinian Authority 2005
➤ RE and EE related strategies.	

This analysis resulted in identification of potential national, regional and international mitigation and adaptation technologies along with businesses that could contribute to achieving these priorities (referred to as the “long list” hereafter). The long list of technologies and measures suitable to Palestine, identified by stakeholders during the first mission, is presented in Table 3.

Table 3 Long list of technologies identified by stakeholders

Sector	Technologies	Relationship with the NDC
Energy	➤ National grid assessment and electricity grid upgrade	➤ Electricity grid upgrade, provision of reliable energy supply
	➤ Various applications of photovoltaic (PV) technologies	➤ Solar photovoltaic, solar water heaters, generation of solar electricity for medium / large scale commercial / industrial application, use of renewable energy such as solar to reduce imported energy, providing reliable energy supply
	➤ Other renewables, including hybrid applications	➤ Use of renewable energy, such as solar, to reduce energy import and provide reliable energy supply
	➤ Natural gas power generation	➤ Provision of reliable energy supply
	➤ Enhancing the	➤ Enhancing the equipment and efficiency of the

	equipment and efficiency of the Gaza Power Plant (GPP)	Gaza Power Plant (GPP)
	➤ Energy efficiency	➤ Energy efficient lighting, energy efficiency of buildings, implementation of energy efficiency measures, reducing energy consumption through introduction of modern production technologies, conducting energy audits, promoting green buildings
	➤ Solar water heating	➤ Promote increased use of solar thermal energy including solar water heaters
	➤ Using local contractors and materials to limit emissions	➤ Replace imported raw materials with local materials whenever possible
Agriculture	➤ Water harvesting	➤ Improve water-use efficiency and using alternatives water resources, rainwater harvesting, enhance the use of additional and alternative water resources for non-domestic resources, develop and improve storm-water systems
	➤ Crop alternation systems	➤ Enhancing agricultural value chain
	➤ Conservation agriculture	➤ Minimize soil erosion, increase available water in the soil profile
	➤ Efficient irrigation	➤ Enhance community level irrigation schemes and infrastructure, improve water-use efficiency, enhancing agricultural value chain, supporting improvements in efficient use of water in women's private small scale agricultural projects. Precision irrigation, computerized irrigation and fertilization systems.
	➤ Aquaponics	➤ Improved water-use efficiency and use of alternatives water resources,, Enhancing agricultural value chain
	➤ Heat/drought resilient crops	➤ Climate-smart production practices, enhancing agricultural value chain
	➤ Climate smart agriculture (precision agriculture)	➤ Climate-smart production practices, enhancing agricultural value chain, greenhouse management
	➤ Resilient animal fodder	➤ Increase the availability of animal fodder, enhancing agricultural value chain
	➤ Introduction of new saline-/ heat tolerant crops	➤ Increase the availability of animal feed, enhancing agricultural value chain
	➤ Animal pens	➤ Energy efficient lighting, energy efficiency of buildings, implement energy efficiency measures, reducing energy consumption through introduction of modern production technologies, conducting energy audits, promoting green buildings

	➤ Cold chain, storage	➤ Fish packaging /preservation industry, construction of large-scale cold storage, construct large scale steel silos for grain
Water and wastewater	➤ Rainwater harvesting	➤ Rainwater harvesting, enhance the use of additional and alternative water resources for non-domestic resources, develop and improve storm-water systems at different scales
	➤ Desalination (including renewable energy application)	➤ Enhance the use of additional and alternative water resources for non-domestic resources, build a large desalination plant for Gaza
	➤ Solar pumps for pumping and distribution	➤ Use of renewable energy such as solar to reduce imported energy
	➤ Wastewater collection and plants (cesspits)	➤ Improved water supply through wastewater collection and treatment systems
	➤ Activated sludge	➤ Improved water supply through wastewater collection and treatment systems
	➤ Water resources monitoring technologies	➤ Improved water-use efficiency
	Transport	➤ Upgrade of the existing vehicle fleet
➤ Improved transportation planning in cities		➤ Reduction of traffic jams
➤ Public transport (modal shift)		➤ Modal shift programs, public transport
➤ Resilient roads, including efficient lighting (interactive lights, wind-powered lights, vehicle specific lanes)		➤ Rehabilitation of resilient road infrastructure
➤ Efficient use of rainwater drainage		➤ Improve water-use efficiency and using alternatives water resources, rainwater harvesting, enhance the use of additional and alternative water resources for non-domestic resources, develop and improve storm-water systems
➤ Flood prevention		➤ Improve water-use efficiency and using alternatives water resources, rainwater harvesting, enhance the use of additional and alternative water resources for non-domestic resources, develop and improve storm-water systems
Solid waste		➤ Waste sorting
	➤ Recycling	➤ Improving waste collection system, 3R
	➤ Composting	➤ Improving waste collection system, 3R

	➤ Waste to energy	➤ Use of waste for electricity generation
	➤ Reduction of methane from landfill	➤ Reduction of methane from landfill
Others	➤ Provision of beach nourishment, reclamation and beach drift rehabilitation	➤ Provision of beach nourishment, reclamation and beach drift rehabilitation
	➤ Development of water, food and sanitation monitoring and safety systems using high technology related to health	➤ Development of water, food and sanitation monitoring and safety systems using high technology related to health
	➤ Flood management schemes	➤ Flood management schemes (cultural sites, eco-tourist attractions), developer and improve storm water systems and drainage infrastructure
	➤ Fuel storage facilities	➤ Reduction of transportation emissions

4. Shortlist of technologies: approach and results

The long list of technologies was scored by relevant stakeholders based on six criteria. These criteria included:

1. Relevance to Palestine context;
2. Linkage to Palestine's NDC;
3. Co-benefits;
4. Acceptability;
5. Transferability to the country; and
6. Possible occupation related challenges.

The technologies were scored from one to ten under each criterion, with ten being highly relevant and acceptable to the Palestinian context.

Once technologies were scored under each criterion, the top 50 percent of technologies with highest aggregated scores from each sector (i.e. top rated technologies) were selected for further assessments for prioritization. This completed the initial prioritization of technologies. The list of prioritized technologies from this exercise is detailed below. A total of 20 technologies were shortlisted for further assessments for the final prioritization of technologies. Further assessments included the identification of key barriers, derisking measures and policy assessment. For those technologies that were not prioritized from this process, the consulting team did not perform further assessments and were, therefore, not in scope of the identification of key barriers, derisking measures and policy assessment. However, these technologies remained as consideration for the final prioritization.

4.1 Energy sector

4.1.1 National grid assessment and electricity grid upgrade

Upgrading the Palestinian grid is crucial for the efficient distribution of electricity throughout its network meeting domestic demand, as well as to diversify energy sources and develop the integration of renewable energy sources as part of its energy mix. The scope of the application of this technology will be limited to a number of grids that are not connected with the Israel side. The infrastructure itself is significantly old and has been degrading. Upgrading these grids is the first priority for the energy sector in order to enable connection of different sources of electricity, especially for renewable energy sources. Therefore, electricity grid upgrade is identified as one of Palestine's adaptation options in the NDC which will reduce its heavy reliance on imported energy fuels.

4.1.2 Various applications of PV technologies

With 3,000 sunshine hours per year and Global Horizontal Irradiance (GHI) over 2,000 kilowatt-hours per meter squared, the West Bank and Gaza rank amongst the world's top locations for construction of solar systems.¹ Moreover, amongst the available renewable energy sources, solar energy can be produced fully independently in Palestine, which will support in the reduction of reliance on imported fuels as well as negative environmental consequences. This technology plays a critical role in meeting one of the energy sector's strategic objectives. The energy sector has committed to achieving 80 percent of renewable energy targets for 2030 with solar PV.

4.1.3 Energy efficiency

Achieving energy efficiency in Palestine is extremely important as the country is almost completely dependent on imported energy products. In 2008, Palestinian dependence on Israel constituted 87.7 percent of total electricity consumption, including 97.7 percent in the West Bank and 68.1 percent in Gaza. In Palestine, buildings consume approximately 43 percent of the total energy consumption per year and this is expected to double by 2020. Additionally, buildings and construction is the fastest growing sector in Palestine, with 2,585 building licenses issued in the last quarter of 2017 in the West Bank. This highlights the importance in generating and consuming energy efficiently through adopting energy conservation and reducing losses and consumption, which is a key mitigation action for the sector.

4.1.4 Solar water heating

Solar water heating systems is already a proven technology in Palestine. It is extensively used in the residential sector, while limited in the service and industrial sectors. This technology is highly relevant in the Palestinian context as most of the electricity is supplied from external sources which the country has no control of, and thus fetch high costs, the most expensive compared with other countries in the region. With Palestine possessing high potential for solar energy, and the fact that the solar water heating technology is not constrained by the country's limitation on electricity supply, there is high rationale in prioritizing this technology. Additionally, there exist local manufacturers for solar water heating systems in Palestine.

4.2 Agriculture sector

4.2.1 Climate smart agriculture (precision agriculture)

Climate change both directly and indirectly impacts agricultural productivity, ranging from changing rainfall patterns, drought, flooding and spread of pests and diseases. Climate-smart technologies have been applied in many parts of the world to manage climate change impacts on landscape such as, cropland, livestock, forests and fisheries. These technologies aim to achieve increased and sustainable productivity, enhanced resilience and reduced emissions. This is significantly important in the context of Palestine where agriculture plays an important role in the country's culture, food security, economy and employment. Most importantly, Palestine has identified applying climate-smart agricultural (CSA) practices to at least 50 percent of farmers by 2040 as a target in its NDC. It is, therefore, an important policy intervention for the sector and there is already a large support for the use of climate smart agriculture technologies in Palestine as a priority action.

¹ Securing Energy for Development in West Bank and Gaza, World Bank, 2017

4.2.2 Efficient irrigation

Improving irrigation efficiency aims at minimizing water use within the agricultural sector while continuing to maintain optimal crop productivity rates. Water efficient irrigation also provides a number of environmental and socio-economic benefits. High irrigation efficiency is becoming increasingly important due to the current decrease in available water resources and growing populations that drive expansion of agricultural activities.² Irrigation efficiency can also be improved through altering farming practices, such as crop rotation and conservation tillage that help improved soil moisture conservation.³

For Palestine, enhancing sustainable community-level irrigation schemes and infrastructure and improving water-use efficiency using alternative water resources are key policy interventions for the agriculture sector. This technology is important in supporting the sector and ensuring that it is well adapted to impacts of climate change.

4.2.3 Resilient animal fodder

Recurring droughts and overgrazing in the West Bank have resulted in herders facing decreased access to grazing land, which increases their dependency on imported fodder and making them more vulnerable to fodder price volatility. The sector has, therefore, identified the development of initiatives and national policies to reduce cost of production inputs, especially prices of fodders, fertilizers and pesticides as one of priority policies. This technology will significantly contribute to mitigating impacts of climate change for the sector and agricultural production.

4.2.4 Conservation agriculture

Conservation agriculture is a farming system that maintains a permanent soil cover to assure its protection, avoids soil tillage, and cultivates a diverse range of plant species to improve soil conditions, reduce land degradation and increase water and nutrient use efficiency. It enhances biodiversity and natural biological processes above and below the ground surface for improved and sustained crop productivity.⁴ Most importantly, conservation agriculture can enhance productivity of farmland already in use and can generate land left in poor condition by past misuse.⁵ This technology is tied closely with the sector's policy intervention on protecting the area of land cultivated and from land degradation expanded annually. This is a critical intervention for the sector in meeting the strategic objective of sustainably managing natural and agricultural resources for better adaptation to climate change.

4.2.5 Water harvesting

Water harvesting is a technique of developing surface water resources that can be used to provide water for livestock, for domestic use, and for agriculture. Rainwater conservation and harvesting for agriculture use provides opportunities to reduce the high risk of yield losses associated with low rainfall and uneven distribution throughout the season. This reduces financial risks associated

² Climate Change Adaptation Technologies for Water: A practitioner's guide to adaptation technologies for increased water sector resilience (2017), UN Environment – DHI Centre, Climate Technology Centre and Network (CTCN) and the UNEP DTU Partnership

³ Climate Change Adaptation Technologies for Water: A practitioner's guide to adaptation technologies for increased water sector resilience (2017), UN Environment – DHI Centre, Climate Technology Centre and Network (CTCN) and the UNEP DTU Partnership

⁴ Food and Agriculture Organization (FAO). Conservation Agriculture. Accessed from <http://www.fao.org/3/a-i6169e.pdf>

⁵ Food and Agriculture Organization (FAO). Conservation Agriculture. Accessed from <http://www.fao.org/3/a-i6169e.pdf>

with crop failure.⁶

Water harvesting, specifically rainwater harvesting, for agricultural use is highly relevant to the Palestinian context. Climate change provides additional stress to already limited rainfalls, coupled with restriction on water withdrawal imposed by Israel, in the region. Additionally, drought and growing population present challenges in meeting the agricultural need for the country. Use of alternative water resources, such as rainwater, has been identified as an important adaptation solution in Palestine's NDC. Therefore, this technology is critical in meeting one of the sector's strategic objectives of increasing and efficiently managing the volume of water available to farmers from both traditional and non-traditional sources.

4.2.6 Low-carbon cold chain storage

Palestine's NAP points out that the current post-harvesting storage techniques in the country are inadequate, such as the lack of large-scale grading and refrigerated cold storage. The impacts of climate change such as rising temperatures and more extreme weather events may increase post-harvest losses due to increased likelihood of spoilage and increased risk of pathogen or pest infestation. Conventional measures have been taken to address such losses such as increasing cooling and improving storage capacities. However, these measures translate into higher costs and intensive energy use. There is a need to introduce lower-cost, low-carbon solution through cold chain technologies to improve food security and reduce greenhouse gas (GHG) emissions.

4.3 Water and wastewater sectors

4.3.1 Wastewater collection and treatment plants and advanced wastewater treatment technologies

The Government adopted the Palestinian National Water Strategy from 2013 to 2032, in which the importance of wastewater management and treatment is emphasized, especially access to water and wastewater services and sustainable wastewater management. Four wastewater treatment plants in Gaza and five wastewater treatment plants in the West Bank are already installed and operating. Improving wastewater services and structure is an important topic for Palestine in maintaining health and protecting the environment from pollution. This technology also provides an option in increasing the amount of available water. Use of treated wastewater is currently being investigated within the agricultural sector for possible use in agricultural purposes. This offers an appealing option to the already constrained water availability in Palestine. Access to water is an extremely significant challenge in Palestine.

4.3.2 Water resources monitoring technologies

Water is one of the key components in both the Palestinian economy and the regional geopolitical setting. Moreover, the West Bank and Gaza are facing significant and growing shortfalls in the water supply available for domestic use, and it is thus primordial to assure water security in Palestine. This can be done partly by implementing water resources monitoring systems to manage freshwater resources, collect essential information in characterizing the physical,

⁶ Baako, A.M. (2015). "Promoting On-Farm Water Harvesting and Conservation Techniques for Sustainable Agricultural Production Systems through Capacity Development of Field Extension Officers and Farmers". *Journal of Developments in Sustainable Agriculture* 10, pg. 55-60.

chemical and biological status of water resources, and determine trends and changes over time.

4.4 Transport sector

4.4.1 Upgrade of the existing vehicle fleet

Outdated vehicles emit higher amounts of air pollutants and potent GHGs in the atmosphere, contributing more to pollution and affecting climate change. Therefore, upgrading a large number of the existing vehicle fleet to hybrid/electric cars appears to be one of the potential solutions to tackle the pollution issue in Palestine.

4.4.2 Efficient use of rainwater drainage

Road drainage is provided by shaping the carriageway with a camber or a cross slope. If drainage is not properly done on the road, it can cause quick erosion of the road surface and pavement load bearing capacity reduction, which may cause further damage to the road. As Palestine is a country facing severe water scarcity with extreme risk of flooding depending on the season, the implementation of efficient road drainage technique and the efficient use of the rainwater collected from it presents an appealing solution to tackle both issues.

4.4.3 Flood prevention

Palestinians, especially those who live in the Gaza Strip, live with the threat of temporary displacement, property losses and health risks due to the flooding risk in winter. According to the Water, Sanitation and Hygiene Cluster (WASH), 60 communities in low-lying locations across Gaza, including 560,000 people, have been identified as being at risk of flooding even from light rainfall.⁷ Therefore, flood prevention represents a key issue not only for Palestine, but also for international humanitarian agencies. Nowadays, several technologies exist to prevent flooding and application of these technologies offer a solution to Palestine in addressing and mitigating impacts from flooding and flood risks.

4.5 Solid waste sector

4.5.1 Waste sorting

Palestine would greatly benefit from improving its solid waste sorting practices as about 50 to 55 percent are comprised of organic waste while the rest can be recycled. Having an effective and environmentally safe management of solid waste will allow for other waste handling alternative options, such as recycling and composting technologies, to become financially viable. In addition, this technology will also contribute to waste reduction and reuse previously unsorted materials.

4.5.2 Composting

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. At the same time,

⁷ Poor infrastructure and lack of funding put over 56,000 people at risk of flooding in the Gaza Strip, 2017, OCHA

the final product, compost, are valuable inputs to the soil and serves as fertilizer providing nutrients for agricultural products. Currently, 50 to 55 percent of the waste in Palestine consist of organic waste, which could be composted through this technology. Organic waste in landfills lead to GHG emissions, mainly methane. This technology will contribute in reduction of waste and related GHG emissions.

4.5.3 Recycling

There are existing recycling facilities in Palestine. However, these are mainly small in scale and have limited capacities. This technology will support in reducing waste, especially by sorting and recycling materials that are recyclable which are currently being dumped in disposal sites.

4.6 Other technologies

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

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. Access to safe water, food and sanitation are human rights. In order to fulfill these rights, institutions delivering these services need to be well-resourced and capable in ensuring that these resources are safe and properly managed. The development of monitoring and safety systems of these resources are essential. Such monitoring and safety systems will help reduce the country's vulnerability to major diseases related to water, food and sanitation.

5. Identification and assessment of key barriers

To further inform the prioritization of technologies, each technology shortlisted was assessed to identify key barriers related to the deployment of the technology in the State of Palestine. The approach involved detailed desktop review as well as stakeholders' engagement during working group meetings. This section presents the summary of the key findings in the key barrier identification and assessment report.

5.1 Energy sector

The following technologies in the energy sector have been shortlisted and have been assessed further.

5.1.1 National grid assessment and electricity grid upgrade

Type of barrier	Summary
Political	Lack of access to energy sources / energy generation
Regulatory	Lack of concrete measures related to improving the grid
Institutional	Sectoral fragmentation
Technical	Lack of technical capacity and know-how (O&M, upgrading assessment)
Financial	Lack of financial sources

The political barrier is related to access to energy generated, including from renewable energy sources. The regulatory barrier is related to the lack of identification of measures within the existing regulation on how it will achieve the grid upgrade. Institutionally, the current set up is fragmented as responsibilities of electricity distribution differs in Gaza, and the southern and central West Bank from that of northern West Bank. Currently, the grid network is maintained poorly due to lack of capital to enhance technical skills of key stakeholders, resulting in electricity losses and network outages. This is not limited to regular maintenance but also on performance of pre-assessment and feasibility studies required for the grid upgrade work. Most importantly, there is a significant cost associated to the grid infrastructure upgrade. Palestine lacks in financial resources and will need external support to finance this technology.

5.1.2 Various applications of PV technologies

Type of barrier	Summary
Political	Limitations in terms of integrations to the grid
Regulatory	Palestinian Electricity Transmission Company Ltd. (PETL)'s capacity in off-taking renewable energy is unknown
Geographical	Limitations in terms of land use
Financial	The risk perceived by investors may remain too high to support further penetration of solar PV in the market

Energy generation and transmission to Palestine is controlled by Israel in which it has high expectations related to the stability of renewable energy and integration to the grid. This limits the scale of solar PV power plants that can be implemented and connected to the grid. Related to regulation, the Palestinian Electricity Transmission Company Ltd. (PETL) is responsible for the off-taking of power and providing transmission infrastructure in the West Bank. However, as of

2017, PETL has yet to fulfil either of these roles. Geographically, solar PV technologies require significant land space to set up solar panels. Area C is considered to be the most suitable location to install large scale solar PV power plants, however, is restricted by the low number of construction permits for the area delivered to Palestine from Israel. Financially, due to high perceived risks by potential investors, driven by political tension between Palestine and Israel, there is little room or interest for private sector involvement. This is a barrier on Palestine's already limited financial resources.

5.1.3 Energy efficiency

Type of barrier	Summary
Regulatory	No mandatory standards for energy efficiency in buildings and no clear standards for green buildings
Financial	Significant initial investment required for retrofits and new buildings
Information	Lack of adequate information about potential energy-efficient technologies
Behavioral	Habits and routines may be difficult to change

Regulatory barrier is related to the lack of building and construction codes and standards for energy efficiency in buildings and green buildings. Financially, the technology requires significant initial investment for retrofitting building insulation. In addition, consumers and end users are often poorly informed about market conditions, technology characteristics and their own energy use. This also leads to behavioral barrier in which particular habits and routines make it challenging to change to enhance energy efficiency.

5.1.4 Solar water heating

Type of barrier	Summary
Regulatory	No regulations to support integration of solar water heating into buildings
Technical	Lack of technical capacities in terms of effectively designing and installing solar water heating systems
Financial	High initial investment costs
Market	Limited market for local producers

There is a lack of regulation which allows for the integration, either voluntarily or mandatorily, of solar water heating technologies in the design, planning and construction of new infrastructures such as buildings. The market size is also too small to accommodate and drive enough businesses. Technically, there is a lack of technical capacities for larger installations in Palestine. Financially, the technology requires high initial investment which is a barrier to Palestine given the economic situation of the country.

5.2 Agriculture sector

The following technologies in the agriculture sector have been shortlisted and have been assessed further.

5.2.1 Climate smart agriculture (precision agriculture)

Type of barrier	Summary
Financial	Significant initial investment required
Cultural	Resistance towards changing traditional agricultural practices
Geographical and access to water and equipment	Limitations in terms of access to land, water, and CSA tools and equipment

CSA practices require initial financial support for installation of CSA technologies and for capacity-building activities. Culturally, the barrier exists for change from traditional agricultural practices as some farmers may be resistant towards implementing CSA technologies. Additionally, CSA technologies require access to land, water and CSA specific equipment and tools which present challenges to the Palestinian context.

5.2.2 Efficient irrigation

Type of barrier	Summary
Financial	Significant initial investment required
Cultural	Need for education and training of farmers on efficient irrigation practice

Efficient irrigation requires significant initial investment financially and requires better agricultural practices that would support greater water-use efficiency. This may be challenged by a cultural barrier from having to educate and train farmers on both crop and water productivity.

5.2.3 Resilient animal fodder

Type of barrier	Summary
Financial	Significant initial investment required
Cultural	Hesitation to adopt new practice
Access to local market and geography	Limited local market and supplier for seed; limited access to the necessary water and electricity due to limited access to land

There is a significant initial investment required in addition to regular maintenance and operational costs which may be a constraint to some farmers. Culturally, some users may be hesitant to adopt new practices as it differs from traditional practice. Barriers related to access are related to availability of the local market and to resources such as water and electricity due to limited availability of land.

5.2.4 Conservation agriculture

Type of barrier	Summary
Financial	High cost to acquire no-till farm equipment and external inputs
Cultural	Resistance towards behavior and commitment change
Information	Poor flow of information to farmers

To implement conservation agriculture, it requires access to no-till farm equipment and inputs which are both costly and out of reach for the majority of the resource-constrained farmers. Culturally, as similar to other climate adaptive agricultural practices, farmers may be resistant

towards behavior and commitment change that differ from traditional practice. There is also a barrier related to poor flow of information to farmers on benefits and components of the technology that may hinder from adopting conservation agriculture practice.

5.2.5 Water harvesting

Type of barrier	Summary
Financial	Significant initial investment required
Cultural	Resistance towards implementation of technology and changing traditional agricultural practices
Geographical	Limited area available that meets site specific requirement

Financial investment is required, not only for the technology itself, but also for support in the development of knowledge and capacity building on the use and operation of the technology. Culturally, capacity building is needed to support end users as this practice differs from traditional agricultural practices and therefore, there may be resistance towards the implementation of the technology.

5.2.6 Low-carbon cold chain storage

Type of barrier	Summary
Political	Importing restrictions may entail additional challenges in introducing the technology into Palestine
Regulatory	Patents need to be protected in Palestine
Awareness	Lack of adequate information about potential cold chain technologies

The implementation of this technology requires imports of resources from outside, which is a barrier for Palestine as this is strictly controlled by Israel. In addition, low-carbon cold chain technologies are driven by the private sector which require the need to protect these patents under efficient policies which currently do not exist in Palestine. The information on benefits of the technology will also need to be further developed and shared with end users to support effective implementation of the technology in Palestine.

5.3 Water and wastewater sectors

The following technologies in the water and wastewater sector have been shortlisted and have been assessed further.

5.3.1 Rainwater harvesting

Type of barrier	Summary
Political	Need to apply for construction and rehabilitation permit with Israel
Financial	High construction cost expected in remote areas
Geographical	Limitation in terms of land use
Awareness	Lack of awareness about water contamination risks

The implementation of rainwater harvesting technology in Palestine will require applying for the required construction and rehabilitation permit from Israel. The implementation will also require

high construction cost, especially in remote areas, in which construction will also be limited due to lack of land availability. In addition, there is a barrier related to lack of awareness on risks of water contamination, which will further impose challenges in the implementation of this technology.

5.3.2 Water resources monitoring technologies

Type of barrier	Summary
Political	Need to apply for construction and rehabilitation permit
Institutional	Lack of clarity on entity with responsibility to implement this technology (governance gap)
Financial	High investment cost expected in remote areas
Geographical	Limitation in terms of land use
Awareness	Lack of awareness about water contamination risks

The implementation of water resources monitoring technologies in Palestine will require permits from Israel as water resources are strictly managed by Israel. Access to water is a critical issue in Palestine and implementing technology to monitor the resource may be of concern to Israel. Institutionally, there is a lack of clarity on entity with the responsibility to implement this technology. The technology implementation will also have high construction cost especially for implementation in remote areas. The technology implementation is also limited by availability of land and lack of general awareness on risks from water contamination.

5.3.3 Wastewater collection and treatment plants and advanced wastewater treatment technologies

Type of barrier	Summary
Institutional	Governance gap in the water sector making it unclear which entities is responsible for what
Technical	Lack of adequately trained human resources
Financial	Lack of financial sources
Geographical	Lack of land space
Access to energy	Lack of electricity and fuel for the proper working of the technology

In the water and wastewater sector in Palestine, there is a multitude of government and non-governmental institutions involved which leads to significant institutional fragmentation and lack of coordination between different stakeholders in the sector. The technology is also relatively expensive to implement, which has been identified as a financial barrier. Geographically, wastewater treatment plants require significant land space to implement and this is constrained in the Palestinian context. In addition, the operationalized plant in Gaza currently is experiencing challenges related to lack of electricity and fuel which are affecting the overall operation of the plant.

5.4 Transport sector

The following technologies in the transport sector have been shortlisted and have been assessed further.

5.4.1 Upgrade of the existing vehicle fleet

Type of barrier	Summary
Financial	Meeting infrastructure requirements will require significant investments
Geographical	Limitations in terms of land use
Information	Insufficient information related to the technology and general issue on climate change
Infrastructure	Introduction of EVs at a large scale requires the implementation of infrastructure specific to hybrid/electric cars

Upgrading the existing vehicle fleet to newer and more efficient ones, and specifically, to EVs in Palestine will require installation of numerous EV charging stations and upgrading the power networks over the country which will result in significant construction cost for new infrastructure. The required construction will also be constrained by the limited availability of land in Palestine. The introduction of this technology will also require the necessary road network and infrastructure to support it and will require approval from Israel for installation of new power networks. In addition, there is lack of information available to end users related to both the technology and the issue of climate change and impacts of GHG emissions. This will be a challenge when trying to shift behavior for adoption of this technology.

5.4.2 Public transportation (modal shift)

Type of barrier	Summary
Financial	Facilities and infrastructure requirements will require significant investments
Information	Insufficient information related to the technology and general issue on climate change

To provide the necessary facilities and infrastructure to secure access to public transportation services, as well as develop the related policies and strategies to support the development of the transport sector, significant investments will be required. There is an existing barrier related to availability of information pertaining to the benefits in patronizing public means of transportation. In addition to the economic and social benefits that modal shift leads to, it is also relevant for the public to understand its significant contribution to addressing the issue on climate change and how it reduces greenhouse gas emissions.

5.4.3 Efficient use of rainwater drainage

This technology was removed from the list of technologies as it was identified as a duplication of technology and overlaps with such related to flood prevention and other alternative water harvesting technologies considered under water and wastewater sectors. Therefore, no additional or further assessment was conducted for the technology.

5.4.4 Flood prevention

Type of barrier	Summary
Political	Restrictions on the import of materials in Gaza, upgrade or renovation work in areas B and C in the West Bank
Financial	Meeting infrastructure requirements will require significant investments

The political barrier related to this technology is the restriction on the import of materials into Gaza from Israel as well as the renovation work that is required in both Area B and C in the West Bank. The implementation of technology also requires extensive infrastructure construction work which makes this technology relatively expensive for Palestine and is identified as a financial barrier.

5.5 Solid waste sector

The following technologies in the solid waste sector have been shortlisted and have been assessed further.

5.5.1 Waste sorting

Type of barrier	Summary
Regulatory	No regulations which require the sorting of solid waste either from the household level or central/communal level
Institutional	Ambiguity in roles and responsibilities resulting in overlap in efforts due to variations in interpretations of responsibilities of relevant institutions
Technical	The effective separation of useful materials from unsorted waste is perceived as difficult

Currently, there are no regulations which require the sorting of solid waste either from the household level or central/communal level. Institutionally, the roles and responsibilities of solid waste management in Palestine are distributed among several national institutions which are resulting in overlap of efforts due to variations in interpretations of responsibilities. Technically, there is a need to introduce efficient waste sorting methodologies and technologies to promote alternative options for waste management such as recycling and composting.

5.5.2 Composting

Type of barrier	Summary
Regulatory	Lack of regulations which define standards for various stages of solid waste management
Technical	Technical expertise and know-how specific to composting is required to ensure its quality

For the composting technology, there are currently no regulations which require the sorting of solid waste. There are also no standards for dealing with special, hazardous, and medical wastes. This is a barrier in introducing and implementing the technology. In addition, there is a lack of capacity building, experience, general awareness and participation of local communities that would ensure quality of the technology.

5.5.3 Recycling

Type of barrier	Summary
Regulatory	Current legislations governing the solid waste management sector lack comprehensiveness in addressing solid waste management issues from a modern perspective
Technical	Lack of technical expertise and know-how on recycling technologies

Social	Lack of acceptance of recycled material by end-users
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Introducing recycling in Palestine is limited by the lack of comprehensive regulation that would support the management of solid waste in addition to the need to develop standards for the various stages of solid waste management such as those for recycling operations. Technically, there is a lack of technical expertise and know-how on recycling based on its overall recycling experience. In addition, the adoption of this technology is limited by lack of acceptance from users and stakeholders, which is mainly due to users not being familiar with recycled materials and use of recycled material.

5.6 Other technologies

The following technologies in other sectors have been shortlisted and have been assessed further.

5.6.1 Provision of beach nourishment, reclamation and beach drift rehabilitation

Type of barrier	Summary
Institutional	Need to have coordinated efforts among the responsible institutions, as well as identify which government institution would take the lead
Access to materials	Restrictions on importing materials
Financial	Requires significant investments
Informational	Insufficient information related to the technology and general issue on climate change

There is a need to have coordinated efforts among the responsible institutions, as well as identify which government institution would take the lead. The import of materials related to beach nourishment, reclamation and beach drift rehabilitation such as sand, rocks, cement and steel are restricted by Israel. It is important to address this restriction. The implementation of beach nourishment, reclamation and beach drift rehabilitation technologies will require significant amounts of investments, which cannot be met by national resources alone. There is a general lack of awareness among the public, especially stakeholders of coastal areas in Gaza on the condition of beaches. There is a need to spread awareness on this issue, in particular, the risks associated with exploiting coastal resources, as well as the necessary measures for proper coastal management.

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

Type of barrier	Summary
Technical	Monitoring and safety systems relevant to the Palestinian context need to be identified
Financial	Introducing the technology requires significant investments
Capacity	Capacities of stakeholders need to be strengthened for the identification and use of systems
Awareness	Lack of adequate information about disease prevention in resource scarcity situations

The implementation of this technology will first require the identification of relevant water, food and sanitation monitoring and safety systems suitable for use in Palestine. Generally, the

introduction of this technology requires significant investment which is a barrier for Palestine as it is limited in financial resources. The effective implementation and operation of the technology will also require capacity building activities for stakeholders as well as awareness on disease prevention measures.

6. Assessment of policies

Relevant laws, strategies, policies and action plans in the State of Palestine were assessed to understand the regulatory environment under which technologies will be introduced and to identify potential regulatory gaps for their introduction. The overall policy and regulatory framework relevant to each prioritized technology has been assessed in the policy assessment report, the summary and key findings of which are presented in this section. Table 4 lists the laws and policies reviewed for the assessment.

Table 4 List of laws, regulations, policies and strategies reviewed

Type of document	Document title
Laws and regulations	➤ Environmental Law No. 7
	➤ Legislative decree No. 14/2015 on renewable energy and energy efficiency
	➤ Law No. 12/1995 on the establishment of the Palestinian Energy Authority
	➤ Legislative Decree No. 10/2011 on the Law of Industry
	➤ Decree No.14 relating to the water law (2014)
	➤ Agriculture Law No. 2 (2003)
	➤ Palestinian Local Government Law No. 1 (1997)
Policies and strategies related to development objectives	➤ National Development Plan (2017 – 2022)
	➤ National Policy Agenda (2017 – 2022)
	➤ National Energy Sector Strategy (2017 – 2022)
	➤ National Energy Efficiency Action Plan (NEEAP)
	➤ National Renewable Energy Action Plan (NREAP)
	➤ National Agriculture Sector Strategy (2017 – 2022)
	➤ Agriculture Climate Change Adaptation Action Plan (2018 – 2020)
	➤ Sustainable Use of Agricultural Land Strategy
	➤ National Water Sector Strategy (2017 – 2022)
	➤ National Water Strategy (2013 – 2032)
	➤ National Transport Sector Strategic Plan (2014 – 2016)
	➤ National Transport Sector Strategy (2017 – 2022)
	➤ National Strategy for Solid Waste Management in the Palestinian Territory (2010-2014)
➤ National Solid Waste Sector Strategy (2017 – 2022)	

6.1 Energy sector

The following technologies in the energy sector have been assessed for relevant policies.

6.1.1 National grid assessment and electricity grid upgrade

Palestine's National Policy Agenda (NPA) 2017 – 2022 identifies sustainable development as one of its strategic pillars, with resilient communities' development identified as one of the national priorities. Within this national priority, Palestine has identified expanding community access to reliable energy and increasing energy efficiency and reliance on renewable energy as policy interventions. This national priority is the basis for the development of the national energy strategy, which provides a more exhaustive overview of sector's strategic objectives and required policy interventions. The sector's national strategy identifies four specific objectives in which one of the objectives, enhance energy sector economic effectiveness, speaks directly to the need of grid upgrade that would support achieving energy security through adopting resources diversity and regional connection with neighboring countries' electric networks.

Grid upgrade is significantly important in improving energy efficiency and access to reliable energy as currently grid experiences limitations related to capacity and integration. Most importantly, this technology will be highly needed to meet other strategic objectives as the grid will need to be updated to accommodate increase in local generated power through renewable sources. This technology is also one of the enabling factors for energy trading and exchange, as noted in the strategy. This suggests that a strong policy environment exists in the sector already that would support the introduction of this technology, especially given that this technology is directly aligned with the sector's national objectives.

6.1.2 Various applications of PV technologies

Solar PV technologies link directly to sector's strategic objectives of increasing local generated power from renewable energy sources and increasing the proportion of locally sourced energy in the net energy mix. Achieving these objectives will help reduce dependence on imported energy from Israel and reduce negative environmental consequences, in line with the strategy. This technology will support in achieving such outcomes.

In addition, the sector's national strategy further guided the development of two action plans, NEEAP and NREAP. The NREAP includes national targets for 2020 and 2030, which are:

1. 2020 target: 100 megawatt (MW), mostly PV; and
2. 2030 target (scenario A): 300 MW including only Area A and B; or
3. 2030 target (scenario B): 500 MW including Area A, B, and C.

Importantly, the plan specifies that it aims to achieve 80 percent of the 2030 targets with solar PV, 10 percent with wind, and 10 percent with biogas/biomass. This demonstrates that there is already a strong enabling policy environment present in Palestine that would support the introduction of these technologies related to solar PV. This will allow for an efficient introduction and implementation of these technologies in Palestine.

6.1.3 Energy efficiency

Energy efficiency technology is identified in meeting one of the strategic objectives which aims to generate and consume energy efficiently through adopting energy conservation and reducing losses and consumption. Energy efficiency measures, through building and efficiency codes, will lead to energy conservation and loss reduction. This importance is emphasized in both the sector strategy and in the NPA, identified as a necessary policy intervention, to manage, protect and promote sustainable use and conservation of natural resources, including energy.

However, while this objective and policy intervention exist and align with the sector's national strategy, it is not yet implemented or mandated to further support the creation of an enabling environment for the introduction of this technology. In Palestine, buildings and construction codes and standards are still insufficient. Currently, there are still no mandatory standards for energy efficiency in buildings and no clear standards for green buildings. Thus, mandating the relevant policy and defining required standards for each building, will be extremely important to support the transfer and replicability of the technology in the country.

6.1.4 Solar water heating

Increasing locally generated power, from renewable energy sources, is an important objective for the sector. In addition, use and application of solar PV technologies is a priority for Palestine in meeting its renewable energy targets, as supported by the sector's national strategy and relevant energy efficiency action plans. NREAP clearly states that majority of targets will be met by solar PV energy production. This supports the creation of an enabling policy environment for the introduction of solar water heating technology in Palestine. However, while relevant regulation exists in supporting the technology, it is not yet implemented or mandated that would support the wide introduction and adoption of this technology. The regulation will need to be implemented in order to further enhance the enabling policy environment for effective introduction of this technology.

6.2 Agriculture sector

The following technologies in the agriculture sector have been assessed for relevant policies.

6.2.1 Climate smart agriculture (precision agriculture)

Palestine developed the Agricultural Sector Climate Change Adaptation Action Plan 2018-2020, which identifies a number of priority interventions. This includes climate-smart agriculture. This plan is in line with the National Action Plan (NAP) and details the climate rationale for the intervention. In addition, promoting and enforcing climate-smart and adaptive, biodiversity-protecting and desertification-combating agricultural policies and technologies is one of policy interventions identified by the sector in meeting its strategic objective to sustainably manage its resources. As highlighted by the Ministry of Agriculture (MOA), there is a large support for the use of climate smart agriculture technologies in Palestine, which is one of Palestine's priority actions. This suggests that there is a strong enabling policy environment for the introduction of this technology in Palestine.

6.2.2 Efficient irrigation

Similar to precision agriculture, the sector's Climate Change Adaptation Action Plan identifies enhancing sustainable community-level irrigation schemes and infrastructure and improving water-use efficiency and using alternative water resources as key policy interventions. This links directly to the sector's strategy in which, as one of defined interventions, increasing the efficiency of the available water is critical in meeting the objective of sustainable managing natural and agricultural resources. According to the MOA, there is already a regulation in place to decrease inefficiencies in water use for irrigation purpose. This suggests that there is an enabling policy environment already in place in Palestine to introduce this technology.

6.2.3 Resilient animal fodder

A number of agricultural by-laws were adopted after the issuance of the Agriculture Law No. 2, including the fodder by-law that supports national standards and specifications of fodders. In addition, one of the sector's strategic objectives focus on increasing agricultural production, productivity, and competitiveness in local and international market, along with their contribution in gross domestic product and food security. In meeting this strategic objective, one of the policy priorities identified by the sector is to develop initiatives and national policies to reduce cost of production inputs, especially prices of fodders, fertilizers and pesticides. The existence of these

relevant by-laws and policies are also confirmed by the MOA. This suggests that there is an enabling policy environment in place that supports the introduction of this technology in Palestine.

6.2.4 Conservation agriculture

One of the strategic objectives for the sector's strategy plan is to sustainably manage natural and agricultural resources. Relevant policy intervention identified is to protect area of land cultivated or from land degradation expanded annually. In support of meeting this objective, the sector has developed Sustainable Use of Agricultural Land Strategy and drafted legislation and procedure manuals in the field of agricultural land management, soil fertility and use of fertilizers. In addition, a national strategy is currently in place for this technology which suggests that an enabling policy environment exists in introducing the technology. This technology also links to the sector's national strategic objective to sustainably manage natural and agricultural resources that adapt better to climate change. Therefore, there is a strong policy and directional support in the use and implementation of this technology in the Palestinian context.

6.2.5 Water harvesting

Similar to efficient irrigation, one of the policy interventions identified for meeting the strategic objective of sustainably managing natural and agricultural resources is to increase and efficiently manage the volume of water available to farmers and livestock breeders from traditional and non-traditional sources. The sector has already worked significantly to implement the application of water harvesting techniques at the experimental capacity. The MOA is also working closely with the private sector, non-governmental and farmers' organizations to implement projects relate to water harvesting interventions. In addition, a by-law currently exists which supports the application of water harvesting in Palestine, suggesting that a strong enabling policy environment exists to introduce the technology.

6.2.6 Low-carbon cold chain storage

Addressing food security is one of the five strategic objectives identified under the sector's strategic plan. The objective is to enhance natural and agricultural production, productivity, and competitiveness in local and international market while contributing to gross domestic product and food security. Food security is a critical priority when addressing impacts of climate change. This technology will allow for the necessary policy intervention that would provide food security for Palestine and therefore, the implementation of this technology is supported by an enabling policy environment, as supported by the sector's strategic plan.

6.3 Water and wastewater sectors

The following technologies in the water and wastewater sector have been assessed for relevant policies.

6.3.1 Rainwater harvesting

PWA's strategic plan 2017-2022 identified lack of available water resources as a priority issue related to water resources. In order to address this issue, integration of management and sustainable development of the water resources, both quantitatively and qualitatively, has been identified as a strategic goal. One of the objectives for this strategic goal includes increasing the

availability of water, both quantitatively and qualitatively, from both conventional and unconventional water resources, including rainwater. Palestine is challenged with water shortage due to limited withdrawal limit imposed by Israel. Use of rainwater in meeting the water shortage would increase the total amount of water available for use by Palestinians. Thus, this technology is highly relevant for the sector. The Ministry of Local Government (MOLG) has also developed a regulation for rainwater harvesting, further encouraging the use of this technology in increasing the water availability. This suggests that there is an enabling policy environment in introducing the technology in Palestine for successful deployment of the technology in the country.

6.3.2 Water resources monitoring technologies

This technology has been proposed as a policy intervention to meet the strategic goal of integrating management and sustainable development of water resources. The necessary policy intervention is to monitor different water resources, both quantitatively and qualitatively, including violations. This addresses the need to efficiently manage water resources in Palestine as availability of water is significantly limited and restricted by Israel. This suggests that an enabling policy environment exists that would support in introducing this technology.

6.3.3 Wastewater collection and treatment plant and advanced wastewater treatment technologies

Improving wastewater services and structure including collection, treatment and reuse is a strategic goal for the sector component related to water supply. This technology will be extremely important in maintaining public health and protecting environment from pollution, increasing the efficiency of wastewater systems and increasing the agricultural areas suitable for treated water irrigation from unconventional water resources. According to Palestinian Water Authority (PWA), there are currently regulations in place on wastewater and wastewater management in Palestine, suggesting there is a supporting policy environment in place.

6.4 Transport sector

The following technologies in the transport sector have been assessed for relevant policies.

6.4.1 Upgrade of the existing vehicle fleet

In supporting the introduction of this technology in Palestine, the Ministry of Transportation (MOT) has already introduced regulations that promote electric vehicles in Palestine, and also for the related infrastructure. In addition, the Ministry offers relevant tax breaks and incentives that allow for the creation of a strong enabling policy environment for the technology.

6.4.2 Public transport (modal shift)

The MOT, as similar to other ministries, has a strategic national plan in place that identify strategic goals and objectives. Modal shift is a key climate change mitigation intervention and the Ministry has introduced relevant policy and regulations to support the introduction of this technology. While the Ministry cannot force the Palestinian population to adopt modal shift, supportive enabling policy environment exists for the technology implementation.

This technology was not originally shortlisted during the earlier process. However, based on

discussions with stakeholders during the second mission, it was agreed upon by stakeholders that this technology is a priority technology. Therefore, no further assessments are included in the report.

6.4.3 Flood prevention

Flood prevention specific to road transportation networks is not supported under the existing policy environment. Upon further discussions and assessment with relevant stakeholders, it was agreed that this technology be considered as an inclusion to the broader prioritized technology of rainwater harvesting.

6.5 Solid waste sector

The following technologies in the solid waste sector have been assessed for relevant policies.

6.5.1 Waste sorting

As per the sector's national strategy 2017 – 2022, there is a strategic objective in place that addresses the need for effective and environmentally safe solid waste management services. One of the strategic interventions in meeting this objective is to enhance solid waste reduction, reuse, recycle, and energy generation before final disposal in regional landfills, which would be met through effective waste sorting technology. To support this, the MOLG prepared a general strategy and policies that would meet the sector's strategic objective. However, as per the Ministry, there is a lack of detailed policies specifically on waste sorting that would further support the introduction of this technology. This is needed in order to create an environment that would enable successful implementation of waste sorting technology.

6.5.2 Composting

Similar to waste sorting, the sector's national strategy has a strategic objective to enhance effective and environmentally safe solid waste management services in Palestine in which a number of strategic policies are identified. However, as per the MOLG, while general strategy on solid waste management services and national standards and policies on composting material currently exist in Palestine, these policies and regulations have not been efficiently implemented. Therefore, while relevant policies, regulations and standards exist, there lacks an existence of an enabling policy environment for the introduction of this technology without the implementation of these policies and regulations.

6.5.3 Recycling

The sector's national strategic objectives identify the need to develop effective and environmentally safe solid waste management services. While this objective exists, along with a number of strategic policies, the MOLG confirmed that there are currently no regulations in place in Palestine specifically on recycling. This suggests that while strategic objectives exist, there is currently a lack of enabling policy environment to support the introduction of this technology.

6.6 Other technologies

For other technologies, the following technologies have been assessed for relevant policies.

6.6.1 Provision of beach nourishment, reclamation and beach drift rehabilitation

This is a national priority to Palestine to ensure safety of the people in these areas from impacts of climate change. Therefore, there is a strong support in this aspect that suggests that an enabling policy environment exists in Palestine. However, a specific technology will need to be identified prior to proceeding for further consideration of this technology for the roadmap implementation.

This technology was not scored by stakeholders during the process of shortlisting technologies. However, based on stakeholder discussion during the second mission, it was agreed upon by stakeholders that this technology should be prioritized, given it is a national priority. Therefore, the assessment was not included as part of the report.

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

One of the waste sector's strategic objectives speak to the need to implement suitable procedures and mechanisms for handling hazardous, medical and special solid wastes. Relevant policy interventions include establishment of follow-up system to evaluate and trace hazardous wastes and development of correct handling procedures and treatment of medical solid waste to reduce environmental impacts. This suggests that necessary policies are in place to support the introduction of this technology. In addition, the Ministry of Health (MOH) has implemented supporting policies. The Ministry of National Economy (MONE) has also prepared the draft Food Safety Law, which further support the policy environment for this technology.

6.7 Summary

For prioritized technologies, relevant policies were assessed to identify policy gaps that would prohibit these technologies to be introduced in Palestine. Overall, policies generally exist in Palestine that support the creation of an enabling environment. This was also confirmed by relevant stakeholders. However, there are gaps for some technologies that will require implementation of these policies in order to enhance the enabling environment.

Sector	Technology	Policy gap
Energy	National grid assessment and electricity grid upgrade	• No or almost no policy gap; enabling environment exists
	Various applications of PV technologies	• No or almost no policy gap; enabling environment exists
	Energy efficiency	• Policy exists; however, it is not implemented or mandated
	Solar water heating	• Policy exists; however, it is not implemented or mandated
Agriculture	Climate smart agriculture (precision agriculture)	• No or almost no policy gap; enabling environment exists
	Efficient irrigation	• No or almost no policy gap; enabling environment exists
	Resilient animal fodder	• No or almost no policy gap; enabling environment exists

	Conservation agriculture	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
	Water harvesting	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
Water and wastewater	Rainwater harvesting	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
	Water resources monitoring technologies	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
	Wastewater collection and treatment plants and advanced wastewater treatment technologies	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
Transportation	Upgrade of the existing vehicle fleet	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
	Public transportation (modal shift)	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists
Solid waste	Waste sorting	<ul style="list-style-type: none"> Policy exists; however, it lacks in details and not specific to 6R waste sorting specifically
	Composting	<ul style="list-style-type: none"> Policy exists; however, it is not efficiently implemented
	Recycling	<ul style="list-style-type: none"> Lack of policy
Others	Provision of beach nourishment, reclamation and beach drift rehabilitation	<ul style="list-style-type: none"> No or almost no policy gap; this is a national priority
	Development of water, food and sanitation monitoring and safety systems using high technology related to health	<ul style="list-style-type: none"> No or almost no policy gap; enabling environment exists

7. Assessment of financial and non-financial derisking measures

For prioritized technologies, key barriers were identified through the key barriers assessment (section 5). For barriers identified for each technology, measures to overcome these barriers were identified for successful transfer of these technologies to the State of Palestine. Both financial and non-financial measures were assessed and identified including derisking arrangements related to private, public and financial derisking. The details are presented in the financial and non-financial measures identification report. This section summarizes its key findings.

For this assessment, UNDP's Renewable Energy Investment Framework approach was applied. Different types of derisking assessed for each technology include the following:

- Private risk: risks directly related to a project, such as risks arising from the unavailability of the material required, limitations in infrastructure, credit quality (counterparty risk), and others;
- Public risks: risks related to policy and regulatory frameworks, such as risks arising from limitations and uncertainties in the market, and/or suboptimal regulations to address these limitations, permit risks and others; and
- Financial risks: risks related to the cost of capital, such as risks arising from scarcity of investor capital (debt and equity) in Palestine for a particular sector, from the country's macro-economic performance and others.

Derisking approaches assessed for each type of risk is summarized in the table below.

Type of risk	Derisking approaches
Private derisking	<ul style="list-style-type: none"> ➤ Capacity building ➤ Awareness programmes
Public derisking	<ul style="list-style-type: none"> ➤ Policy measures ➤ Regulatory instruments ➤ Standards and codes, i.e., grid codes, building codes, etc.
Financial derisking	<ul style="list-style-type: none"> ➤ Feed in tariffs ➤ Tax breaks ➤ Payments against results (Result based finance) ➤ Carbon derisking

7.1 Energy sector

The following technologies in the energy sector have been shortlisted and have been assessed further.

7.1.1 National grid assessment and electricity grid upgrade

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Political	Lack of access to energy sources / energy generation	Agreement with Israel
Public risk	Regulatory	Lack of concrete measures related to	Development of detailed

		improving the grid	regulations
Public risk	Institutional	Sectoral fragmentation	Development of a cooperation framework
Private risk	Technical	Lack of technical capacity and know-how (O&M, upgrading assessment)	Capacity building
Financial risk	Financial	Lack of financial resources	External financing

For grid upgrading, public derisking involves negotiations with Israel in relation with accessing energy resources and energy generation in the country, the development of concrete measures and regulations detailing how the grid will be assessed and upgraded, as well as clear institutional arrangements. Private derisking involves capacity building related to the grid assessment, operation and maintenance. Financial derisking is related to sourcing external resources to introduce the technology.

While public derisking can mainly be led and implemented by the Palestinian Government without external support or with almost no external support, technical assistance and financial derisking will require significant external support from donors. Overall, the development of the technology will require lengthy negotiations related with energy access and generation, which will come in addition to measures required to assess grid upgrading requirements. This suggests that grid upgrading may be implemented in the long term.

7.1.2 Various applications of PV technologies

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Political	Limitations in terms of integrations to the grid	Negotiations
Public risk	Geographical	Limitations in terms of land-use	Negotiations
Public risk	Regulatory	PETL's capacity in off-taking renewable energy is unknown	Development of regulations and incentives
Financial risk	Financial	The risk perceived by investors may remain too high to support further penetration of solar PV in the market	Financial scheme

For the application of PV technologies, financial derisking involves additional support to private developer. While there are already derisking programmes for solar PV technologies in Palestine, such as Sustainable Use of Natural Resources and Energy Finance (SUNREF), those mainly target small and medium scale projects. Larger projects may require additional support as the risks involved can be perceived as higher by investors.

Although financial derisking for smaller scale projects may be conducted by Palestine with fewer support from international partners, public derisking may require external support for the capacity building of PETL and the development of regulations such as feed-in-tariffs. Other types of public derisking mainly involve negotiations with Israel, and require a significant involvement from Palestine. However, it is important to emphasize that negotiations will be crucial in order to implement the technology in integration with the grid.

7.1.3 Energy efficiency

Type of risk	Type of barrier	Summary	Derisking approach
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Public risk	Regulatory	No mandatory standards for energy efficiency in buildings and no clear standards for green buildings	Development of standards
Financial risk	Financial	Significant initial investment required for retrofits and new buildings	Financial incentives and financial schemes
Private risk	Information	Lack of adequate information about potential energy-efficient technologies	Awareness campaigns
Private risk	Behavioral	Habits and routines may be difficult to change	Awareness campaigns

One of the main barriers faced by energy efficiency in Palestine is the absence of mandatory standards for energy efficiency in buildings and of clear standards for green buildings. Public derisking is related to formulating the relevant policy environment for energy efficiency. Private derisking involves the development of outreach and awareness campaigns in order to provide the relevant information to building owners and act on behavioral barriers.

Finally, financial derisking involves the development of financial schemes incentivizing energy efficiency measure, which will support private stakeholders in covering the initial investment costs.

Although outreach campaigns may be conducted by Palestine with almost no support from international partners, Palestine will require external support for the development of capacity building programme related to the development of standards for energy efficient building. While Palestine will need to design an attractive scheme for private sector engagement, it is expected that it could rely on external financing sources to fund part of the incentive scheme.

The potential engagement of the private sector, the potential market for energy efficiency and the fact that derisking measures do not require complex negotiations suggest that energy efficiency may be feasible on a short term basis.

7.1.4 Solar water heating

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Regulatory	No regulations to support integration of solar water heating into buildings	Development of detailed regulations
Public risk	Market	Limited market for local producers	Support to local producers
Private risk	Technical	Lack of technical capacities in terms of effectively manufacturing, designing and installing new and efficient technologies for solar water heating systems	Capacity building
Financial risk	Financial	High initial investment costs	Incentives and financial schemes to support investments

Public derisking involves the development of a local market through the development of regulations for the integration of solar water heating into the design, planning and construction of new infrastructures. Private derisking is related to the development of capacities on the technical aspects of solar water heating systems, especially after the introduction of regulations. Finally, financial derisking involves the development of incentives schemes that will support investments from building owners as well as small-holders in solar water heating systems, as initial investment

costs remain significant.

Palestine will require external support for the development of capacity building programme related to the development of standards and of local capacities in manufacturing, designing and installing solar heaters. While Palestine will need to design an attractive scheme for private sector engagement, it is expected that it could rely on external financing sources to fund part of the incentive scheme.

Overall, the development of the technology will require building the market for local producers. While this requires time and efforts, the potential engagement of the private sector, given that it is supported by the relevant enabling environment, suggests that these solar water heating technologies are feasible on a short term basis.

7.2 Agriculture sector

The following technologies in the agriculture sector have been shortlisted and have been assessed further.

7.2.1 Climate smart agriculture (precision agriculture)

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	Significant initial investment required	Incentives and financial schemes to support investments
Private risk	Cultural	Resistance towards changing traditional agricultural practices	Awareness campaigns and development of farmers' organizations and cooperatives
Public risk	Geographical and access to water equipment	Limitations in terms of access to land, water, and CSA tools and equipment	Incentives and financial schemes to support investments and negotiations

Financial derisking involves the provision of adequate financing schemes directed toward farmers, communities and the public sector. It could include blended finance schemes, which would support the provision of concessional finance to local stakeholders. This can be combined with public derisking, with the provision of subsidies for farmers and other stakeholders to purchase inputs and equipment, or through the provision of public budget (grants) in a blended finance scheme. As the technology is also related to accessing water, negotiations with Israel will also be crucial to secure the water resources needed for application of the technology.

As there might still be some resistance towards changing traditional agricultural practices, private derisking will involve support to farmers' organizations and cooperatives in the form of capacity building, in order for them to lead change at local level, as well as outreach campaigns.

While financial and public derisking will require external support and the involvement of the private sector, given that the private derisking could be led by the Palestinian government, with an effort from local farmers' group, this technology is feasible in the short term.

This is strongly supported by the fact that there are already some success stories in Palestine in the use and application of climate smart agriculture technologies, such as bio-digesters for the production of biogas for electricity generation. With respect to the land and water availability related to public derisking, this will require negotiation with Israel which is not achievable in the short-term. However, Palestine could focus on the area that is currently available for the application of CSA technologies.

7.2.2 Efficient irrigation

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	Significant initial investment required	Incentives and financial schemes to support investments
Private risk	Cultural	Need for education and training of farmers on efficient irrigation practice	Capacity building

For the introduction of efficient irrigation, financial derisking mainly involves is the introduction of financial incentives to overcome the high costs associated with these systems. These financial incentives could be provided by introducing schemes on installation of the irrigation systems as capital subsidy and remaining amount could be sourced through low interest debts and farmer contributions. Cultural barriers can be overcome by private derisking, through capacity building, which would mainly involve clear information on how the technology works and on its impact on cultivation itself.

Palestine will require external support in financial derisking related to the technology. However, the technology has minimal barriers related to occupational challenge. Thus, this technology is feasible in the short term.

7.2.3 Resilient animal fodder

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	Significant initial investment required	Incentives and financial schemes to support investments
Private risk	Cultural	Hesitation to adopt new practice	Capacity building
Public risk	Access to local market and geographical	Limited local market and supplier for seed; limited access to the necessary water and electricity due to limited access to land	Negotiation; support to local producers

The introduction of animal fodder will require financial, private and public derisking. Financial derisking involves the development of subsidy programs, which will support the creation of the enabling environment for potential private sector involvement. Private derisking is related to the development of demonstration plots where this technology could be applied and tested, providing local farmers an opportunity to experience benefits of this technology. Public derisking involves the development of a local market through the introduction of financial models and negotiations for the access to energy and water.

Overall, the development of the technology will require building the market for local producers. While this requires time and efforts, the potential engagement of the private sector, given that it

is supported by the relevant enabling environment in which this technology is already applied in Palestine, suggests that this technology is feasible on a short term basis.

7.2.4 Conservation agriculture

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	High cost to acquire no-till farm equipment and external inputs	Incentives and financial schemes to support investments
Private risk	Cultural	Resistance towards behavior and commitment change	Capacity building
Private risk	Information	Poor flow of information to farmers	Awareness campaign

The introduction of conservation agriculture will require financial and private derisking. Financial derisking involves the development of financial schemes that may allow local farmers to access some level of mechanization and access to specific equipment. This may for example be done through leasing. Private derisking requires the development of capacity building with continuous information dissemination and training activities delivered to individual farmers and farmer groups, among other activities, in order to address the information gaps.

Similar to CSA technologies, an external support is required for financial derisking in providing the necessary tools, input and equipment accessible. However, private derisking can be led by the Palestinian government, without external support. The technology also allows for application within the current jurisdiction of Palestine, which makes this feasible in the short term.

7.2.5 Water harvesting

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	Significant initial investment required	Incentives and financial schemes to support investments
Private risk	Cultural	Resistance towards implementation of technology and changing traditional agricultural practices	Capacity building
Public risk	Geographical	Limited area available that meets site specific requirement	Negotiation

For water harvesting, financial derisking mainly involves the development of subsidies to farmers in order for them to adopt water harvesting technologies. Private derisking activities will focus on campaigns to build water scarcity awareness in agricultural communities and on potential end use of water harvesting technologies. Public derisking is related to securing the land for water harvesting, which may be done through negotiations with Israel.

Palestine will need external assistance in financial derisking while the application of the technology in areas favorable to the site specificity will require communications with Israeli occupation authorities over Area C. However, by focusing on the area under current jurisdiction of Palestine, this technology is feasible in the short-term.

7.2.6 Low-carbon cold chain

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Political	Importing restrictions may entail additional challenges in introducing the technology into Palestine	Negotiations
Public risk	Regulatory	Patents need to be protected in Palestine	Development of regulations
Private risk	Awareness	Lack of adequate information about potential cold chain technologies	Awareness campaigns

This technology will require both public and private derisking. Public derisking will involve negotiations related to the importation of material required for the development of cold chains. It will also involve the development of legal protection for patents related to these technologies. Private derisking may involve awareness campaigns, which would explain the merits of low-carbon cold chain technologies, especially in terms of cost savings could constitute a mitigation option.

The technology requires significant derisking for the private sector to get involved. It is not clear whether Palestine can ensure that patents are protected under its current legal system, which might discourage technology providers, until this becomes possible.

7.3 Water and wastewater sectors

The following technologies in the water and wastewater sectors have been shortlisted and have been assessed further.

7.3.1 Rainwater harvesting

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Political	Need to apply for construction and rehabilitation permit with Israel	Negotiations
Financial risk	Financial	High construction cost expected in remote areas	Financial schemes
Public risk	Geographical	Limitation in terms of land-use	Negotiations
Private risk	Awareness	Lack of awareness about water contamination risks	Capacity building

The introduction of rainwater harvesting will require public, financial and private derisking. Public derisking involves seeking international support and solidarity in addition to communications with Israeli occupation authorities related to construction and rehabilitation, as well as with land-use. Financial derisking may involve the development of incentive schemes, especially for remote areas, where the cost of the technology will be significantly higher. Private derisking may include capacity building related to operation and maintenance.

Palestine will need external assistance in capacity building, while the application of the technology in areas favorable will require negotiation with Israeli occupation in Area C. However, by focusing on the area under Palestine's current jurisdiction, the implementation of this technology seems feasible in the short-term.

7.3.2 Water resources monitoring technologies

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Political	Need to apply for construction and rehabilitation permit	Negotiations
Public risk	Institutional	Lack of clarity on entity with responsibility to implement this technology (governance gap)	Development of detailed regulations
Financial risk	Financial	High investment cost expected in remote areas	Financial schemes
Public risk	Geographical	Limitation in terms of land-use	Negotiations
Private risk	Awareness	Lack of awareness about water contamination risks	Awareness campaigns

The introduction of water resources monitoring technologies requires the introduction of a number of measures. Public derisking involves negotiations to monitor water resources, which are currently controlled by Israel in the West Bank. It will also be important to clarify, through the development of detailed regulations, the responsibilities of each stakeholders in the sector for water monitoring. Financial derisking relates to the investment required for the introduction of the technology and to train human resources. The Government may also make the private sector accountable for the safety of water provided to citizens through the implementation of quality standards and strong regulations. Private derisking involves the development of capacity building programmes for local engineers.

While financial derisking can mainly be implemented by the Palestinian Government without or with almost no external support, capacity building will require significant external support from donors. Overall, the development of the technology will require lengthy negotiations with Israel for cooperation, which will come in addition to the implementation of detailed regulations and policies. This suggests that water resources monitoring technologies may be implemented in the long term.

7.3.3 Wastewater collection and treatment plants and advanced wastewater treatment technologies

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	Lack of financial resources	Financial schemes
Public risk	Geographical	Lack of land space	Negotiations
Public risk	Institutional	Governance gap in the water sector making it unclear which entities is responsible for what	Development of detailed regulations
Private risk	Access to energy	Lack of electricity and fuel for the proper working of the technology	Develop internal energy sources
Private risk	Technical	Lack of adequately trained human resources	Capacity building

For this technology, financial derisking involves the development of a financial scheme under the polluter pays principle, which could support investment in treatment plants. Public derisking mainly involves securing land for the construction of treatment plants, through negotiations with Israel. It will also involve clarifying the current governance framework for the sector. Private derisking is related to the development of internal energy sources to power the plants, such as in Gaza, as well as training adequate human resources.

In the case Palestine chooses the polluter's pay principle, financial derisking can mainly be

implemented by the Palestinian Government without or with almost no external support. While capacity building may require external support from donors, this can be done at relatively low-costs.

Additionally, the Palestinian Government was able to obtain written consent from Israeli Authorities to allow the Palestinian Government to import all related equipment needed for the implementation of wastewater treatment plants, and confirmation that Israeli military forces would not threaten this type of projects. Therefore, the implementation of this technology seems feasible in the short-term.

7.4 Transport sector

The following technologies in the transport sector have been shortlisted and have been assessed further.

7.4.1 Upgrade of the existing vehicle fleet

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Infrastructure	Introduction of EVs at a large scale requires the implementation of infrastructure specific to hybrid/electric cars	Development of new power infrastructure, negotiations with Israel for more electricity supply
Financial risk	Financial	Meeting infrastructure requirements will require significant investments	External resources
Public risk	Geographical	Limitations in terms of land-use	Negotiations
Private risk	Informational	Insufficient information related to the technology and general issue on climate change	Awareness campaigns

For this technology, public derisking is related to the development of new infrastructure, such as charging stations and renewable energy capacities, as well as negotiations with Israel related to land-use. Financial derisking is related to meeting infrastructure requirements, which are significant. Private derisking is related to improving awareness in relation to the technology and its benefits.

Palestine will require external support for the development of infrastructure and financing. However, it is uncertain that donors and financial institutions would commit to such investments. One major barrier, which may only be overcome by negotiating or obtaining independence on grid management / upgrading, is the integration of renewable energy to the grid and its connection to charging stations. This suggests that this technology may be more adapted for a long-term perspective.

7.4.2 Public transportation (modal shift)

Type of risk	Type of barrier	Summary	Derisking approach
Financial risk	Financial	Facilities and infrastructure requirements will require significant investments	External resources

Private risk	Informational	Insufficient information related to the technology and general issue on climate change	Awareness campaigns
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Financial derisking for modal shift is related to meeting facilities and infrastructure requirements which needs significant investments. Private derisking is related to improving awareness in relation to the technology, its benefits and general issue on climate change.

Palestine will require external support to develop its transport infrastructure and facilities to enhance its public transportation services and encourage shift in behavior to utilize public transport instead of using private vehicles.

7.4.3 Flood prevention

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Political	Restrictions on the import of materials in Gaza, upgrade or renovation work in areas B and C in the West Bank	Negotiations
Financial risk	Financial	Meeting infrastructure requirements will require significant investments	External resources

Introducing this technology will require public and financial derisking. Public derisking mainly involves negotiations with Israel for the import of materials in Gaza as well as approvals for renovation or upgrade in Area C.

Palestine will require external support for the financing of infrastructure. One major barrier, which may only be overcome by negotiation, is to obtain less strict importation rules for materials in Gaza. This suggests that implementing this technology in Palestine in areas where it is most needed may be conditional to a number of long term factors.

7.5 Solid waste sector

The following technologies in the solid waste sector have been shortlisted and have been assessed further.

7.5.1 Waste sorting

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Regulatory	No regulations and policies which promote and enforce the sorting of solid waste either from the household level or central/communal level.	Development of regulations and policies
Public risk	Institutional	Ambiguity in roles and responsibilities resulting in overlap in efforts due to variations in interpretations of responsibilities of relevant institutions	Clarification of roles and responsibilities
Public risk	Technical	The effective separation of useful materials from unsorted waste is perceived as difficult	Technology transfer and awareness campaigns

Waste sorting mainly involves public derisking, which may include the development of regulations detailing waste sorting responsibilities, the roles of responsibilities of each organization, as well as the transfer of technologies and methodologies used for waste sorting in other countries.

Palestine may require support from international partners for technology transfer and the development of pilots. This technology does not require negotiations with Israel, which suggests that it is relatively easy to implement.

7.5.2 Composting

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Regulatory	Lack of regulations to enforce standards established for composting	Development of regulations
Public risk	Technical	Technical expertise and know-how specific to composting is required to ensure its quality	Capacity building

Similarly to waste sorting, introducing composting technologies mainly involves public derisking, with a component on regulations and another related to capacity building. Palestine may require support from international partners for capacity building on the quality of compost. This technology does not require negotiations with Israel, which suggests that it is relatively easy to implement, if land can be secured.

7.5.3 Recycling

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Regulatory	Current legislations governing the solid waste management sector lack comprehensiveness in addressing solid waste management issues from a modern perspective, including its efficient enforcement	Development of regulations and enforcement
Public risk	Technical	Lack of technical expertise and know-how on recycling technologies	Capacity building
Private risk	Social	Lack of acceptance of recycled material by end-users	Awareness campaigns and capacity building

Introducing this technology will require both public and private derisking. Public derisking is related to the development of detailed regulations related to solid waste management, which should enable to clarify roles and responsibilities as well as income streams for the organizations responsible for solid waste management, among others. Capacity building, related to the operation of the technology itself, will also be required. Private derisking is related to the development of awareness campaigns and capacity building will be required to ensure stakeholders understand the benefit and the need of this technology, as well as to develop value chains that integrate recycled material.

Palestine has already received support from Japan International Cooperation Agency (JICA) on solid waste management. The development of regulations and capacity building will require additional support from other international partners. If land can be secured, the technology could be implemented quickly. Private derisking may be implemented by Palestine with almost no

external support. However, Palestine may need support to develop value chains integrating recycled material.

7.6 Other technologies

The following technologies from other sectors have been shortlisted and have been assessed further.

7.6.1 Provision of beach nourishment, reclamation and beach drift rehabilitation

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Institutional	Need to have coordinated efforts among the responsible institutions, as well as identify which government institution would take the lead	Designation of roles and responsibilities
Private risk	Access to materials	Restrictions on importing materials	External support and negotiations
Financial risk	Financial	Requires significant investments	External support
Private risk	Informational	Insufficient information related to the technology and general issue on climate change	Awareness campaigns

The development of beach nourishment, reclamation and beach drift rehabilitation technologies will require significant external support from donors. This applies not only in terms of providing financial resources, but also direct involvement in implementation and management, to potentially alleviate the barrier on access to materials.

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

Type of risk	Type of barrier	Summary	Derisking approach
Public risk	Technical	Monitoring and safety systems relevant to the Palestinian context need to be identified	Technology transfers
Public risk	Capacity	Capacities of stakeholders need to be strengthened for the identification and use of systems	Capacity building
Private risk	Awareness	Lack of adequate information about disease prevention in resource scarcity situations	Awareness campaigns
Financial risk	Financial	Introducing the technology requires significant investments	External support

Palestine may require support from international partners for technology transfer and capacity building related to the management of such systems, as well as for financing. It is important to emphasize that technologies require significant capacity building and system requirements, which are prerequisites in implementing the technology.

7.7 Conclusion and recommendations

This assessment identified potential measures for derisking technologies on the long list. The set of measures will be more or less complex to implement depending on the technology. Additionally, some technologies may require the full set of proposed measures to be attractive, while others may be able to take up with partial derisking measures. Technologies with less complex sets of derisking measures may be implemented faster.

8. Final prioritization of technologies: approach and result

The shortlisted technologies were further assessed, based on findings and results from the key barrier identification and assessment report, policy assessment report, and financial and non-financial measures identification report. To further assess technologies in consideration of their potential for short-term, medium-term and/or long-term introduction, level of derisking measures for its introduction, and the level of external support required, an additional set of three criteria were introduced in the prioritization process as follow:

1. Feasibility of current policy environment;
2. Risk assessment; and
3. The need for external support for the introduction of technologies.

The scoring of the technologies for the additional three criteria was conducted through targeted consultations with sectoral working groups. Detailed discussions on technologies took place during a series of working group meetings with stakeholders from each sector in which feedback were collected. After which, a prioritization workshop was organized with the purpose to finalize the prioritized technologies for each sector.

This resulted in the final list of prioritized technologies for the Technology Roadmap. A total of 19 technologies were prioritized. This list is presented below, in order of ranking, for each technology in each sector.

Sector	Technology
Energy	1. National grid assessment and electricity grid upgrade
	2. Various applications of PV technologies
	3. Energy efficiency
	4. Solar water heating
Agriculture	1. Climate smart agriculture (precision agriculture)
	2. Efficient irrigation
	3. Resilient animal fodder
	4. Conservation agriculture
	5. Water harvesting
Water and wastewater	1. Rainwater harvesting
	2. Water resources monitoring technologies
	3. Wastewater collection and treatment plants and advanced wastewater treatment technologies
Transportation	1. Upgrade of the existing vehicle fleet
	2. Public transportation (modal shift)
Solid waste	1. Waste sorting
	2. Composting
	3. Recycling
Others	1. Provision of beach nourishment, reclamation and beach drift rehabilitation
	2. Development of water, food and sanitation monitoring and safety systems using high technology related to health

9. Gender mainstreaming assessment

To develop a gender-informed Technology Roadmap, a high-level gender analysis on relevant areas such as policy, societal norms and attitudes, climate change, workforce, energy, agriculture, transport, water and wastewater, solid waste, as well as integration of gender into the assignment was conducted. The analysis involved a desktop review of available literature and validation of findings with stakeholders during the second mission. Specific recommendations to ensure that the Roadmap is fully gender responsive are provided and can be found in the gender mainstreaming report. This section summarizes the key findings in the report relevant to the prioritized sectors.

9.1 Energy sector

There is a lack of information on the gender dimensions of the energy sector in the West Bank. Electricity supply is controlled by Israel which decides on its value and volume⁸. Due to the domestic burden of women at the household level, it is assumed that an interrupted supply of electricity has a disproportionate effect on women. As previously noted, while women are generally the decision-makers regarding energy use at the household level, men are sometimes higher consumers of energy.⁹

In Gaza, frequent electricity cuts have increased women's vulnerability and stretched the coping mechanisms of households.¹⁰ Power outages have also threatened the life and well-being of vulnerable groups, particularly those needing urgent medical attention.¹¹ The general decline in the access of people to basic services in relation to water and electricity, has undermined the ability of women and girls to engage in income-generating activities.¹² This is directly linked to the customary division of labor in Palestinian society, where women and girls bear the primary responsibility for the functioning and maintenance of households, which has become more time-consuming.¹³ Married women with disabilities face additional hardship.¹⁴

9.2 Agriculture sector

While earlier agricultural policies did not consider gender mainstreaming, the 2017-2022 National Agriculture Sector Strategy does give it some strategic importance, though the outcomes of this are yet to be measured.¹⁵ While the importance of the agriculture sector in terms of its share of Gross Domestic Product (GDP) has been shrinking, it is still significant in terms of women's employment, with 20 percent of women in the labor force working in agriculture.¹⁶ This does not,

⁸ Heinrich Boll Stiftung (2014, Sept 4) *Socio-Economic Analysis of Renewable Energy Usage in Palestine*. [Blog Post] Retrieved from: <https://ps.boell.org/en/2014/09/04/socio-economic-analysis-renewable-energy-usage-palestine>

⁹ World Health Organization, *Gender, Climate Change and Health*, 2014

¹⁰ UN Women - UN OCHA: *Needs of women and girls in humanitarian action in Gaza: Gender Alert for the 2016 Response Plan*

¹¹ GBV Sub-Cluster: *The Humanitarian Impact of Gaza's Electricity and Fuel Crisis on Gender-based Violence and Services*, 2017

¹² Ibid

¹³ GBV Sub-Cluster: *The Humanitarian Impact of Gaza's Electricity and Fuel Crisis on Gender-based Violence and Services*, 2017

¹⁴ UN Women - UN OCHA: *Needs of women and girls in humanitarian action in Gaza: Gender Alert for the 2016 Response Plan*

¹⁵ Palestine Ministry of Agriculture, *National Agricultural Sector Strategy 2017-2022*

¹⁶ Japan International Cooperation Agency (JICA) Kokusai Kogyo Co., Ltd. *Gender Profile: Palestinian Territories Final*

however, necessarily empower women. Their contribution is often underestimated, not only by others but also by the women themselves.¹⁷ This could be attributed to the fact that many women work in family-run farms, in many cases as unpaid family members.¹⁸ Men benefit from the majority of agricultural projects, especially training and extension services, although women perform most of the labor.¹⁹

While agricultural cooperatives are popular in Palestine, the proportion of women members is small. In men-led cooperatives, women tend to have little decision-making power.²⁰ Women-only cooperatives tend to concentrate on 'feminine' work which is in line with traditional women's roles as caregivers.²¹

9.3 Water, waste and wastewater sectors

Women are underrepresented across the water sector. They do not exceed 8 percent of employees in water provision utilities, and 32 percent in ministries and authorities, none of which are decision-making or leadership positions.²² The Water Sector Reform Plan 2013 - 2015 states that there are segments of Palestinian society, - including the poor and women - with limited access to water and wastewater services.²³

Limited access to drinking water, domestic use water and wastewater and solid waste management in the Gaza Strip, Area C and East Jerusalem have significant impact on household spending, health and hygiene, and school attendance.²⁴ Inadequate WASH facilities expose women and girls to threats and burdens associated with meeting their personal hygiene needs, undertaking basic domestic chores, managing household water needs, and securing the needs of children, people with disabilities, the elderly and the chronically ill.²⁵

Hygiene and sanitation in Palestinian refugee camps is especially poor, with infrastructure (water systems, electricity, roads) and housing not properly built or maintained.²⁶ Infrastructure and social services are provided by local authorities and United Nations Relief and Works Agency (UNRWA), both of which suffer from insufficient financing.²⁷ Consequently, services are

Report, 2016

¹⁷ Japan International Cooperation Agency (JICA) Kokusai Kogyo Co., Ltd. *Gender Profile: Palestinian Territories Final Report, 2016*

¹⁸ Ibid

¹⁹ Palestinian Water Authority, *Water Governance in Palestine Sector Reform To Include Private Sector Participation National Report, 2015*

²⁰ Ibid

²¹ Japan International Cooperation Agency (JICA) Kokusai Kogyo Co., Ltd. *Gender Profile: Palestinian Territories Final Report, 2016*

²² Palestinian Water Authority, *Water Governance in Palestine Sector Reform To Include Private Sector Participation National Report, 2015*

²³ Ibid

²⁴ UN Women - UN OCHA: *Needs of women and girls in humanitarian action in Gaza: Gender Alert for the 2016 Response Plan*

²⁵ UN Women - UN OCHA: *Needs of women and girls in humanitarian action in Gaza: Gender Alert for the 2016 Response Plan*

²⁶ UN Women - UN OCHA: *Needs of women and girls in humanitarian action in Gaza: Gender Alert for the 2016 Response Plan*

²⁷ Ibid

dependent on inconsistent support by donors and Non-Governmental Organizations (NGOs).²⁸

9.4 Transport sector

Freedom of movement is restricted for both women and men due to Israeli occupation, settlement and blockade policies. However, for women, these restrictions are double-edged as they are, a) restricted in their movements by the occupation and b) restricted in their movements by male family members who aim to “protect” them from Israelis. This is due to body searches and the danger of harassment, including sexual harassment, at the checkpoints.²⁹

Checkpoints constrain men’s and women’s travel routes and choice of transport from villages and towns to cities and within urban centers.³⁰ Women use public transport extensively in the West Bank, where most men travel for work and markets and most women travel for education and health care for children and social activities.³¹ Both women and men complain about the irregularity of public transportation.³² The occupation often causes routes to change at the last minute.³³ Many educated women have given up aspirations for employment due to poor or lack of transportation.³⁴

Security is a serious mobility constraint for women due to verbal and physical harassment and theft in public spaces.³⁵ Transport costs are affordable for women and men with good incomes, but not for the poor in the refugee camps.³⁶ Drivers often charge above standard rates, particularly where roads are poor.³⁷

9.5 Recommendations for gender mainstreaming

Within the sectors relevant to climate change, the gender analysis has unearthed a gap between women and men in Palestine that may affect the ability of women and other vulnerable groups to fully reap the benefits and outcomes afforded by the Palestine Technology Roadmap. Following are some general recommendations to ensure the full and active participation of all members of Palestinian society, women or men, in all related areas. In addition to these recommendations, it is advisable that the Palestine Technology Roadmap applies a gender lens in all tasks and activities going forward to ensure that the Roadmap is fully gender responsive and more specific interventions can be identified.

Access to technology

- Aim for at least 50 percent representation of women in all related committees and meetings, including the Climate Change Committee. Where this is not feasible, build the

²⁸ Ibid

²⁹ Japan International Cooperation Agency (JICA) Kokusai Kogyo Co., Ltd. *Gender Profile: Palestinian Territories Final Report*, 2016

³⁰ World Bank. *Making Transport Work for Women and Men*, 2012

³¹ Ibid

³² Ibid

³³ Ibid

³⁴ Ibid

³⁵ Ibid

³⁶ Ibid

³⁷ Ibid

capacity of female staff in relevant ministries to eventually join the committee through providing mentorship or job shadowing opportunities.

- Work with civil society, female owned enterprises, women's cooperatives and relevant ministerial bodies to reach women, youth and persons with disabilities in different geographical areas.

Knowledge

- Aim for at least 50 percent representation of women in all capacity building activities. Where necessary support an internship or job shadowing program to increase the technical knowledge of women and other groups.
- Ensure that communications strategies target key users and influencers such as women and youth. Behavior change messages and means of communication -social media, radio, TV, home visits - should be specially crafted for the different targeted groups.
- Strengthen local governance by encouraging the formation of community level associations for water, agriculture and energy, comprised of both women and men.

Access to finance and economic opportunities

- Identify women-owned or women-led businesses to receive capacity building or supply technologies and/or services where possible.
- Identify income generation/access to finance opportunities for persons with disabilities.
- Develop and implement tailored products and services to meet financial needs of women entrepreneurs and female heads of household.

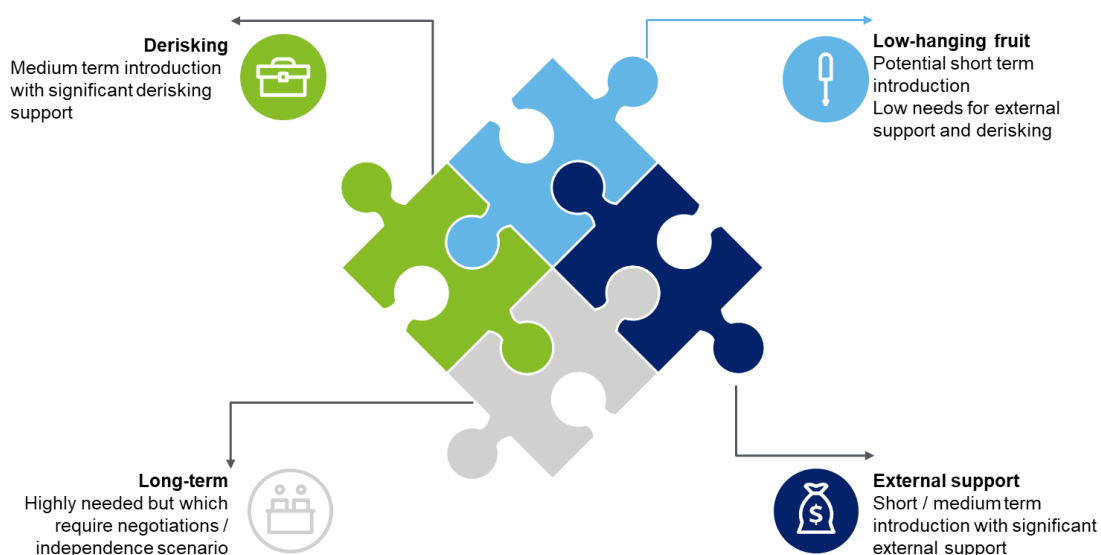
10. Recommendations and next steps

10.1 Recommendations

Based on the results of the prioritization exercise, the final list of prioritized technologies have been categorized into four categories to take into account their potential for short-term, medium-term and/or long-term implementation, level of derisking measures for its introduction, and the level of external support required. These technologies have been prioritized, not only considering ease of implementation but also considering the importance and significance of technologies regardless of efforts required. It is recommended that technologies are efficiently prioritized as per the following categorization:

1. **“Low-hanging fruit”**: technologies suited for short-term introduction which require low external support and derisking measures;
2. **“External support”**: technologies that can be introduced over short- to medium-term but with significant external support;
3. **“Derisking”**: technologies that can be introduced over medium-term but require significant derisking support; or
4. **“Long-term”**: technologies that are highly needed in Palestine but require negotiations / or favorable to the independence scenario.

Figure 1 Categories of prioritized technologies



10.2 Next steps

For the prioritized technologies, next steps include the development of a comprehensive roadmap for removing the barriers and risks for the implementation of the prioritized technology. This will also include the development of a management plan for the monitoring and evaluation of prioritized mitigation and adaptation technologies and business transfers. The implementation

roadmap will detail actions and measures needed for the introduction of each technology which includes:

- Introduction of new regulations;
- Capacity building measures;
- Institutional and implementation arrangements;
- Funding modalities (e.g. GCF, non-GCF sources);
- Timelines; and
- Geographical application (e.g. West Bank, Gaza).

The roadmap will also detail synergies with the GCF Country Programme and the NDC implementation work. It will also provide the expected impacts for each technology according to the GCF impact areas. In addition, the roadmap will detail connections between technologies which will fully support how they will meet climate change mitigation and adaptation needs in Palestine.

The management plan for monitoring and evaluation will be developed to determine the timeline, budget, roles and responsibilities for the implementation of Technology Roadmap. It will include a logical framework with Specific, Measurable, Achievable/Attributable, Relevant, Timely (SMART) indicators, baselines and targets for each technology. The strategy will mainly detail who will implement monitoring and evaluation, the type of sources and methods used, as well as its timing.

Annex 1: list of prioritized technologies

Sector	Technology
Energy	1. National grid assessment and electricity grid upgrade
	2. Various applications of solar PV technologies
	3. Energy efficiency
	4. Solar water heating
Agriculture	1. Climate smart agriculture (precision agriculture)
	2. Efficient irrigation
	3. Resilient animal fodder
	4. Conservation agriculture
	5. Water harvesting
Water and wastewater	1. Rainwater harvesting
	2. Water resources monitoring technologies
	3. Wastewater collection and treatment plants and advanced wastewater treatment technologies
Transportation	1. Upgrade of the existing vehicle fleet
	2. Public transportation (modal shift)
Solid waste	1. Waste sorting
	2. Composting
	3. Recycling
Others	1. Provision of beach nourishment, reclamation and beach drift rehabilitation
	2. Development of water, food and sanitation monitoring and safety systems using high technology related to health

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