Ministry of Foreign Affairs

Solar market study Bangladesh

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Solar market study Bangladesh

Opportunities to increase Dutch engagement

LARIVE INTERNATIONAL

LightCastle Partners

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Status: Final report

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Image credit cover: World_Bank_Bangladesh_Final_Edit_0019

Introduction

Abbreviations

A = Actual

ADB = Asian Development Bank

BB = Bangladesh Bank

BEZA = Bangladesh Economic Zones Authority

BN = Billion

BPDB = Bangladesh Power Development Board

BPMI =Bangladesh Power Management Institute

BEPRC = Bangladesh Energy and Power Research Council

B2B = Business-to-Business

B2C = Business-to-Consumer

CAGR = Compounded Annual Growth Rate

CBB = Central Bank of Bangladesh

CD = Customs Duty

CEI = Chief Electric Inspector

CO2 = Carbon dioxide

CRA = Climate Resilient Act

CVF = Climate Vulnerable Forum

C&I = Commercial & Industrial

DRE = Distributed Energy Resources

DER = Distributed Energy Resources

EBITDA = Earning Before Interest Taxes and Depreciation

EPC = Engineering, procurement and construction

EUR = Euro

F = Forecast

FDI = Foreign Direct Investment

FX = Foreign Exchange

FY = Fiscal Year

GDP = Gross Domestic Product

GoB = Government of Bangladesh

GW = Gigawatt

IDCOL = Infrastructure Development Company Limited

Int. = International

IPP = Independent power producers

JV = Joint Venture

KG = Kilogram

KMT = Kilo Metric Tonnes

KW = Kilo Watt

kWh = Kilo Watt Hour

kWp = kilo Watt Power

LNG = Liquified Natural Gas

Larive = Larive International B.V.

M&A = Merger & Acquisition

MS = Market share

Max = Maximum

MAC = Middle and Affluent Class

Min = Minimum

MMT = Million metric tonnes

MMSCFD = Million standard cubic feet per day

MN = Million

MPEMR = Ministry of Power, Energy and Mineral Resources

MT = Metric Tonnes

MW = Mega Watt

NBFIs = Nonbank Financial Institutions

N/A = Not available

p.a. = Per Annum

PC = Power cell

PGCB = Power Grid Company of Bangladesh

PV = Photovoltaic

P&L = Profit and Loss

R&D = Research and Development

SDG = Sustainable Development Goal

SOC = State Owned Corporation

SOE = State Owned Enterprise

SREDA = Sustainable And Renewable Energy Development Authority

Tcf = Trillion cubic feet

USA = United States of America

US$ = United States Dollar

USGBC = United States Green Building Council

W = Watt

ERV- Energy Recovery Ventilation

HVLS- High Volume Low Speed

YoY = Year on Year

Introduction

Project background

- Larive International B.V., is a Netherlands-based international business development firm specialized in assisting companies in entering and expanding their business activities in high-growth markets (hereinafter referred to as "Larive"). To support clients locally, Larive has established a network of local (partner) offices in Asia, Central and Eastern Europe, Turkey and Sub-Saharan Africa, combined in the Larive Group. Services include business and market intelligence, market entry and growth strategy development, M&A advisory and implementation support.
- LightCastle Partners Ltd. founded in 2013, is a data-driven business consulting firm, supporting companies, governments and development partners with market research, business consulting and growth advisory in Bangladesh (hereinafter referred to as "LightCastle"). LightCastle has been the exclusive member of the Larive Group in Bangladesh since 2020 (the partnership is hereinafter referred to as "Larive-LightCastle").
- Bangladesh has a fast-growing demand for energy which is currently dependent on imported fossil fuels. Renewable energy sources can be cost-efficient and could make Bangladesh self-efficient. The Netherlands hosts various private sector players offering innovative and sustainable solutions in the field of solar energy. In order to contribute to the further expansion of solar energy usage in Bangladesh, facilitate the energy transition in Bangladesh and increase Dutch engagement (i.e. trade and investment) in Bangladesh, the Embassy of the Kingdom of the Netherlands in Dhaka (hereinafter referred to as 'EKN Dhaka') has engaged Larive-LightCastle to conduct a market study on the solar energy market in Bangladesh.

Objectives

- Provide to-the-point detailed information for Dutch companies and institutes active in the solar market value chain to elevate the solar energy sector of Bangladesh through investments, knowledge, and/or technology;
- Provide further insight and pave ways for interventions to support relevant supervisory, facilitating and regulatory bodies and key chain actors and businesses in Bangladesh;
- Overview of incentives and opportunities available to attract foreign (Dutch) investment in Bangladesh;
- List of laws, regulations and policies that are important to know for foreign investors;
- Provide further insight on how the development of the solar energy sector in Bangladesh can contribute to socio-economic development.

These objectives have a strong focus on activity clusters of the Netherlands in Bangladesh, its key public-private actors, linkages, trends, issues, challenges and (business) opportunities. The objectives envision to realise growth and development of the Bangladesh solar energy sector in order to support its green transition and private sector development and increase Dutch-Bangladeshi trade and investment in a sustainable manner.

Timing

- The study has been conducted in November 2022 - March 2023.

Methodology

- Information has been collected and assessed through desk research (e.g. company reports, media, domestic statistics, Larive International learnings) and primary research (e.g. interviews with Dutch and Bangladeshi companies, knowledge institutions, local industry experts). The information in this study has been collected on a best effort basis.

Executive summary

Bangladesh's hunger for sustainable energy solutions

- Bangladesh is among the fastest growing economies in Asia, with an increasing demand for energy (GAGR 8.4% over the past 5 years), with a net energy consumption reaching 85.6K GW in 2021-22. For the country's economic growth to be sustainable, it requires a reliable energy infrastructure that can keep up with the pace of rising energy demand.
- The Government of Bangladesh managed to implement rapid electrification in recent years (from 32% of the population in 2020 to nearly 100% in 2022). While that is an admirable feat, virtually all energy is generated through the utilization of non-renewable (fossil) resources such as natural gas, oil, coal, and diesel (jointly >80% of the country's energy mix). Only 3.7% of the domestically produced energy comes from renewable sources (for a large extend contributed by the successful roll-out of off-grid solar home systems).
- Recent disruptions in the global energy supply chains in combination with devaluation of the Bangladeshi Taka against the US Dollar and the expected depletion of the country's natural gas resources within 10 years, underlined the dependency the country has for generating energy with imported fossil fuels. Already, the Bangladesh government spends a substantial amount on subsidies to balance price inflation of energy for the public.
- These developments are a matter of concern as Bangladesh strives to grow economically while simultaneously alleviating its adversity to climate change (Bangladesh is one of the top-scoring countries on the climate vulnerability index). Introducing and expanding solutions to boost the country's renewable energy capabilities would enable Bangladesh to become less dependent on energy imports, stabilize energy prices and moreover contribute to more sustainable production.
- According to the Bangladesh Power Development Board, solar offers the most competitive solution (lowest price per kWh). To accelerate its renewable energy ambitions, Bangladesh needs to focus on attracting foreign technologies and investments, to develop existing capacities and scale its renewable energy generation. The country has set a target to produce 40% of its energy mix in 2040 from renewable sources.

Leveraging Dutch solar USPs in Bangladesh

- The Netherlands host a sizeable solar energy industry and represents the 3rd largest market in the EU in terms of installed solar generation capacity (3.6 GW in 2022). The Dutch solar ecosystem involves close cooperation between the private sector, research institutes, financial markets, and government institutes.
- The Bangladeshi market is price sensitive and Asian (Chinese) suppliers have dominant positions. However, there are ample opportunities to introduce and expand Dutch solar-energy innovations in Bangladesh, including:
  - A. High quality and high energy efficient (i.e. high yielding) PV technologies (in the field of inverters, battery storage, and monitoring systems), which could be integrated in existing infrastructure (i.e. buildings), particularly targeting the commercial and industrial segments.
  - B. Integrated solar powered solutions for complex environments, such as mission-critical industries, high-density populated areas and challenging circumstances:
    - ✓ Cold storage facilities for agri-food perishables, pharmaceutical and medical applications.
    - ✓ PV technologies combined with storage (battery) systems, enabling Bangladeshi users to solve power cuts, peak challenges and provide energy to rural areas where stable access to the grid is minimal.
    - ✓ Floating solar solutions, tapping into the potential of Bangladesh's vast water bodies.
    - ✓ Waste-water treatment and solar irrigation pumps.
  - C. EV charging systems.
- Backing by Dutch financial institutions would increase the success of the introduction and expansion of Dutch solar solutions in Bangladesh, as domestic players lack expertise of the industry and are hesitant for provide financing.
- The highest likelihood for successful introduction and expansion of Dutch solar-energy innovations in Bangladesh can be expected when tapping into existing Dutch interventions, such as in the aquaculture, livestock and (protected) horticulture sectors. Their positioning could be facilitated by establishing pilot projects (demonstrating technical and commercial capabilities) and more structurally via a collective (cluster / PPP) approach.

Bangladesh Chapter

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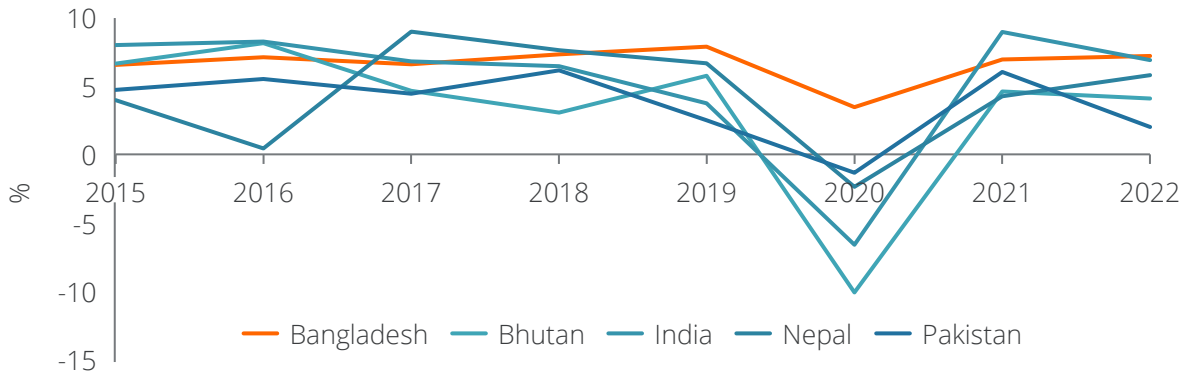
Market analysis

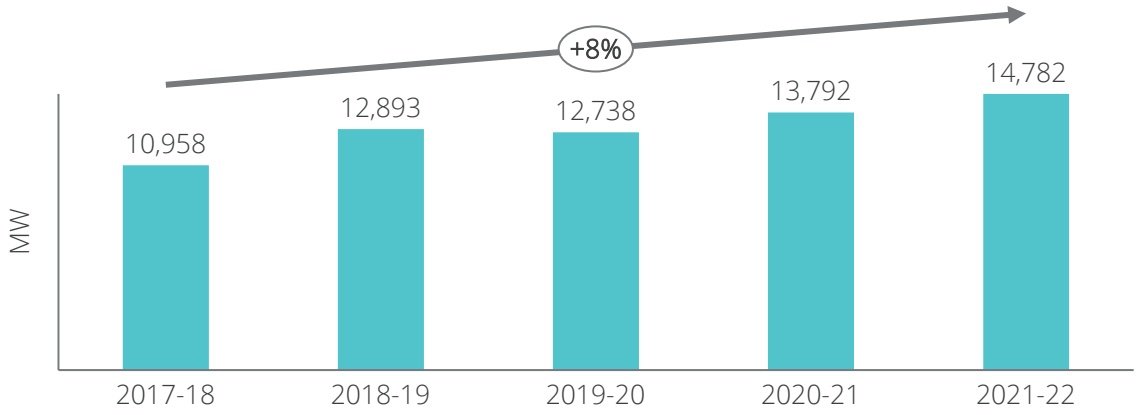
Macroeconomic overview

Bangladeshi electricity demand is expected to reach 50 GW by 2041

GDP growth rate, in %, over 2017 - 2022



On-grid maximum capacity generation, in MW, over 2017 – 2022



Trends and developments

Sector overview

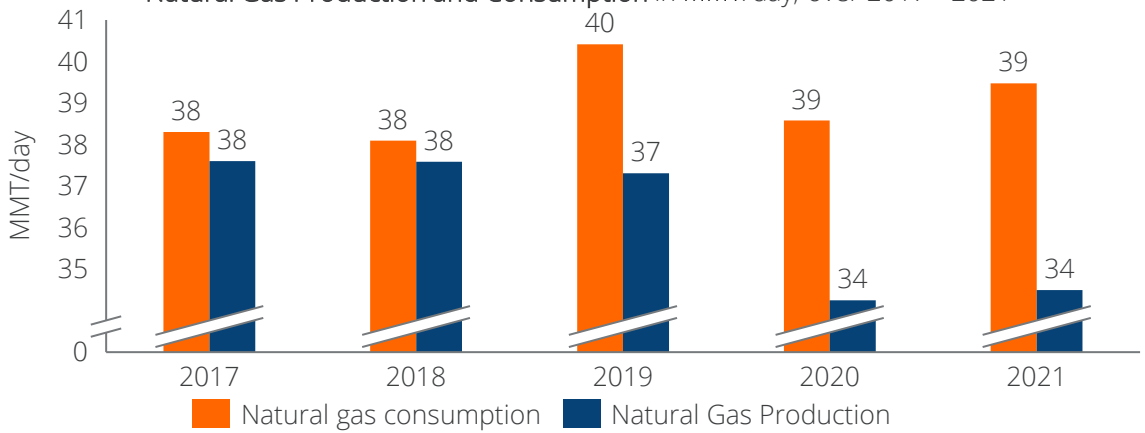
- Bangladesh (population of 165 MN in 2022) has made enormous strides in all socio-economic indicators during the last decades. In 2019, Bangladesh portrayed a GDP growth of 7.9% and during the pandemic, the country sustained a higher economic growth than its peer countries. The GDP growth rate for 2020 was 3.4%, due to the pandemic, whereas peer countries such as India, Nepal and Bhutan had GDP growth rates of -6.6%, -2.4% and –10% respectively. This encouraging growth scenario is a result of strong domestic demand driven by vibrant economic activity, strong export and overseas remittance. Moreover, the introduction of various infrastructural development projects and the development of Export Processing Zones have also been a driving force for growth.
- EUR 3.6 BN was allocated for 10 mega projects which focus on strengthening communication networks, power and the energy sector (FY 2019-20). Furthermore, the demand for power and energy has been increasing due to the country's Middle and Affluent Class population that increased over the last decade with 11% CAGR.
- In 2022, the installed generation capacity of the country (both captive and renewable sources) stands at 25.5 GW (154W per capita). The increase in power generation capacity and availability of more power over the last 5 years has been another significant propellant of GDP growth.
- Moreover, the government was successful in bringing almost the entire population under electrification (98%) in 2021, and by the year 2030, the government plans to increase the installed electricity generation capacity to 30 GW. Given the growth of GDP and current capacity generation, Larive-LightCastle expects the installed electricity generation trajectory to continue in the future.

Source: IMF, Bangladesh Economic Overview 2022, BPDB Annual Report 2021-22. (1 BDT=0.0091 Euro).

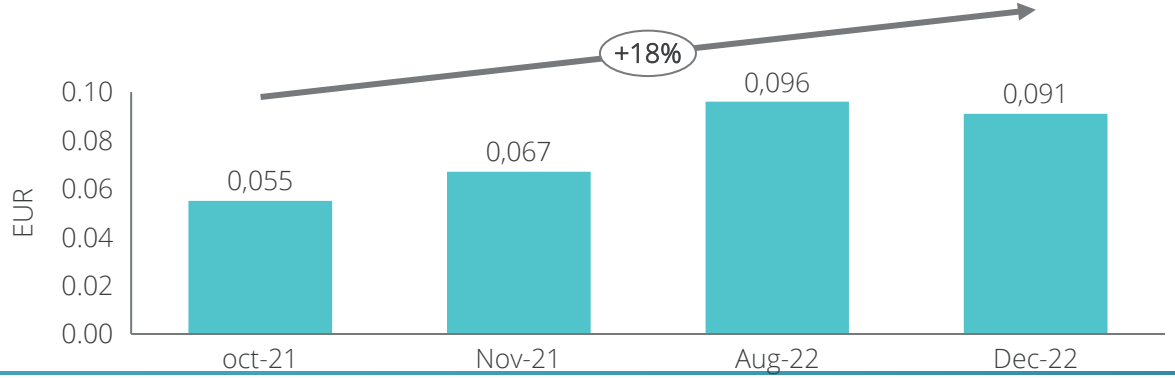
Energy consumption

Bangladesh's natural gas production has been relatively stable, while consumption increases

Natural Gas Production and Consumption in MMT/day, over 2017 - 2021



Price of generating one unit of energy with diesel, in KWh, 2021 and 2022



Trends and developments

Energy demand & production

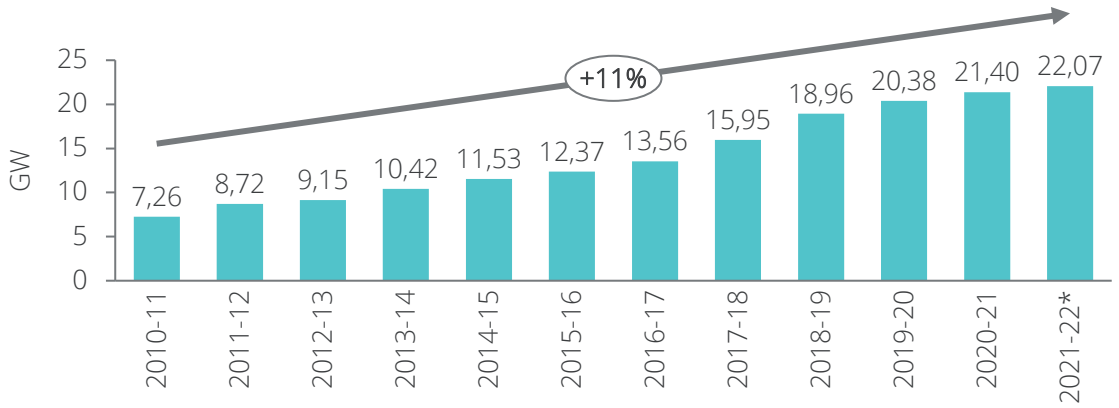
- In 2018, a gas shortage emerged resulting in a 7 MMT/day shortfall and today the gas deficit stands at 10 MMT/day. This leads to fuel import dependency which puts Bangladesh at international price and supply fluctuation risks. Bangladesh imports around 25% of its consumed gas and because of the Russia-Ukraine conflict, import prices of LNG rose drastically resulting in an average import cost price of EUR 1.38/MT. Which used to be EUR 0.52/MT in 2017 (increase of 165%).
- Furthermore, a reduced number of explorations done in the past years has led to declining production from gas wells. The country consumed a total of around 260 MN tons of gas in the last 20 years, but only discovered about 40 MN tons of gas. The known reserves are projected to be depleted in 10 years. The probability of local production increasing is unlikely unless new gas fields are discovered to supplement the known reserves.
- The GoB plans to increase renewable energy production to meet SDGs 2030 and graduate to an advanced economy by 2041. Therefore, it needs to reduce CO2 emissions along with energy generation. E.g., the GoB cancelled 10 coal-fired power plant projects in 2021 which would have a total generation capacity of 8,451 MW.
- Furthermore, Bangladesh has pledged to the Climate Vulnerable Forum to generate 40% of electricity from renewable sources by 2041. This would result in a 16 GW RE capacity (target of 30%) in 2031, and a 40 GW RE capacity (target of 40%) in 2041.
- Solar energy is currently the only dependable renewable energy source that can be resourced on a large scale given the lack of geothermal and hydro potential and onshore wind. Solar power plants with a combined capacity of 657 MW are under construction at various locations such as Sylhet, Mongla etc. A few of these projects are the Solar Home system, Rooftop Solar Projects, Solar Mini-Grid Projects, and Solar Irrigation Program.

Source: CEIC,
(1 BDT = 0.0091 Euro)

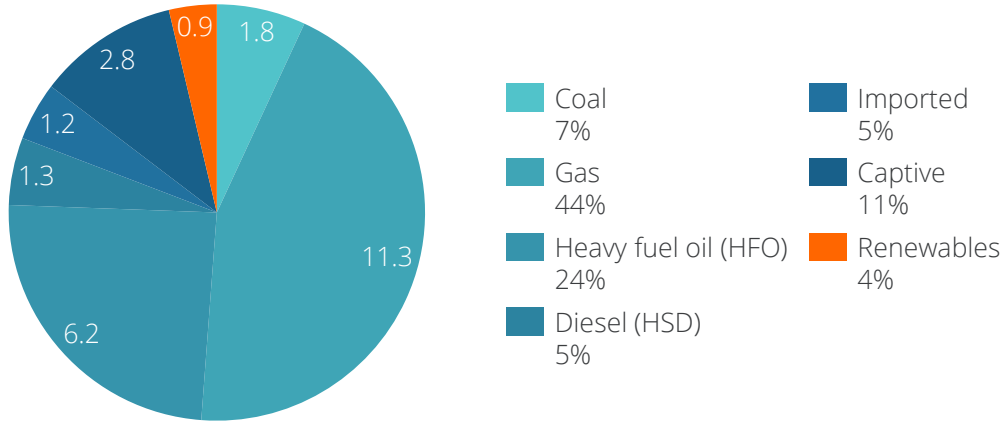
Solar market growth

Renewables account for 3.7% of the energy mix in Bangladesh, of which solar accounts for 75%

On-grid installed capacity, in GW, over 2011 – 2022



Installed energy capacity, in GW, in 2022



Energy production and power cuts

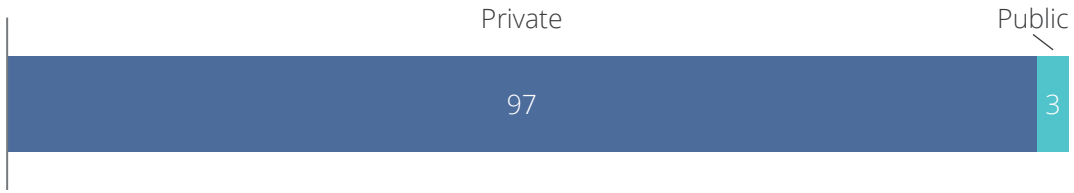
- The power sector in Bangladesh has witnessed significant growth over the last 10 years. The on-grid power that was generated was 7.3 GW in the FY 2010-2011 and increased to 22,1 GW by the fiscal year 2021-2022 (+204%).
- Of the total grid-based installed capacity, 10,146 MW (46%) came from the public sector, 9,481 MW (43%) from the private sector, 1,244 MW (6%) from JVs and 1,160 MW (5%) from cross border power trade (import) with India (2021).* As of 2022, there are 57 total power plants in the public sector, 94 in the private sector and two joint ventures.
- The current fuel mix of Bangladesh's power plants heavily depends on natural gas, oil, coal and diesel (jointly >80%). Because of the current energy prices in combination with the expected depletion of natural gas resources within 10 years, the GoB plans to reduce dependence on domestic natural gas. This is done by increasing the use of imported liquified natural gas (LNG), importing more electricity from neighboring countries and expanding the use of renewable resources, especially solar power.
- In the current situation, 3.7% of the total energy mix is contributed by renewable sources, of which approximately 75% (or 2.8% of the total energy mix) is contributed by solar energy.
- As per 2016, the share of generation capacity in the private sector versus public sector is approximately 50/50.
- With the rising costs of fuel following the Russia-Ukraine conflict, both industrial and household communities in the urban areas are facing 3-5 hours of power cuts on average. The situation is far worse in rural areas, where according to recent reports, there are days when power cuts are faced every alternate hour.

- *Larive-LightCastle estimation*
- *Source: Bangladesh Economic Review 2022 published by the Bangladesh Ministry of Finance, in the FY 2020-2021, Power System Master Plan (PSMP)*

Solar market growth

Off-grid solar energy production, which accounts for 50% of all solar energy produced, mainly consists of solar home systems

Public vs Private Solar Grid Energy Generation, in %, in 2021



Off-grid vs on-gris energy production per technology, in MW, in 2022

Technology	Off-grid (MW)	On-grid (MW)	Total (MW)
Solar	356	376	732
Wind	2	1	3
Hydro	0	230	230
Biogas to electricity	<1	0	<1
Biomass to electricity	<1	0	<1
Total	359	607	966

Trends and developments

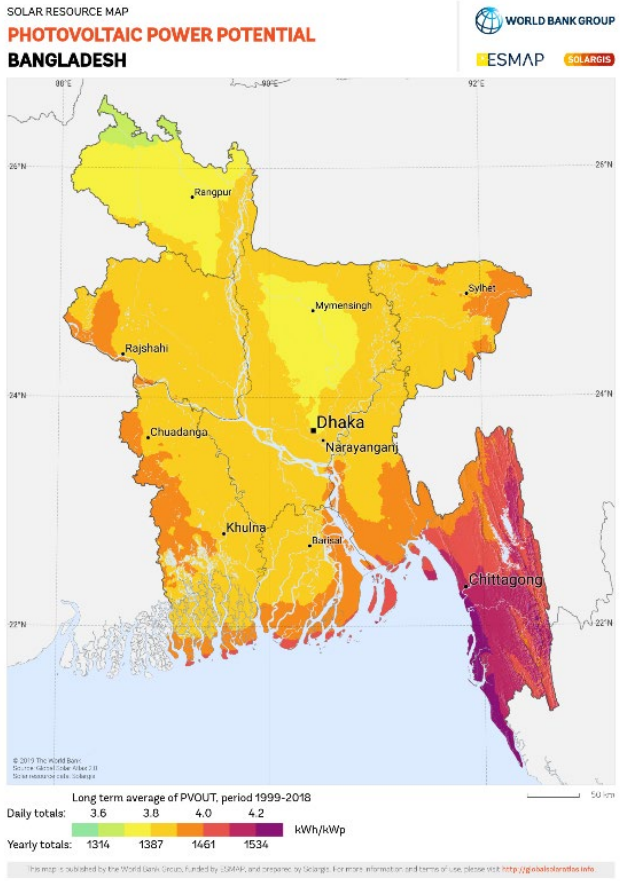
Solar energy

- The hydro and wind energy sectors have shown limited growth over the past years due to Bangladesh's geographical limitations. Therefore, solar PV is being prioritized by the GOB to scale in the long run. Difficulties in attaining land for solar parks and solar grid facilities have shifted the focus towards rooftop systems with net metering systems and DRE solutions. Floating solar is given priority considering the enormous amount of water available. However at current, floating solar is still in a nascent state.
- According to the SREDA, the split between off-grid and on-grid solar energy solutions is nearly 50% – 50%. The recent growth in off-grid solutions can be attributed to solar home systems, solar irrigation, and rooftop solar systems without net metering.
- The GoB had envisioned that renewable energy would contribute to 10% of the total amount of energy produced by 2020. Yet, the present amount is only 3.7%. Hence, the 40% target has been reinstated till 2041. Nevertheless, the GoB prioritizes utilizing power generated from renewable over non-renewable sources. According to government officials, multiple solar projects with a combined capacity of over 3 GW are scheduled for the upcoming years.
- Nearly 97% of the total solar grid generation in 2020-21 came from private sector providers, while only 3% was from public power plants. In 2018, the Power Division launched the Net Metering system for consumers to become prosumers. This potential for accumulating credit for any excess electricity generated acts as an incentive for conglomerates to install rooftop solar systems.
- Bangladesh is currently the leading country in terms of the number of green RMG factories with 192 LEED-certified buildings under the United States Green Building Council (USGBC). According to BGMEA, over 500 additional factories are in the pipeline of becoming green factories by 2023. Export-oriented green factories in the country get a 2% tax incentive. As green factories are required to install rooftop solar, there is significant potential for rooftop captive solar power.

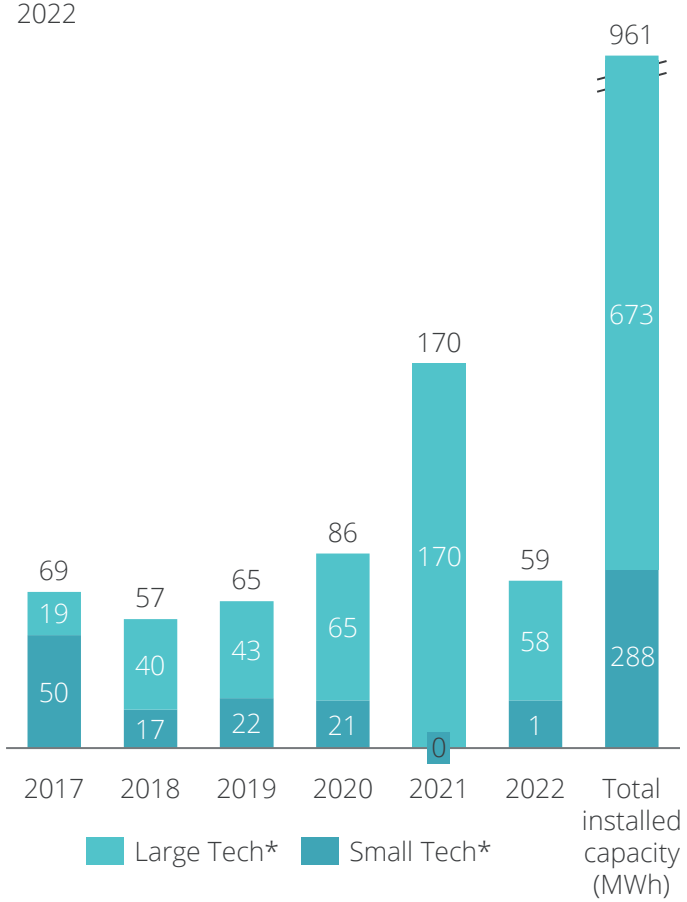
Source: Sustainable and Renewable Energy Development Authority (SREDA) (2022)

Market growth – Regional development

The current implemented and under-planned projects are expected to have a maximum capacity generation of 3,235 MW by 2026



Yearly and total installed capacity, in MWh, over 2017 - 2022



Photovoltaic power vs wind & hydropower

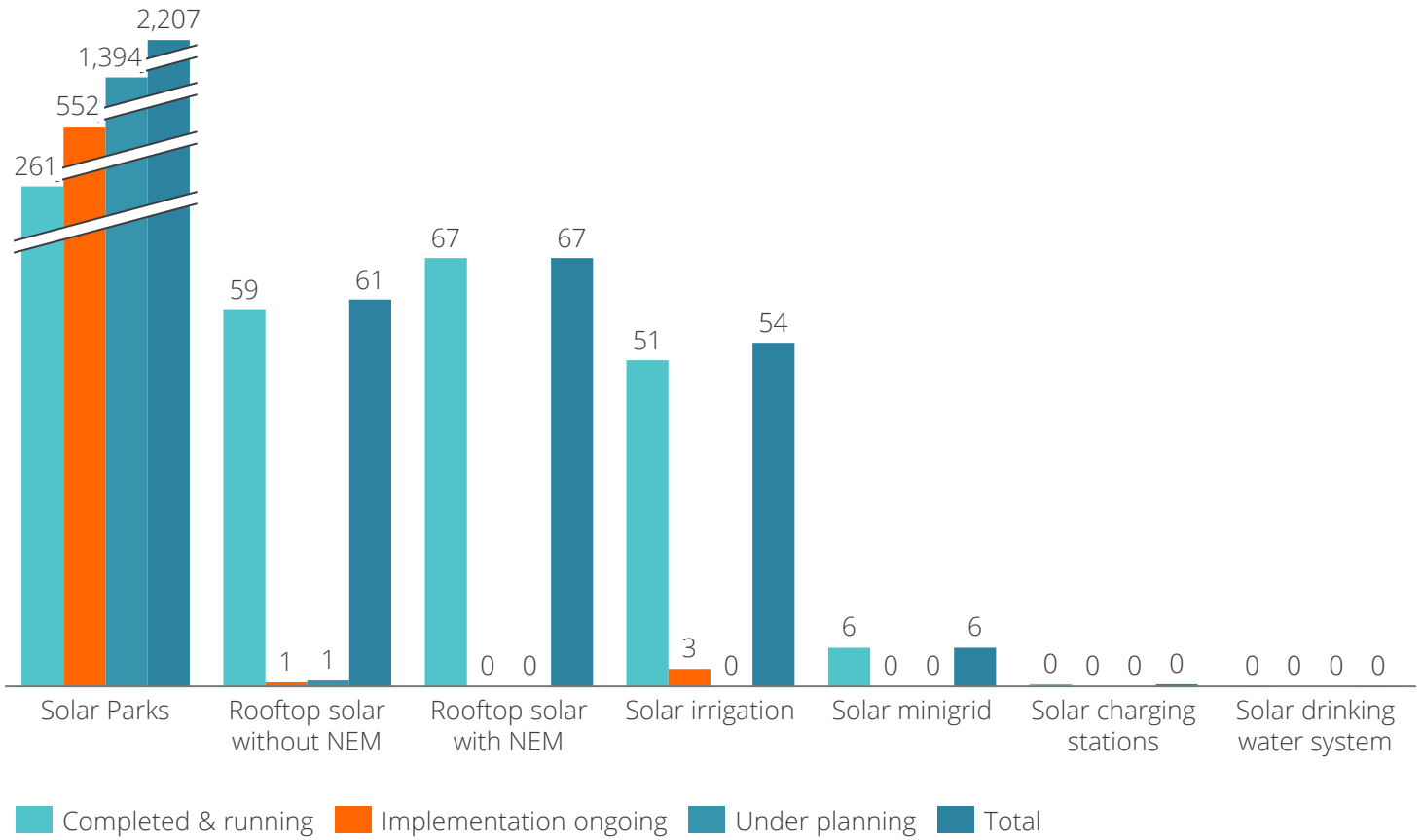
- The average speed of wind in Bangladesh is not feasible for commercial-scaled electricity generation. In addition, the country's flat terrain and low altitude is not suitable to establish hydroelectric power plants. As a result, the prospects of wind and hydropower are relatively low. In contrast, the potential for photovoltaic (PV) is much higher and consistent through the entire country. The Chittagong province is considered to have the highest PV return.
- The renewable energy capacity has been growing over the past decade. Deviating between small-scale and large-scale projects, most capacity resides in large-scale solar projects including solar-powered rooftops, irrigation, mini-grids, micro-grids, nano-grids and solar charging stations. Wind turbine projects are in the pipeline, but effective implementation is hampered by the need for feasibility checks. Most small-scale renewable energy projects consist of solar-powered home systems and streetlights.
- As Bangladesh has reached an electrification rate of nearly 100%, the solar home market segment will soon be fully saturated. According to the SREDA, the country has the potential to produce a maximum of 12,000 MW from captive rooftop solar PV systems in 2041, however, private stakeholders have claimed the estimate to be optimistic.

Source: Sustainable and Renewable Energy Development Authority (SREDA) (2022)

Market growth – solar project pipeline

Increasing focus on large-scaled projects to improve dependency on renewable energy

Planned installed capacity, in MW, till 2026



Trends and Developments

- **Segmentation.** At present, the solar park segment is the largest segment in Bangladesh, with a total capacity of 261 MW. The solar rooftop segment is the 2nd largest segment, with a combined generation capacity of 126 MW.
- **Short-medium-term growth outlook.** Larive-LightCastle has identified the solar park segment as the fastest-growing segment in Bangladesh, with multiple investment plans for solar park development scheduled until 2026. At current, approximately 1,400 MW are in the planning phase, and around 552 MW is already in the implementation phase. Due to the difficult legal and land acquisition processes, implemented projects are expected to be delayed. Large-scale projects are also prioritized by the Bangladeshi government. SREDA has prioritized large-scale projects since 2020 and will continue to do so at least to 2026.
- **Long-term outlook.** In the long term, growth prospects are expected to be higher for the rooftop solar segment compared to the solar park segment. This is primarily due to the intensity of maintenance and difficult administrative and land acquisition procedures for solar parks compared to solar rooftops.
- The growth prospects for solar irrigation, mini-grids, charging stations and drinking water systems are low compared to the solar park and solar rooftop segments. However, according to industry experts, these segments are expected to grow in the long term, especially in rural areas.

Source: Sustainable and Renewable Energy Development Authority (SREDA) (2022).
**Note: Large-scale projects include projects in the C&I sector, and projects in the residential building segment.*

Bangladeshi solar market developments – Key drivers for growth

Favorable policies, financing measures and trade and investment stimulate solar market growth

Global/national drivers	➢ International treaties have been signed to foster the transition towards green energy. ➢ The recent global fuel price hike has made industries shift towards sustainable energy solutions, with solar as top priority.
Policy drivers	➢ **GDP growth rate of 7.2% in 2022** and its middle and affluent population increased with a **CAGR 11%** over the last decade. ➢ The Bangladeshi government set two for the total energy production to be generated by renewable sources, including **30% in 2030 and 40% in 2040.** ➢ Release of Renewable Energy Policy in 2008 and Net-Metering Policy in 2018 has stimulated the rise of technological innovations in the renewable energy sector. ➢ The Bangladesh Bank increased its refinancing scheme size for green financing from **EUR 18.2 MN to EUR 37.4 MN** due to the rising demand for renewable energy. ➢ Export-oriented green factories get a **2% tax incentive** compared to non-green export-oriented factories. As green factories are required to install rooftop solar, the tax incentive has created a significant potential for investment in the captive rooftop solar market in Bangladesh.
Investments & Microeconomic drivers	➢ Private and public investments in the modernization of grid connectivity stimulate the development of renewable energy projects in Bangladesh. ➢ The electricity generated by solar parks increased from **3 MW in 2017 to 261 MW in 2022,** indicating an upsurge of investments in the sector. ➢ Youngone (Leading RMG Player) is set to install the largest rooftop solar plant of 40 MW in Korean EPZ. Similarly, industry leaders in the agricultural and FMCG landscape have been investing in rooftop solar solutions to reduce dependency on diesel or gas.

Competitive landscape analysis

Chinese dominates the Bangladeshi solar market given its cost competitiveness

Solar equipment suppliers in Bangladesh		
Top Foreign Players	Jinko Solar	China
	Trina Solar	China
	Longi	China
	Risen Energy	China
	Suntech Power	China
	SunPower	China
	Envision Energy	China
Domestic Manufacturers	Solaric	Bangladesh
	Rahimafrooz	Bangladesh
	GTS	Bangladesh

Top foreign EPC contractors in Bangladesh	
Sungrow	China
Power China	China
Energy China	China
Chint Solar	China
Trina Solar	China
Jinko Solar	China
Shanghai Electric	China
China Ghezhouba	China
Tata	India
Mahindra	India
Sterling & Wilson	India
L&T	India
Rays India	India

International & domestic players

International Players

- Over the last decade, the solar panel manufacturing capacity has increasingly shifted from Europe, Japan and the USA towards China. The country now has >80% of all manufacturing stages of solar panels globally. The primary reason for this dominance is China's cost competitiveness. Production costs are 10%, 20% and 35% lower than in India, the US and Europe, respectively.
- Foreign players enter the market in Bangladesh by acting as dealers of solar panel modules and components for Bangladeshi EPC contractors. Moreover, international players are also or are directly involved by providing financing solutions for setting up a solar system or by providing end-to-end turnkey project execution.

Domestic Players

- Local EPC players in Bangladesh apply both CAPEX and OPEX solar models. In the OPEX model turnkey solutions are provided without the initial investment from the buyer. In the CAPEX model, the client buys the solar system outright and pays the entire cost upfront. In this case, the local EPC contractor only provides design and consultation services.
- There are also EPC players such as Rahimafrooz that manufacture solar panels locally and provide design and consultation services to clients. However, Rahimafrooz is soon shutting down its solar panel production due to China's overwhelming dominance in cost competitiveness.

Value chain analysis

Key stakeholders in the solar energy value chain in Bangladesh

Bangladesh Bank

- It is the central bank and apex regulatory body for the country's monetary and financial system.
- In 2011 a comprehensive green banking initiative to support and promote environmentally responsible financing was introduced by Bangladesh Bank.

IDCOL- Infrastructure Development Company Ltd.

- Bangladesh's leading diversified financial institution providing a wide range of financing products and fee-based services with private-sector infrastructure, renewable energy, energy efficient , and Public-Private Partnership (PPP) based projects as its focus areas.

SREDA- Sustainable and Renewable Energy Development Authority

- SREDA works under the Power Division of the Ministry of Power, Energy and Mineral Resources (MPEMR).
- It aims to promote sustainable energy and build an energy conscious nation to ensure energy security and to reduce carbon emission.

BPDB- Bangladesh Power Development Board

- Bangladesh Power Development Board (BPDB) is a government agency operating under the Ministry of Power, Energy and Mineral Resources.
- It is responsible for major portion of generation and distribution of electricity mainly in urban areas except Dhaka and West Zone.

MPEMR- Ministry of Power, Energy and Mineral Resources

- The MPEMR has two divisions, one is the Power Division and the other is the Energy and Mineral Resources Division.
- Power Division is responsible for all policies and matters relating to electricity generation, transmission and distribution.
- The Energy and Mineral Resources Division carries out a detailed analysis of the basic energy related policies.

Bangladesh Energy and Power Research Council (BEPRC)

- It is established to bring technological innovation in energy and power as well as to ensure energy security through research and development.

Chief Electric Inspector

- It is an important government agency of the Power Division in charge of providing license and inspecting and approving electrical safety issues in any establishment like the substations (high and medium voltage) and new buildings so that the power connections are safe for use.

Power cell

- It is a Bangladesh government regulatory agency under the Ministry of Power, Energy and Mineral Resources responsible for regulating the power (electricity) industry in Bangladesh. The Power Cell is responsible for promoting and reforming the power sector.

See appendix B

Key stakeholders in the solar energy value chain

Bangladesh Power Management Institute

- It is a is the premier training institute in power sector. The main function of BPMI is to enhance the professional skills of engineers and officials working in the power sector in the public and private sectors.

Power Grid Company of Bangladesh Ltd (PGCB)

- It is the sole organization entrusted with transmission of power throughout the country.
- The main purpose of the company is to construct adept and effective management of national power grid.

Dhaka Power Distribution Company Limited (DPDC)

- It is one of the largest power distribution companies in Bangladesh.

Electricity Generation Company of Bangladesh Ltd

- Electricity Generation Company of Bangladesh (EGCB) Ltd. (An Enterprise of Bangladesh Power Development Board) produces and sales electricity. EGCB has a plan to become a leading electricity generation company across the country.

Ancillary stakeholders in the Solar energy value chain

Development Partners and Associations

Solar Module Manufacturers Association of Bangladesh

- It's a representative organization for solar module manufacturers of Bangladesh.

Bangladesh Solar and Renewable Energy Association (BSREA)

- The largest association of business houses and NGOs working for promoting the clean energy industry in Bangladesh. It is a non-profit organization established in 2011. Currently, it has 42 active members and 15 executive members. BSREA's main partner is Ministry of Power, Energy and Mineral Resources.

Solshare

- Founded in 2014-2015 and the platform creates solar microgrids allowing household solar panel owners to buy and sell electricity according to their needs.

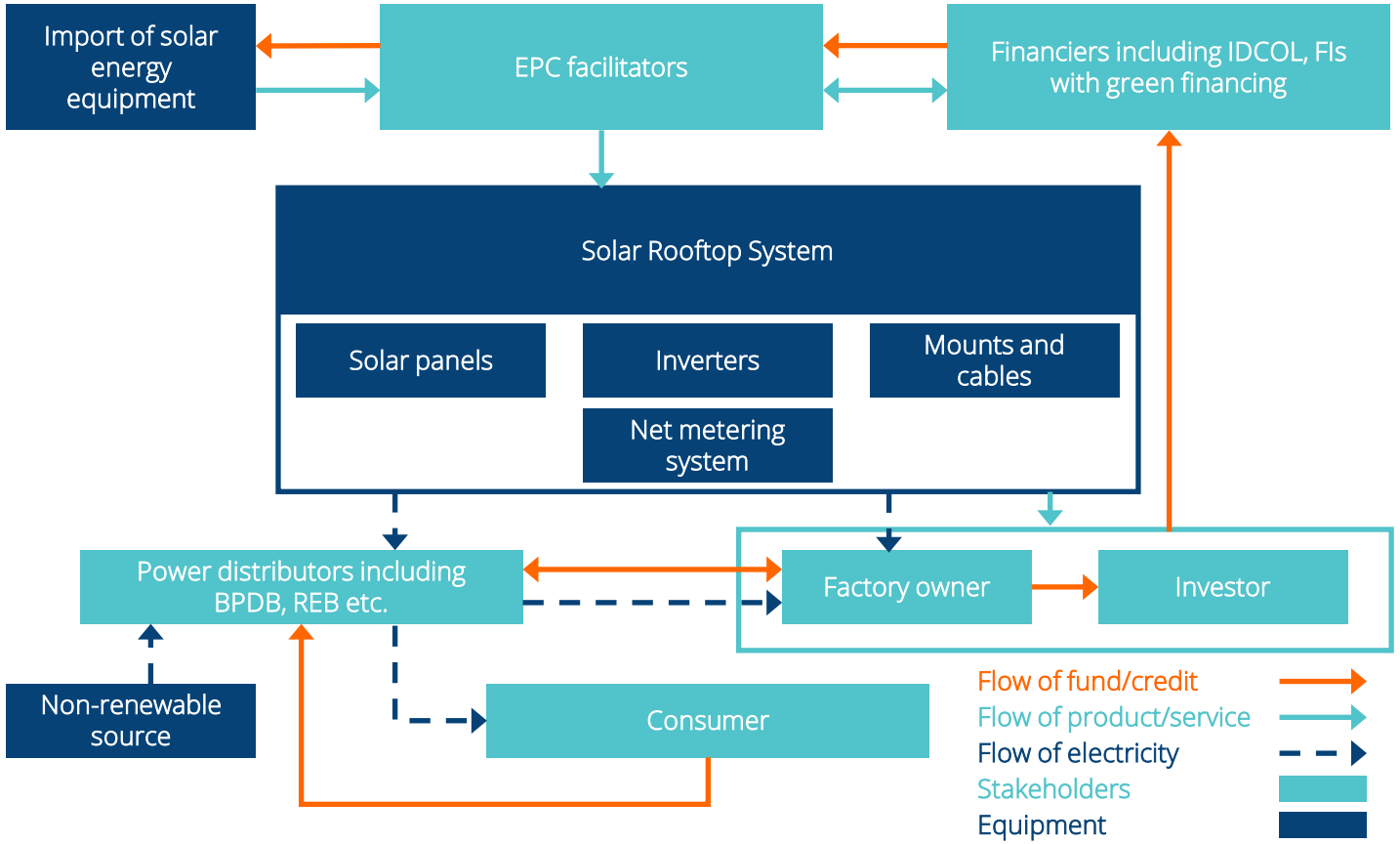
Grameen Shakti

- Created in 1996 as a not-for-profit company under the Grameen Bank, with the goal to promote and supply renewable energy technology at an affordable rate to rural households of Bangladesh. As of 2020, 1.8 million Solar Home System (SHS) has been installed by Grameen Shakti

Engineering, Procurement and Construction Companies (EPC)

- Solar Electro Bangladesh (SEBL)
- SCUBE Technologies
- Xolaren
- Solarland Bangladesh
- Super Star Renewable Energy
- Ifada Electronics
- UCC
- POWER CONTROL & MANAGEMENT
- Power Utility Bangladesh
- Supernova enterprise

Value chain of captive solar rooftops



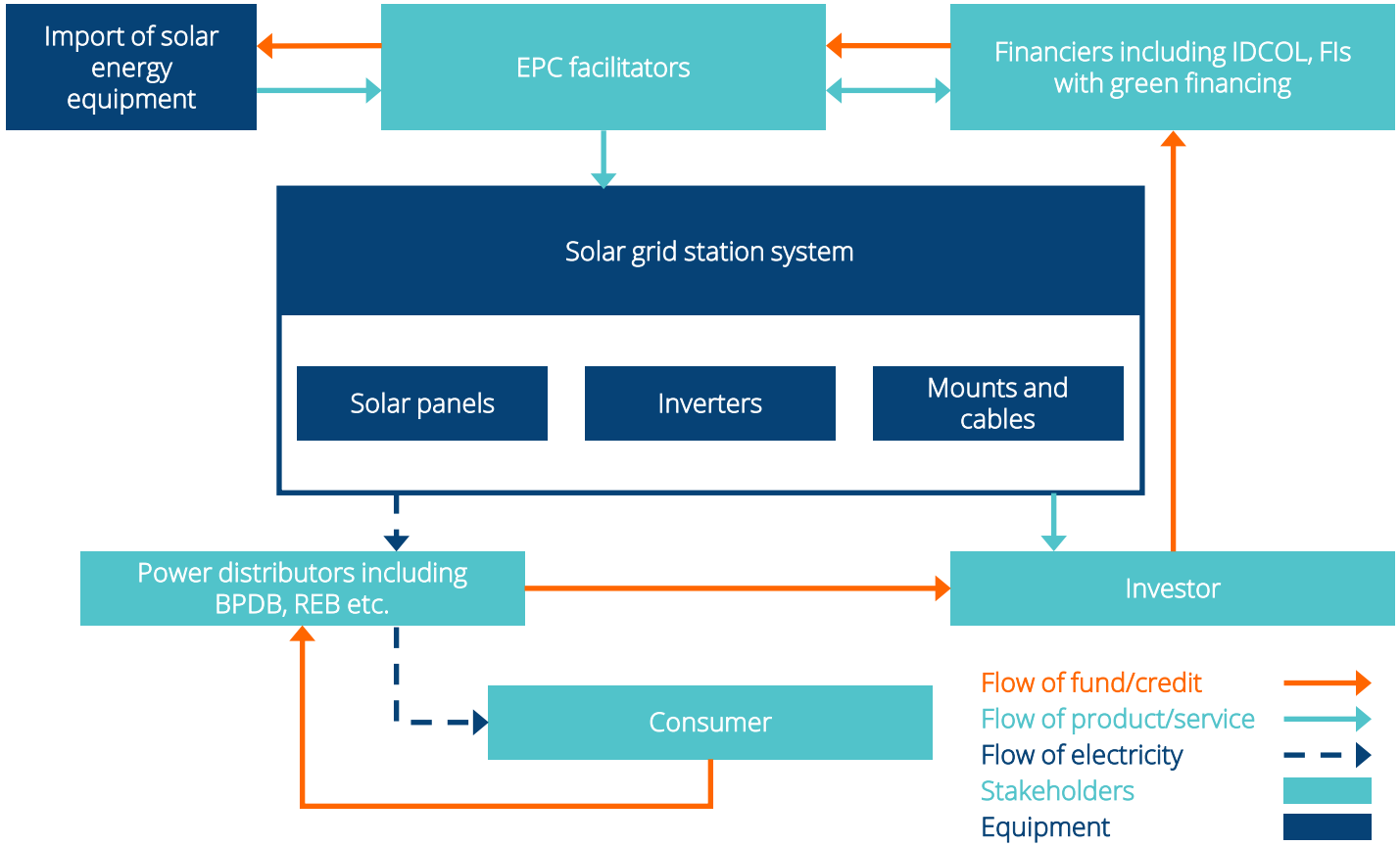
- **Opportunity for investment:** The prospect for the solar rooftop value chain is high. Multiple conglomerates are planning to build solar rooftop to reduce their operating costs. Since Dutch players are viewed as high-quality suppliers in this area, there is an opportunity for investment. In addition, Dutch players can facilitate integration of properly working financing measures and loan systems.

Trends and developments

High growth prospects

- The left diagram represents the captive solar rooftop value chain. Captive solar rooftops have a net metering system that can provide energy to the grid.
- Power distributors are one of the main stakeholders in the captive rooftop value chain. The power distributor BPDB coordinates multiple distributors including the REB and Desco.
- EPCs perform full project development from importing the solar equipment to installation of the solar panels on the rooftop.
- Captive solar rooftops operate either with a CAPEX or OPEX investment model. In the CAPEX model, the factory owner purchases the solar rooftop system and directly owns the electricity generated from its solar panels. In the OPEX model, an investor buys the solar system, while the factory owner purchases the electricity from the investor (often at a rate 20% cheaper than when purchased directly from the grid).
- The main challenge in the captive solar rooftop value chain is the limited and corrupt processes of quality control on installation and maintenance of solar rooftops (in the residential and commercial segments). At current, there is a minimum requirement of electricity that needs to be generated by solar energy (3% for the residential segment versus 10% for the commercial segment). Building owners sometimes bribe control officers to falsely clarify that the owner complies to this bar.
- There is a lack of knowledge in financial institutions in Bangladesh. This causes private entity with difficulties to obtain loans to finance their projects.

Value chain of independent power producers (IPP)



- **Opportunity for investment:** IPPs require large land plots that are scarce in Bangladesh. Hence, its future growth is doubtful. However, there is unused government land that can be used to develop solar grids network.

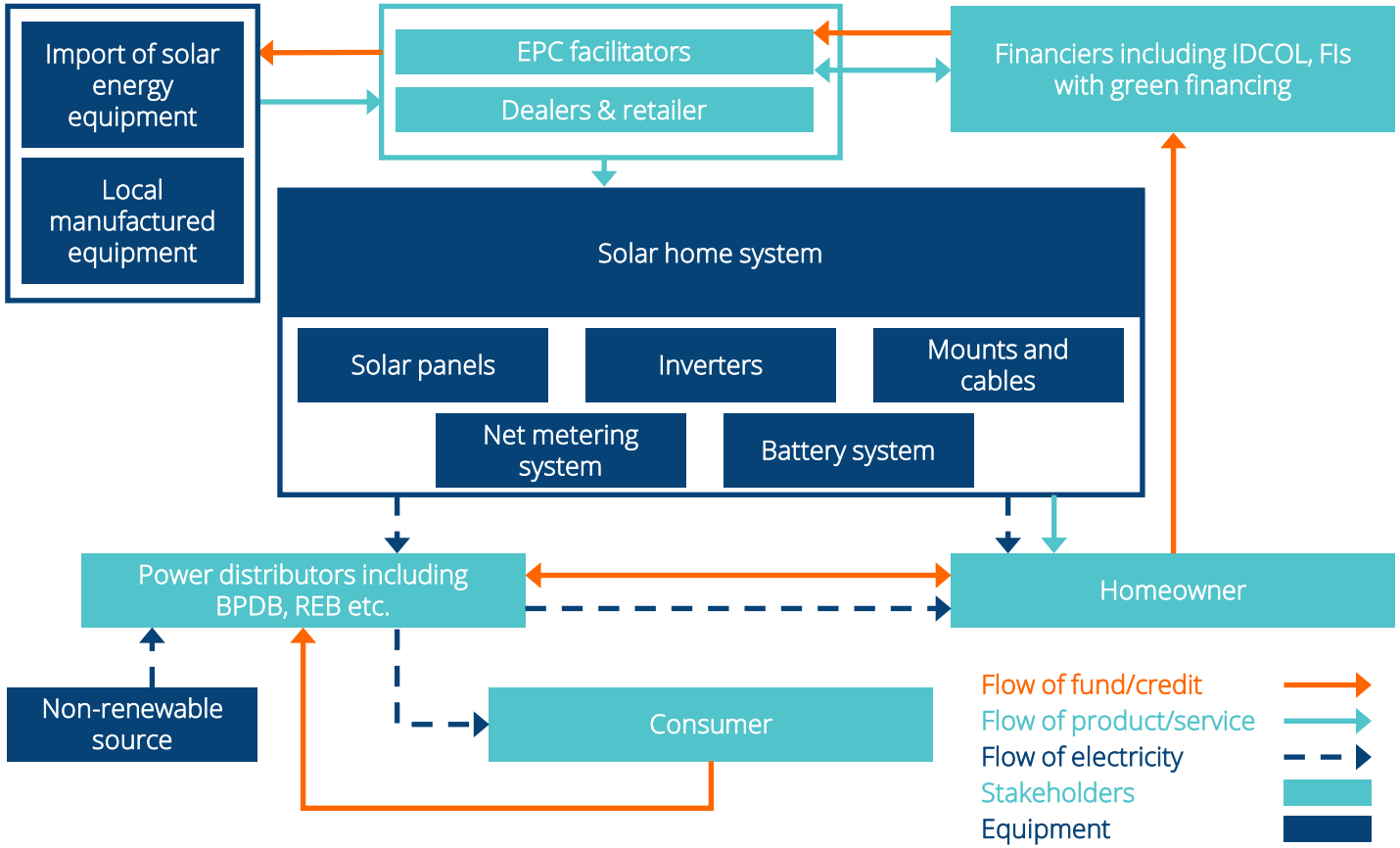
Trends and developments

Medium growth prospects

- Larive-LightCastle has identified three different value chains in the solar energy sector including IPPs, CSRs and SHSs.
- The IPP value chain is built around IPPs, non-public entities that own and operate facilities to generate electricity. The generated electricity is sold to utilities, the central government and end users. IPPs invest in generation technologies and recover their costs from the sale of the electricity.
- In an IPP station, batteries and a net metering system are not required as the stations are directly connected to the grid.
- EPC facilitators are the core actor in the IPP value chain, managing all key stakeholders in the value chain including project consultants, financers, power distributors and investors. EPCs conduct both upstream value chain activities (sourcing of equipment), midstream and downstream activities (installation and maintenance of equipment).
- EPC's primarily source tier 1 graded equipment sourced from China and sell it to power distributors. EPC facilitators thus act both as importers and distributors. Power distributors sign a PPA (Power Purchase Agreement) with the IPP for a certain period of tenure at a set rate.

Bridging Power for Bangladesh (IPP Project) | APR Energy – YouTube.

Value chain of solar home systems



- **Opportunity for investment:** Prospects of solar home systems are low as the country has reached nearly 100% electrification in 2021. However, long hours of load shedding have led homeowners to opt for solar home systems in hard-to-reach areas.

Trends and developments

Low growth prospects

Bangladeshi residents in remote areas experience heavy load shedding.

- The solar home systems value chain describes the full lifecycle of solar home systems, starting at the import of solar equipment up until the sales and installation of solar systems in houses
- Solar home services are provided by EPCs, dealers and retailers who primarily source their equipment locally from Bangladesh.
- Home solar rooftops can include a net-metering system however adoption rate is low. Generally, a battery system is installed that charges during the day, to provide electricity during the night.
- Homeowners in remote areas experience heavy load shedding. At this point in time, the stored electricity can be used. Regarding off-grid locations, battery-supplied electricity is the only power source during the night.

Regulatory framework analysis

Regulatory framework market entry

There are no legal constraints for foreign investors with respect to ownership

Market entry process Bangladesh		
Step	Registered office*	WOS or JV establishment**
1	Apply to BIDA	Apply for name clearance to RJSC
2	Notify Bangladesh Bank after obtaining registration	Open temporary bank account for deposit of capital
3	Register with Income Tax Authority	Prepare Articles and Memorandum of Association and apply for incorporation with RSJC
4	Register with RJSC	Register with Income Tax Authority
5	Obtain Trade License	Register for Trade License
6		Obtain VAT registration

- If the registered office wishes to generate and receive revenue locally, approval from BIDA is required along with VAT registration.
- Office registration processes require 6 to 7 weeks, company incorporation procedures take approximately 5 weeks.

Trends and developments

- *Implementing entities.* The CBB and Bangladesh Investment Development Authority (BIDA): regulate, facilitate and guide investments.
- *Approval required.* All investments have to be approved by BIDA. Equity ownership is subject to confirmation by Customs and Exercise Office of the import document and procedure of foreign investment in Bangladesh.
- *Share structures.* May be given to foreign investors against capital, that is invested in machinery imported to Bangladesh. 100% FDI or Joint Venture FDIs are allowed to participate in the primary and secondary stock markets.
- *Access to local banks.* Foreign Investors are allowed to have access to local banks for working capital requirements. IP is protected by Law.

Investment incentives

- ✓ No foreign ownership restrictions. 100% FDI, joint ventures, partnerships, PPPs, non-equity mode (technology transfer, licensing franchising, contracting etc.), and foreign lending are allowed.
- ✓ Investors are provided a citizenship for investing a minimum of EUR 372,710 or by transferring EUR 745,421 to any recognized financial institution (non-repatriable). Permanent residency is provided by investing min. EUR 55,906, which is non-repatriable.
- ✓ Immunity from nationalization and expropriation guaranteed.
- ✓ 5 to 7 years of custom taxation exemption opportunities for international investors, and up to 15 years for priority sectors including power. Find a full overview of tax exemptions in Annex A.
- ✓ Taxation treaty Bangladesh – NL to avoid double taxation.
- ✓ PV-modules, engineering and light engineering sectors are earmarked as "special development sectors", fostering import of raw materials.
- ✓ According to capital repatriation policies, full repatriation of invested capital, profits and dividends are allowed. Foreign investors reinvesting their retained earnings/dividend will have their investment be treated as new and not recurring.
- ✓ Foreign investors are provided multiple entry visas to Bangladesh, valid for 3 years.

**Note: An entity willing to import equipment and machinery to Bangladesh must obtain an import registration certificate (IRC) from the Ministry of Commerce. The process requires an approximate of 10 days to obtain the certificate.*
***Note: Incorporated companies are governed by Registrar of Joint Stock Companies and Firms (RJSC).*

Policy parameters in the renewable energy sector

Release of Renewable Energy Policy in 2008 and Net-Metering Policy in 2018 has stimulated technological innovations in the renewable energy sector.

Optimistic aspirations being hindered by dated policies

- *Transition to a climate-resilient economy*. Current renewable energy goals include 100% access to energy in 2020 with 10% generated by renewable energy sources, 30% by 2030 and 40% by 2040. At current, around 3.7% of the total generated electricity comes from renewable energy sources.
- *Optimistic approach towards grid modernization.* An optimistic approach taking grid modernization, financing and investment into account stimulates achieving the renewable energy goals set for 2030, leading to **net energy consumption saved equal to of EUR 1,721 MN by 2030,** based on an electricity price of 0.088/kWh**.** This contributes to achieving Sustainable Development Goals 7 (Affordable and Clean Energy) and 13 (Climate Action).
- *Policy signals:* Identification of competitive renewable energy zones on land, lakes, at sea, clusters of rooftops, and canals to be matched with incentives and relevant grid investment and development could be an opportunity to rapidly surpass the target while providing access to low priced power and creating jobs.

Extension and modernization of grid connectivity

- *Grid modernization plan.* The plan aims to accelerate grid technology with increased installation of storage technology and increased distributed energy resources, increased flexibility to integrate market opportunities such as a new ancillary services market for ramping products, and fast frequency response from batteries. The plan also aims for new market participants to provide ancillary services, such as wind turbines providing inertial response, solar PV and utility-scale storage providing voltage support, and DERs providing frequency and voltage control.
- The integration of VRE occurs in six different phases, where each phase depends on the degree of VRE penetration into the grid and requires different measures to support system flexibility. Bangladesh is currently at phase 1 and in the coming decade the system will move to phase 2 and phase 3. In these phases, issues regarding fluctuations in power demand and supply will incur that can be addressed through short-term frequency control measures. Following a study by IRENA, increasing the percentage of electricity generation by renewable energy sources with 10%, would require an increase in reserved VRE capacity of 2% (1.5% to 4%).

Net metering policy 2018

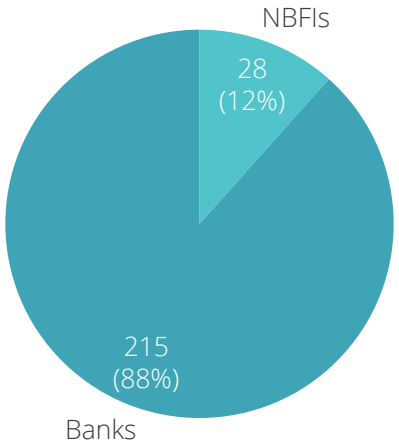
- *Net-metering policy, 2018.* Aims to facilitate DRE solutions by transferring the excess energy generated to the grid in return for a credit on the electricity bill. The policy has increased ROI for investors and increases access to electricity generated by renewable energy. The policy has marked 22 solar panel models and 51 grid-tied inverters eligible, with solar panel brands including Jinko, JA Solar, Canadian Solar, Longi Solar, Trina Solar etc., and invertor brands including Huawei, Sungrow, SMA, Sunways etc.
- *Bangladesh Standard and Testing Institution (BSTI) has implemented component quality standards for solar energy system components.* The components in the net metering program are approved, hence new market entrants are required to meet the standards criteria set by BSTI.

Source: Energieopwek.nl, 2022. PV-magazine.com, 2022. TNO, 2022.

Solar financing

The availability of green financing at preferential rates is not being utilized due to the lack of capacity of the FIs

Green Finance loan disbursement, in EUR MN, over April – June 2022



2.35 MN loan disbursed under Refinancing Scheme in Apr-Jun, 2022

77% of the loan disbursed under Refinancing Scheme is towards Green Certified Building

Solar energy system	Energy capacity (kWp)	Lending cap (EUR)	Loan tenure (Years)
Solar Home System	10 Wp to 1 kWp	1,605	4
Solar Park	-	2,752,293	8
Solar Irrigation System	6 kWp to 12 kWp	32,110	8
Net Metering Rooftop Solar	-	183,486 (Household); 458,751 (Commercial); 917,431 (Industrial)	5 (Household); 8 (Commercial and Industrial)
Solar Pump for Drinking Water	-	275,229	8
Solar Cold Storage	-	733,944	8

Sustainable and Green Financing Mandates of the Central Bank

Refinancing scheme

- Current refinancing scheme BB is EUR 37.4 MN for green and sustainable projects. Financial institutions provide loans at 5.5% and refinance them at 3% from the central bank.
- In Bangladesh, Banks and NBFIs have to disburse 5% of their total loan disbursement as "green loans". However, few organizations are able to meet the target, with an average of 4.1% in Apr-Jun 2022.

The challenge

- Loans are granted through provision of a clear business case to financial institutions. However, in the solar industry, only an artificial income stream can be provided through CAPEX investments, calculated as the reduced cost of electricity when using solar energy.
- At current, only Infrastructure Development Co. Ltd., a government-owned NBFI, has sufficient resources to understand this artificial income stream and to analyze the feasibility of the project before approving the loan. However, most organizations lack this capacity. As a result, it is difficult for companies to attain these loans.
- In OPEX model investments, where investors directly receive income from the electricity customer, there is a clear income stream, making it easier for investors to obtain a loan.

The apparel and textile industry: compliance policies

International buyers have become more and more sensitive about the working environment of their order sources

Different components of compliance requirements in the RMG industry

Social compliance (include wages)	Environmental, health and safety (EHS)	Global security verification
Environmental compliance	Building safety	Quality technical standards

Examples of buyer codes of conduct – H&M	
Environmental permits	Company must have the relevant environmental permits and licenses for its operations.
Handling of chemicals	Chemicals used must be following H&M's Chemical Restrictions for the relevant product type. Chemical containers must be properly labelled and safely stored. A material safety data sheet (MSDS) must be available (in the local language) in the workshop. The instructions in the MSDS must be followed. (Refer to ILO Convention 170).
Water management and wastewater treatment	The treated wastewater quality must meet the requirements in local legislation or the Building Safety Regulatory Guidelines (BSR), whichever is stricter.

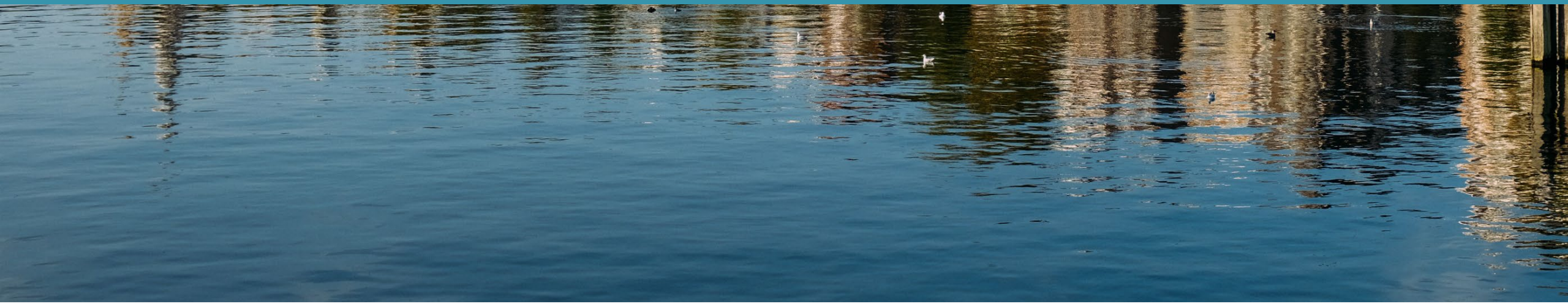
RMG compliances

- Nowadays, most international RMG buyers are serious about compliance before placing any import order. At the basic level, Bangladeshi factories must comply with the country's own environmental requirements. However, international buyers are increasingly demanding Bangladeshi producers obey their own regulated codes of conduct.
- The main agency in charge of awarding factories with environmental clearance certificates, is the Department of Environment (DOE) under the Ministry of Environment and Forests and Climate change. Depending on the impact on the environment, the DOE classifies all the projects into four categories: Green, Orange A, Orange B and Red. The apparel and textiles fall into the Orange B category, while the textile dyeing, and chemical processing is a Red category. In both categories, factories are required to obtain Environmental clearance from the DOE.
- Among the many prerequisites for getting Environmental clearance (such as Initial Environmental Examination, Environmental Management Plan for orange B; and an additional Environmental Impact Assessment for red category projects), is the installation of an Effluent Treatment Plant within the factory premises. Nevertheless, many firms that have installed mandatory environmental plans don't use them because of significant operating costs and because of weak monitoring from the government.
- RMG companies are increasingly facing pressure in terms of buyer compliance, as international buyers have become more and more sensitive about the working environment of their order sources. Therefore, RMG factories have the incentive to invest heavily in compliance to achieve sustainability as their end goal.
- A full overview of current compliance policies for the RMG sector is provided in Annex B.

Risk analysis

Risk Categories	Possibility of Incurrence	Explanation
Macroeconomic risks	Moderate	High dependency on imported equipment makes the market volatile to global economic events that may hinder Bangladeshi currency valuation and overall trade.
Permit risks	High	Acquiring land permits to set IPPs is unpredictable because of the extensive due diligence process. Moreover, the low availability of non-agricultural land and ownership transfer of multiple small lands to allocate a sizeable area can make the process of setting IPPs cumbersome.
Power market risks	High	The ambitious targets of the renewable energy sector could be hindered by the low level of market liberalization, high cost of installation, and current subsidies on fossil fuels hindering its growth. Also, because of the lack of a standardized PPA process, every intervention needs to be examined by multiple stakeholders in the value chain.
Political risks	Moderate	There is a need for a strong relationship between the PV sector and government stakeholders to ensure ease of implementation.
Resourcing risks	Moderate	Solar projects in remote areas have underdeveloped infrastructure and transmission lines. Furthermore, the non-agricultural lands used as project sites are prone to flooding and land erosion.
Financial risks	High	Renewable energy is a capital-intensive investment that requires relatively heavy funding. However, very few banks have proper experience in this sector resulting in a lack of access to finance even with the central bank setting targets for sustainable and green loans.

Netherlands chapter



LightCastle Partners

LARIVE INTERNATIONAL

Market analysis

Dutch solar market

The Netherlands is the 3rd largest player in the EU in terms of PV installed capacity (3.6 GW) after Spain (4.8 GW) and Poland (3.8 GW)

➢ Market

- Fast growing market, with a CAGR of over 10.5% over 2022 – 2027 and a population of ~17.5 MN (2021). Increasing GDP per capita (EUR ~45,216/capita) with a growth rate of ~10.9% over 2020-2021.
- 2nd highest Watt per capita globally generated from solar energy (825 Watt/capita) after Australia (1,049 Watt/capita). The total per capita electricity consumption is 6,500 kWh (2021), which is 20% above the European average.
- Europe's 3rd largest player in terms of installed PV capacity (3.6 GW) after Spain (4.8 GW) and Poland (3.8 GW) in 2021.
- Active innovation policy combined with strong R&D capabilities results in high-quality, reliable products and integrated solutions suited to different contexts.

- The matrix on the right provides an overview of R&D segmentation in the Netherlands.
- Dutch companies and institutes hold strong knowledge and experience to deal with complex energy supply and demand in emerging countries.
- Active innovation policy combined with strong R&D capabilities results in high-quality, reliable products and integrated solutions suited to different contexts.

R&D Consultancy (Universities, Institutions)		
Equipment & supplies	Materials & semi finished products	PV-cell
Materials & Semi finished products	Integrated panels	Mounting & tracking
Materials & Semi finished products	Equipment & supplies	Equipment & supplies

Dutch solar industry segmentation

Tight-knit alliances between industry, research and government allow Dutch solar sector players to deal with complex energy supply and demand in emerging countries such as Bangladesh

➢ Research and innovation

- The Netherlands is a global leader in both fundamental and applied solar research.
- Primary focus: PV-cell technology, design and development of solar panels, optimization of current systems and integration of PV-technology in buildings and vehicles.
- Competitive advantage: Dutch knowledge institutes and private sector players are specifically strong in developing PV generation technology with high quality and high energy efficiency levels.
- Matchmaking: Dutch knowledge institutions could support enhancement of the Bangladeshi solar sector by developing appealing business cases through calculation models, measuring equipment and simulation setups to predict potential yields with higher accuracy.

➢ Financing

- Dutch financing institutions facilitate maximizing renewable energy projects returns by offering attractive (re)structuring, negotiating debt and equity packages.
- Most financing institutions (e.g. FMO_ focus on large-scale investments, >EUR 5 MN.
- For smaller investments, Dutch companies that envision to expand towards Bangladesh can use export financing loans (Invest International) for start-ups, SMEs or use export funds (Atradius) to reduce upfront investment costs by using purchasing loans, lease and partial lease options.
- Dutch companies can collaborate with solar investors such as Obton, that are actively investing in the development of large solar parks both in and outside the Netherlands and are looking for projects to add to their portfolio.

➢ Connecting and mobilising

- Several industry associations (FME, Top Sector Energie, Connectr, SEECE) mobilise the solar sector and match companies, knowledge institutes and government players to connect supply and demand.
- Branch organizations such as Holland Solar advocate for companies and consumers in the solar energy industry.

Private sector players

Dutch solar companies have a competitive advantage in designing and developing high-quality and energy efficient solar solutions

➢ Private sector segmentation

- The Dutch solar market is dominated by commercial rooftop developers (40%, 1.4 GW), followed by the residential segment (35%, 1.3 GW) and the ground-mounted and PV solar accounting for 25% (0.9 GW).
- Residential segment players focus primarily on the integration of PV-technology in buildings such as solar rooftops and solar home systems.

➢ PV-producers

- PV-producers focus on developing high-quality PV-panels with innovative cell technologies.
- Imported PV-panels could be replaced by higher-quality Dutch PV-panels resulting in higher solar panel lifespan, energy reliability, productivity and yields.

➢ System integration and installation

- Integrators source solar equipment, design optimal solar systems, integrate these into a single product and install it at the customer. Often, these stakeholders perform maintenance and planning services as well (e.g. Independent Energy),
- Most Dutch integrators and installers focus on rooftop solar fields or floating solar (e.g. Groenleven, Floating Solar, Solarfields). The Netherlands is renewed for having the largest floating solar panel project in Europe.

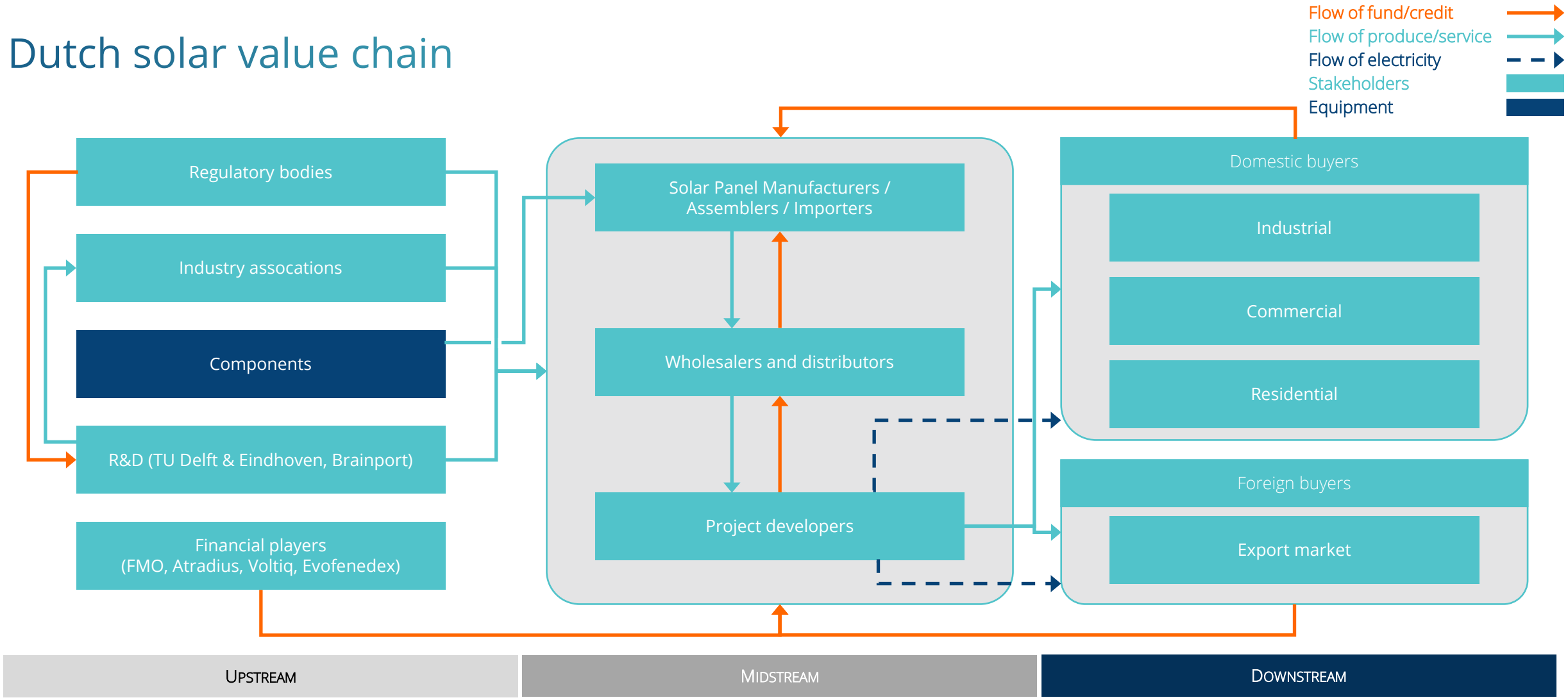
➢ Sustainable mobility

- Solar mobility suppliers develop solutions to reduce urban emissions and congestion, designed for sharing platforms and private use.

➢ Battery storage – cold storage

- Dutch battery producers apply innovative methods to design batteries with optimal solutions.
- High-quality flow batteries, lithium batteries and refurbished batteries are provided by Dutch players.

Dutch solar value chain



- Dutch companies and institutes are active throughout the entire value-chain, from raw materials, design, manufacturing equipment, software all to development of high-end solar modules and project development.

Dutch solar market developments – Key drivers for growth

Government policies and switching consumer behavior towards renewable energy sources fosters solar market growth

Rising supply and demand for solar energy	➢ *Rising demand*. The increasing fossil fuel prices, government incentives, increased R&D in the solar sector and company's sustainability goals have facilitated the consumer switching behavior towards solar powered electricity, stimulating the demand for solar energy. ➢ *Increasing supply*. 25.5% of the total electricity demand was generated by solar energy in August 2022. This high percentage was primarily caused by increased production and installation of PV-panels combined with the high number of sunny hours in August. The envisioned installed PV capacity is expected to increase further, from 14.3 GW in 2021 to a maximum installed capacity of 55 – 132 GW in 2050.* ➢ Companies are switching toward solar energy primarily for their own branding, and for achieving their sustainability goals.
Political drivers	➢ The Dutch energy policy is planning to reduce greenhouse gas emissions (GHG) emissions by 49% by 2030 and by 95% by 2050 and for 100% of electricity to come from renewables by 2050. ➢ The Dutch government aims to source all its electricity supply from renewable sources by 2030. Hence, it is likely to boost solar PV deployment across the country. ➢ In June 2021, to improve the renewable energy-based generation within the country, the Netherlands Enterprise Agency, has allocated 4,406 MW of renewable energy capacity through bidding rounds. ➢ Subsidies are granted to stimulate installation of solar panels by companies and consumers (SDE++). ➢ Falling deployment costs and feed-in-tariffs.
Private investments	➢ In April 2021, RWE AG has officially commissioned its first ground-mounted PV project in the province of Limburg in Netherlands. The project has an installed capacity of 14.7 MW and consists of more than 36,000 solar panels. ➢ Due to the SDE++ subsidy, about 2,269 MW of PV project proposals have been accepted, accounting for over 90% of all pre-assigned capacity.

Source: Energieopwek.nl, 2022. PV-magazine.com, 2022. TNO, 2022.
**Note: 55 GW is expected under the adapt scenario, the assumption includes that the maximum available potential is not fully utilized. 132 GW is expected under the transform scenario, where the maximum available capacity is fully utilized.*

Case studies

Case study: Floating solar

Floating solar systems can provide Dutch companies a unique position in the global floating solar market.

Introducing Floating Energy Solutions (subsidiary of Sun Projects)

- Floating Energy Solutions is part of Sun Projects, established in Amstelveen. Floating Energy focuses on floating solar. Sun Projects also focuses on solar carports and building facades. The company supplies large energy suppliers such as Eneco and Shell.

Products and projects

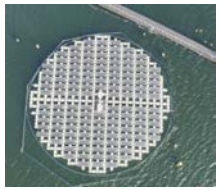
- Floating Energy designs and installs floating solar systems where the unique technical part of these systems, including the combination and ratio of specific equipment, provides the most added value. @ma
- The company conducts legal, technical and financial due diligence prior to establishing an installation agreement and construction of systems to the grid.

Trends and developments

- Groenleven B.V. has the exclusive right to use a renewed, highly productive, floating solar system called the 'Zimmerman System'. However, other Dutch companies such as Engie and Floating Energy have developed comparable systems. Floating Energy primarily uses 'east-west systems'.

Growth ambitions and interest in Bangladesh

- Floating Energy has a strategy to grow organically and till current focused on European markets primarily. The company has subsidiaries in Portugal, Belgium and Germany.
- Floating Energy is interested to explore opportunities in emerging markets such as Bangladesh.



Case study: Storage

Solar powered storage solutions are necessary to overcome the power challenges in Bangladesh. Dutch companies are well equipped to develop such solutions

Introducing Zenon

- Zenon Energy designs and builds leading energy storage systems from cell to system. The company ranks first in terms of quality and battery life duration in the Netherlands.

Assortment

- Storage systems are tailored to the customer needs. Zenon produces multiple types of batteries differentiating between high-quality batteries that are fast charging and have a long lifespan, and simple, cheaper batteries with a lower amount of features.
- Whereas the high-quality batteries fit perfectly to Dutch customers requiring fast charging and a long lifespan, the simple batteries are especially equipped for developing markets such as Bangladesh.

Global developments ambitions

- Zenon focuses primarily on European markets and has little experience in international markets outside Europe.
- The company recognizes the urgent need to further develop (solar) storage products for emerging markets, as these can support combating energy power challenges in these markets. Specifically, solar generated power combined with storage can solve power outrages, peak challenges and provide energy to rural areas where access to the grid is often minimal.
- The challenge to further develop these ambitions primarily includes the minimal amount of locations to source raw materials required for the production of batteries, making batteries still expensive.
- Zenon does recognize an upward trend of cheaper batteries that can be used for emerging countries such as Bangladesh in the near future.

Case study: Cold storage

Zenon Energy recognizes the urgent need to develop (solar) storage products to combat the current power challenges in Bangladesh

Introducing Dawsongroup Benelux

- Dawsongroup Benelux offers portable cold storage solutions, both rental and sales.

Assortment

- Dawson designs and produces cold storage facilities suitable to different contexts. The cold storage facilities have the ability to provide up to -20 degrees Celcius inside, to +40 degrees Celcius outside, ensuring maximum product integrity.
- For emerging markets such as Bangladesh, Dawson has designed inflatable solutions together with the UN. These inflatables are resistant to extreme climate conditions, flexible, reliable, especially well equipped to provide cost-effective power solutions vital in supporting temperature critical operations in remote locations and environments of the humanitarian aid and disaster relief sectors.
- Dawson develops both large containers and smaller products. While the larger (20 up to 100 ft) units are primarily used in areas with high risks of natural disasters, smaller units are mainly used for the last mile medical equipment and vaccination storage.

Global developments ambitions

- Dawson focuses primarily on the UK and the Netherlands. However, Dawson conducts project-based activities in Asian and African markets as well, mostly in collaboration with the UN.
- Dawson recalls the need to integrate solar and storage into cold storage facilities and implement these in Bangladesh, as a means to reduce food loss and waste, facilitate the pharmaceutical sector to store vaccinations and medical equipment. Dawson recognizes the opportunity to connect cold storage with solar and battery storage, to provide green solutions for reduction of food loss and waste, and to facilitate storage of vaccinations in Bangladesh.

Case study: Solar design and integration

Designing and integrating solar and storage into different products allows development of products specifically tailored to Bangladeshi needs

Introducing Independent Energy

- Independent Energy provides a range of services from design, manufacturing, up until installation and after-sales services.

Assortment

- Independent Energy provides solar and solar-related products including standard, power distribution, solar container. The company has strong capabilities to identify the specific needs of a customer and tailor the product design according to these needs.
- For the Bangladeshi environment, Independent Energy could design multiple solar powered solutions for different sectors, on rooftops or as standalone product.

Global developments ambitions

- Independent Energy is currently active in the Netherlands, Nigeria, Oman, Surinam and Sierra Leone. The picture on the right demonstrates a fish-farm integrated with solar panels in Rwanda, designed and developed by the company.
- Independent Energy recognizes the need to further integrate solar into different sectors in Bangladesh. However, the company Director, Peter van Zwol, stresses that it will be hard to export solar panels or products itself.
- The Director has identified the opportunity to integrate solar into several products, combining solar energy with horticulture, EV-mobility and cold storage, the latter especially in the pharmaceutical and aquaculture sector.

Case study: Knowledge transfer

"Focus on the integration of solar in other products. Don't sell a product, sell a solution to a specific problem."

Introducing SEECE

- SEECE is the Sustainable Electrical Energy Centre of Expertise for sustainable, reliable and affordable electrical energy supply. It is a public-private partnership of companies, institutions and various groups with in the HAN that stimulates necessary innovation and ensures sufficient labour capacity.

Where do you see an opportunity for Dutch companies in Bangladesh?

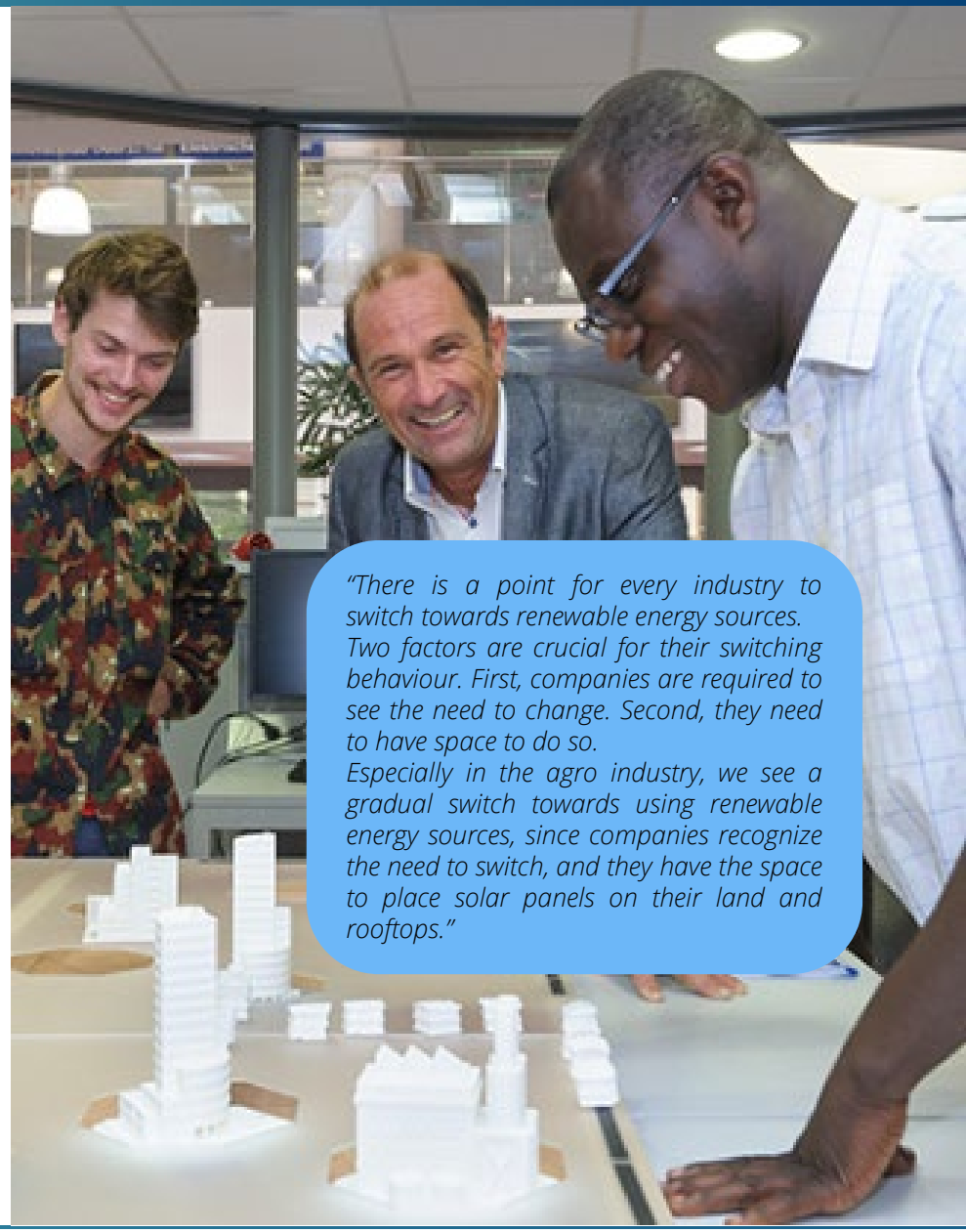
- *Focus on integration of solar in other products*. Don't sell a product, sell a solution to a specific problem. This will motivate customers to pay a premium price.
- *Focus on after-sales service.* If there is a problem with the equipment, you want it to be repaired quickly, so you don't loose power and consequently loose profit. Companies are willing to invest more in solar equipment if products can be replaced easily and rapidly through good after-sales services.
- *Create an enabling environment through training programs.* To accommodate for these after-sales services in developing countries, it is important to create a sufficient workforce capable to provide these after-sales services. This can be achieved by providing training programs in-house or via a consortium method similar to the RenewableTechNigeria solar project.

What are risks for Dutch companies when internationalizing to Bangladesh?

- *The product is not suited to Bangladeshi (environmental) conditions.* Products need to be simple to install, cheap and easy to maintain. On top of this, a product has to be engineered towards specific environmental conditions. For example, the Nedap N.V. Powerrouter stopped producing it because it could not bear the heat combined with the sea salt. Making a product suited to European conditions is no guarantee for success in Bangladesh.
- *Time.* Introducing new products in a developing market takes much time. It is easier to first get a good picture of the industry and identify where are the low hanging fruits.

Global developments experience and ambitions?

- SEECE has performed multiple projects in Africa and Asia and is motivated to, in collaboration with Larive, expand its activities in Bangladesh through a consortium approach.



Case study: Solarparks

"Solarfields has limited knowledge, experience or partners in Bangladesh. Yet, the company is open minded and innovative, and is interested in a cluster approach to entering the Bangladeshi market.

Introducing Solarfields

- Solarfields is the market leader in developing solarparks on land and building rooftops. It's main competitors include Groenleven and Sunrock.
- Capacity: 858 MW (2022).
- Target 2030: 4 GW of power generation and 1 MN people provided of energy.
- Product-portfolio: Transitioning from single-asset (energy generation through solar parks) focus towards a full-service company (energy generation, management and storage).

Trends and developments in the solar market

- Increasing market for storage. Solarfields has employed pilot projects including:
  - Green hydrogen (300 MT/year).
  - Battery storage (17 MWp, battery of 1MW and 1MWh).
  - Solar thermal energy (energy for households).
  - Other projects are being developed.

Appetite for the Bangladeshi market

- At current, Solarfields is active in the Netherlands. The company envisions to expand towards Scandinavia, Germany, Benelux, Austria and the UK in the coming 1-2 years.
- While Solarfields is currently looking towards European markets, the company is openminded towards projects in developing markets. Since Solarfields has limited knowledge, experience and feet on the ground in Asia, the company would be interested into joining a consortium of companies to enter the Bangladeshi market.

Case study: Connecting and mobilising

Connectr Arnhem: 18,000 M² innovations around one mission: Energy transition

Introducing Connectr

- Connectr focuses on electrical energy technology, electrochemical energy storage and sustainable drive systems. With the help of an innovation program and lab, shared facilities, Connectr supports companies to accelerate the application and scaling of their product.

What do you think is the competitive advantage of Dutch companies over international players?

- Charging infrastructures, battery capacity combined with solar energy.
- Solar combined with vehicle to grid charging.
- System integration such as Zenon is conducting. While the technology used by Zenon could be used by other companies, Zenon is specifically capable in designing and developing the communication systems.

FME

- Mobilizes and connects technological industry and society.

TKI Urban Energy

- Consortium that stimulates the development of innovations for a sustainable, reliable and affordable energy system in the built environment.

Holland Solar

- Representative of the Dutch solar energy sector.
- Influence decision-making and steer agenda around legislation, regulations and subsidies.

Trade and investment opportunities

Matchmaking Dutch strengths to opportunities in the Bangladeshi solar sector

Innovative Dutch technologies in design & integration of solar applications are vital to overcome challenges of the Bangladeshi energy sector

The Dutch solar sector excels in designing integrated solar solutions with innovative technologies, which could advance the productivity of current solar solutions, advancing the Bangladeshi renewable energy sector to a more professional level. These essential (key) technologies are centred around four themes including solar powered software, solar integrated into EV-mobility, solar powered water desalination and solar integration into cultivation, lightening and storage of fruits and vegetables. Sector-specific niche initiatives that can be scalable and business viable include:

Solar & digital transformation

- Centralized data collection, analysis and storage.
- Solar PV-software (e.g. Solar Monkey).
- Big data on solar rooftops and floating solar parks.
- Design and installation software for solar PV-systems.
- Energy-efficiency management in factories.

Solar & EV-mobility

- Transforming towards clean and green transport.
- Integrating smart grid solutions and solar generated smart EV-charging.
- Using lithium batteries, the Bangladeshi EV-charging network can be further developed.
- DC-charging and fleet management.

Solar & Horticulture

- Applying solar energy for protected cultivation.
- Horticulture lightening using solar energy.
- Solar powered water irrigation.
- Solar powered storage facilities to reduce post-harvest loses and enabling fostering export to international markets.

Solar & cold storage

- Reduce CO2 emissions by replacing diesel powered cold storage.
- Reduce food loss and waste by reducing power loss and optimizing cold storage capacity up to -40 degrees Celsius.
- Improve storage of vaccinations, medication with solar energy.

Solar rooftops & financing models

- Reduce dependency on diesel generators by installation of solar rooftops.
- Potential business model for Dutch players: providing low-cost, low-carbon elektricity solutions to help business accelerate their sustainability goals.
- Reduce dependency on CAPEX models by fostering development and integration of OPEX models in the captive rooftop segment.

Potential angles for Dutch private sector engagement: Solar rooftops

High likelihood of success

Dutch players could support knowledge transfer and capacity building for installation and maintenance

Solar rooftop landscape in Bangladesh

- Following a mandate implemented in 2010, there is a minimum requirement of total electricity to be generated by solar, including 3% for the residential segment versus 10% for the commercial/industrial segments, and excludes power required for air conditioning. At current, there are ~61,693 rooftop solar systems with a total capacity of 42 MWh, managed by two power distribution companies (DESCO and DPDC) in Dhaka.

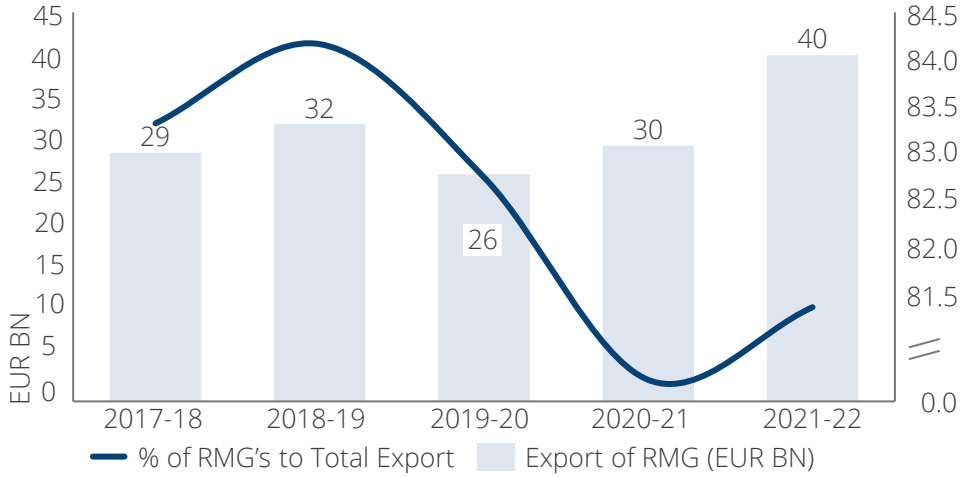
The challenge in Bangladesh

- Low-quality panels, inverters and transformers installed*; limited inspection on solar rooftop systems by PDCs; limited knowledge and awareness on the business case of solar rooftops; and due to the availability of grid power, reluctancy by building owners to ensure proper maintenance of the solar systems.

Opportunities for Dutch players

- *Installation and capacity building skills.* Dutch players are specifically renown for their installation and maintenance skills regarding solar systems. Dutch companies and knowledge institutes could transfer their knowledge and skills to Bangladeshi players, fostering knowledge transfer and capacity building between Dutch and Bangladeshi stakeholders, while simultaneously improving the Bangladeshi solar sector.
- *Increased relationships, trade and investment.* Consequently, increasing knowledge and skills of Bangladeshi stakeholders will improve awareness on the potential of Dutch, high-quality equipment, the importance of proper installation, maintenance and quality control. As a result, this will foster relationship building and stimulate trade and investment between the Netherlands and Bangladesh.
- *Dutch competitive advantage.* Dutch solar players such as Solarfields, BeSolar and Groenleven are specialized in developing solar rooftops. E.g., the world's largest solar roof was installed in the Netherlands, including 48,040 high-quality solar panels with a peak output of 18 MW, which is enough to supply 4,500 households with electricity. Dutch solar rooftop suppliers would be preferred over other suppliers include light weighted panels: up to a difference of 50% compared to Chinese PV-panels, high energy efficiency; cost-effective; high level of reliability.

Export value and export share of RMG, in EUR BN and %, over 2017 -2022



Solar rooftop development in the RNG sector

- Contributing to ~80-85% of its export earnings, Bangladesh's economy depends heavily on the apparel sector. With 171 US Green Building (USGBC), Bangladesh is global leader in Energy and Environmental Design (LEED) certified green factories with a high energy consumption.
- Export-oriented green factories get a **2% tax incentive** compared to non-green export-oriented factories. As green factories are required to install rooftop solar, there is significant potential for rooftop captive solar power in Bangladesh.

*Note: (before the new net metering guideline 2018) that cannot be used in the net metering system (1,152 in 2017-2018).

Potential angles for Dutch private sector engagement: Cold storage

Substantial likelihood of success

Solar powered cold storage could reduce post-harvest losses and CO2 emissions

Cold storage in Bangladesh

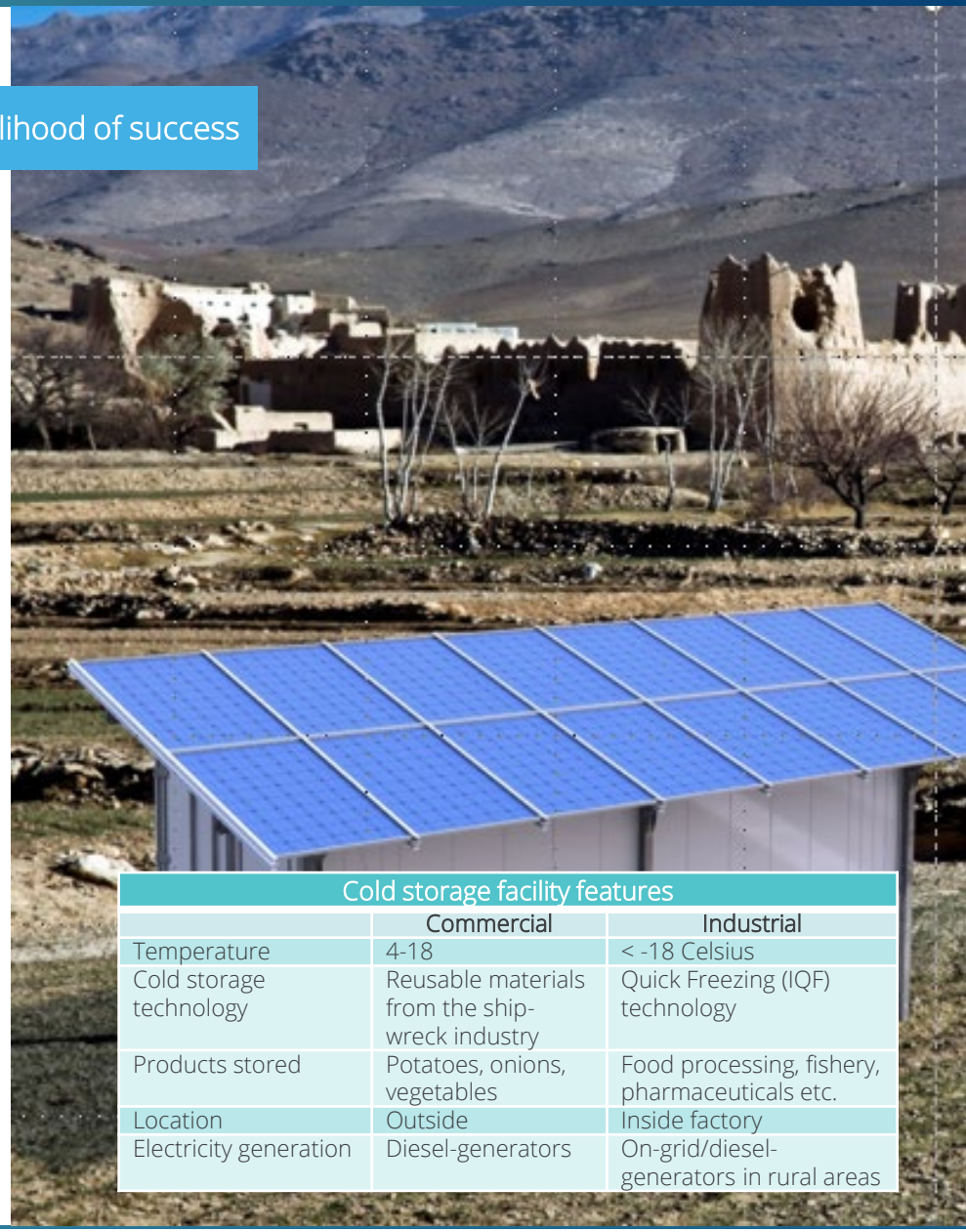
- The cold storage landscape in Bangladesh is split in the commercial and industrial segment. The current cold storage capacity in Bangladesh: 6 MN, and a target of 7.7 MN for 2022.* Storage costs are ~EUR 0.0037/kg per day.

Challenges in Bangladesh

- *Commercial segment:* At current, Bangladesh has an estimated post-harvest loss of >25% of the total production volume for fruits and vegetables, forcing farmers to sell their produce at a loss to traders and hoarders. Cold storage integration could reduce post-harvest losses. However, the market for cold storage is still underdeveloped. There are a limited amount of off-grid cold storage suppliers and low adoption rate by customers due to limited technical knowledge by farmers regarding installation and maintenance, and low willingness/capacity to invest in cold storage.
- *Industrial segment:* High dependency on expensive and environmental harmful diesel-generators by operators in rural areas due to high power cuts.

The opportunity for Dutch players

- *Commercial segment:* Dutch companies could design and develop solar integrated cold storage solutions with battery storage to enable 24/7 cold storage in off-grid locations, to reduce post-harvest losses.
- *Industrial segment:* The pharmaceutical and active pharmaceutical ingredient (API) industries have a combined market size of ~EUR 3 BN, contributing to 2% of the GDP in Bangladesh. There is a strong need for high-quality cold storage in warehouses and transport, specifically (4-25 degrees Celsius), powered by cost-effective solutions to replace current expensive diesel-generators. This combined with government incentives for APIs through fiscal and export subsidies, provides an attractive market for Dutch players.
- Dutch suppliers could tap into this market by developing solar integrated cold storage facilities to develop solar integrated cold storages solutions specifically designed for Bangladeshi needs.



Cold storage facility features		
	Commercial	Industrial
Temperature	4-18	< -18 Celsius
Cold storage technology	Reusable materials from the ship-wreck industry	Quick Freezing (IQF) technology
Products stored	Potatoes, onions, vegetables	Food processing, fishery, pharmaceuticals etc.
Location	Outside	Inside factory
Electricity generation	Diesel-generators	On-grid/diesel-generators in rural areas

*Source: BCSA.
*Note: With an estimated 1/4th of the surplus being stored.

Potential angles for Dutch private sector engagement: Floating solar

Substantial likelihood of success

The ADB has identified three suitable sites for floating solar power plants with a generation capacity of 61-MW

Floating solar in Bangladesh

- Floating solar has several benefits including avoiding competition with agriculture or other land usage, natural cooling form the water and reduced water evaporation; scalability, and the its possibility to be combined with different energy sources such as hydrogen.
- The ADB has identified three suitable sites for floating solar power plants with a generation capacity of 61-MW including pit lakes in Dinajpur, Jhenidah's Joydia boar lake and Jashore's Bukhbare boar. A feasibility study in these regions suggested to combine electricity generation with aquaculture, to promote the dual usage of water systems. However, following the SREDA, successful implementation requires additional research.

The challenge in Bangladesh

- The main risk for floating solar parks is the growth hindrance of aquaculture species. This hampers Bangladeshi stakeholders to stimulate development of floating parks in Bangladesh.

Opportunity for Dutch players

- The Netherlands is globally renowned for building large, productive floating solar parks. With integrated Floating Solar systems that follow the sun, Dutch floating solar parks are able to generate 30% more electricity compared to traditional floating solar installations. At current, the "National Consortium Sun on Water", has targeted installed capacity of 2 GW for 2023.
- Several Dutch companies produce sunlight-transmitting PV-panels specifically designed to transmit sun through, called Bifacial solar panels. When these panels would be integrated in floating solar parks, this could provide an opportunity for Dutch players to establish themselves in the Bangladeshi market. However, till date, this has not been implemented in floating solar parks by Dutch players yet.
- The difficulty for Dutch players operating in Bangladesh is the risk of reduced added value when operating outside the Netherlands. Their added value mainly resided in their human capacity installating the parks, and human capacity can be difficult to transfer to international locations.

GroenLeven zonne-energie

FLOATING ENERGY

Global developments ambitions of Dutch companies

- Most Dutch floating solar companies focus on Dutch and European markets.
- Floating Energy B.V. is looking to Asian markets on a project basis.

Potential angles for Dutch private sector engagement: EV-mobility

Substantial likelihood of success

Dutch companies have a competitive advantage in the development of high-quality battery storage for EV-mobility

The (three-wheeler) EV market in Bangladesh

- Bangladesh has been shifting from Internal Combusting Engines (ICE) run vehicles to hybrid models or fully electric vehicles. Current power production capacity utilization: ~50%.
- Market volume: There could be as many as 2 MN 3-wheelers in the form of motorized rickshaws and easy bikes and they facilitate the transport of 250 MN citizens. Due to its inexpensive operating nature, many Bangladeshi residents use 3-wheelers for daily transport.

The challenge in Bangladesh

- The charging stations at present use grid electricity to charge EV batteries. The garages charge the batteries in cyclical order since the batteries in the market take longer time period to charge.

The opportunity for Dutch players

- Dutch companies (Alfen, Zenon, Iwell, A-teps and others) are specialized in designing and developing solar battery power for EV-charging stations with high yield. Dutch solar players such Tux and Squad are well equipped to integrate rooftop solar panels and efficient battery storage into the 3-wheelers, reducing the cost of energy and providing a reliable, constant power source.
- Dutch solar players such as Zenon Energy have developed high quality, off-grid lithium batteries with multiple benefits including:
  - High quality.
  - Reduced charging time.
  - Increased battery lifespan.
  - Self-managed batteries including temperature control and cell balancing.
  - Age or as backup power source.

Case study: Solshare

- A Dhaka based company that provides peer-to-peer solar energy exchange platforms and pay-as-you-go solutions to low-income households and micro enterprises.
- Their garages offer battery charging and leasing services using a combination of solar PC energy and main grid.
- They have also introduced new battery technology and improved the financing conditions of market entry for 3-wheeler EVs.

Potential angles for Dutch private sector engagement: Water treatment

Modest likelihood of success

Dutch desalination solutions can provide access to clean drinking water in rural areas, whilst saving up to 75% of energy compared to traditional desalination

Solar water treatment in Bangladesh - Access to clean drinking water

- >97% of the Bangladeshi population in rural areas relies on groundwater and approximately 82% of the population in Dhaka relies on groundwater versus 18% coming from water treatments plants.
- To provide clean drinking water, GIZ Bangladesh, under its Sustainable Energy for Development (SED) program, has helped install 123 solar powered water pumping facilities in the Southwest region of the country. In addition, the French company Suez, will establish a prefabricated water treatment plant for remote areas. The project is supported by the Danish government's Export Credit Agency (EKF), the "EKF Green Accelerator" fund.

Challenges in Bangladesh

- While the water requirement is estimated at 2,100 MN liter per day, the Dhaka WAS capacity is capped at 1,950 MN liter per day. This gap in supply is felt especially in rural areas. And due to the reduction in rainfall, 50% over the last 5 years, there is an increased amount of salinity in groundwater, reducing access to quality water even further.

The opportunity for Dutch potential players

- Dutch companies such as Elemental Watermakers provide access to clean and reliable water through desalination boxes, saving up 75% of energy required compared to traditional desalination, contributing to responsible water supply.
- While the Dutch capacities are present, the likelihood of success in Bangladesh is low due to the limited customer capacity. Bangladeshi inhabitants are often not capable to buy desalination systems themselves. Projects have to emerge from NGOs or government funded projects aimed at improving access to clean drinking water for Bangladeshi inhabitants rather than making a clear profit. As a result, the current market for Dutch players to sell their products is still limited.

elemental water makers

Potential angles for Dutch private sector engagement: Solar irrigation pumps

Modest likelihood of success

Solar powered irrigation pumps account for <1% of total irrigation pumps in Bangladesh

Status quo of solar-operated irrigation pumps

- Bangladesh currently has 2,732 solar irrigation pumps with a combined capacity of 50.55 MWh.
- Ongoing implementation plans for 96 more solar irrigation systems with a capacity of 2.78 MWh. As a comparison, there are 1.21 MN diesel-operated pumps.

The problem: Limited amount of solar powered irrigation pumps (2,732) compared to the amount of environmentally harming diesel-powered water pumps.

- Bangladesh currently has 2,732 solar irrigation pumps with an installed capacity of 50.55 MWh.
- Ongoing implementation plans for 96 more solar irrigation systems with a capacity of 2.78 MWh, compared to 1.21 MN diesel-operated pumps.
- At present, 1,523 of the solar irrigation pumps are under IDCOL's "fee for service model" initiative while the rest are based on ownership or group ownership structures. IDCOL targets installing 50,000 pumps by 2027. Based on that target, these solar irrigation pumps can be expected to help avoid CO2 emissions from diesel irrigation by up to 0.83 million tons per year.

Challenges in the crop cycle and the alternative usage of power

- The country has a crop cycle of 1/3rd of a total year which allows the system to generate excess energy during off-seasons. Operators in some parts of the country have started using the energy to operate other types of agricultural machinery and farming activities in the poultry and agriculture sector. However, the financial viability of selling the water is weak from an investor's perspective as well. Excess energy is still generated after using it for alternative purposes. Hence, it is important for the program to establish on-grid connectivity.

Low potential for Dutch players

- Likelihood of success in Bangladesh is low because of a lack of initial customer capital. Therefore, these projects generally have to be initiated by NGOs or the Bangladeshi government.

Source: Sustainable and Renewable Energy Development Authority (SREDA) (2022). Minor Irrigation Survey Report 2020-21, BADC. Solar Irrigation in Bangladesh, IWMI. 2021.

Connecting current public-private partnerships in Bangladesh

Peter van Zwol (Independent Energy): "Public-Private partnerships facilitate Dutch companies to cooperate, to design tailored solutions, and facilitate mutual collaboration processes between Dutch companies. The spinoff really emerges from joining different Dutch techniques and apply these in different emerging markets".

Leveraging synergies with existing and upcoming programs.

- Aquaculture sector.
- Poultry sector.
- Horticulture sector (potato, union, fresh vegetables, flowers).
- Other perishables (dairy, ice cream).

FoodTechBangladesh: options for solar energy in aquaculture:

- Opportunity to equip centers of excellence in Khulna, Sylhet and Cox's Bazar with solar rooftop (e.g. Aftab feed plant) and tilapia hatchery (solar energy for hatchery battery solution).
- Network of containerized cold storage locations near fish and shrimp farms, for example in partnership with Gemini Sea Food (also applicable for other agriculture and horticulture perishables).
- Focus of FoodTechBangladesh is on improving technical performance of fish and shrimp breeders and famers. However, processing and cold chain are important for scaling. Since these segments are relatively energy intensive, solar solutions could be implemented to greatly reduce energy intensity in these segments. E.g., Gemini processing (shrimp & other fish) for export.

Source: PPP zero emission and PPP Blue light.

Business case A: Solar powered cold storage (Gemini)

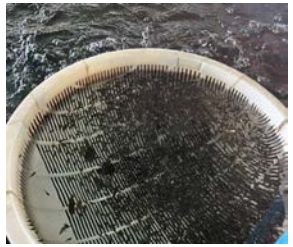
Dutch solar companies have a competitive advantage in the development of high-quality battery storage enabling development of off-grid solar charging stations

Introducing Gemini

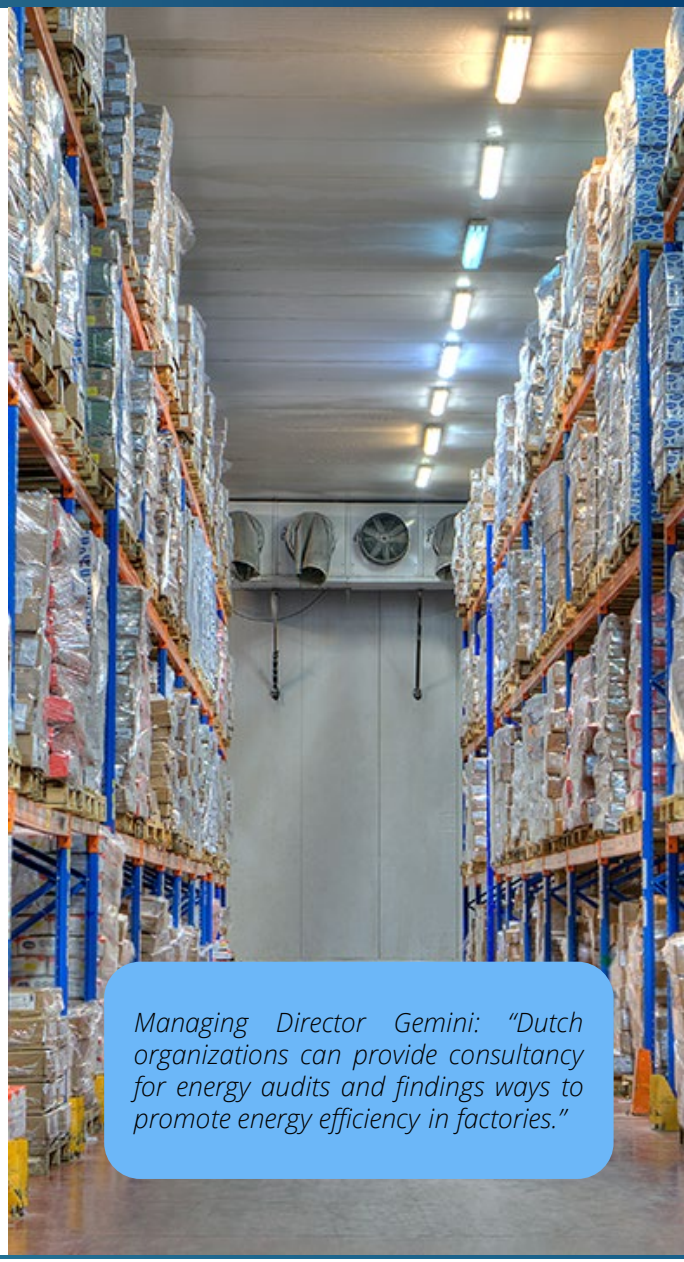
- Gemini seafood processes high-quality fish and shrimps for export markets. The company sources fish and shrimps from local farmers/suppliers in the Khulna region primarily. At current, there are 1,000 farmers in the region, out of which >200 are supplying Gemini. Average farm size is approximately 1 acre.
- Farmers use vans with ice to transport the fish and shrimp from the farms to the Gemini Seafood processing facility, which takes up to 2 hours to reach the destination. However, during the post-harvest process, the quality of the produce declines rapidly. In order to deliver the highest cooking quality of shrimp for the European market, ideally shrimp would be stored in proper cold storage facilities as soon as possible after harvesting (preferably at site). There would be a huge opportunity to increase quality and limited post-harvest losses when establishing a network of cold storage facilities near the primary fish and shrimp farming areas.

The problem and potential interventions

- Due to frequent electricity cuts, Gemini relies on expensive diesel-generators to power its cold storage facilities. Powering the cold storages through solar energy could reduce CO2 emissions and cut costs.
- The current monthly power demand is equal to 1 MW. Gemini's rooftop space can facilitate a maximum of 0.76 MW solar energy solution. Total cost of installation is estimated at ~EUR 410,000 and have a ROI of 4-5 years.



Technical details Gemini Seafood processing facility Khulna	
Storage capacity	960 MT
Temperature	< -18 Celsius
Cold storage technology	Quick Freezing (IQF)
Monthly electricity consumption	120,000 kWh
Total cost of electricity	EUR 11,000/month (at 0.092/kWh)
Estimated rooftop space available for solar panels	100,000 square ft. (2.3 acres)



Managing Director Gemini: "Dutch organizations can provide consultancy for energy audits and findings ways to promote energy efficiency in factories."

Business case B: Solar integrated rooftop (LC Packaging)

*Installation of a solar rooftop system can save up to EUR 53,920 per year, resulting in a breakeven point after 4 years**

Introducing LC Packaging

- LC Packaging is a Dutch producer and distributor of packaging materials, operating in Europe, Africa and Asia. LC Packaging has a Bangladeshi entity Dutch-Bangla Pack (DBPL), including ~1210 employees. DBPL produces big bags for different sectors including food, pharmaceuticals and chemicals and is renowned for its high-quality products produced in a sustainable manner.

The problem and potential intervention

- The DBPL factory in Gazaria Mushinganj has a total energy demand of ~12,000 MWh per annum. The current solar installation only generates 0.026% of the total power demand. The other 99.9% is generated from two gas generators and one diesel generator, in addition to the grid connection from the REB. LC packaging would like to increase its electricity generation from solar towards 442 KW.
- The challenge for LC is that the payback term provided by current suppliers is relatively long (15+ years). Dutch suppliers generally calculate a lower payback term (5-7 years). This low payback term is possible due to the high-quality equipment used by Dutch suppliers including a high level of productivity and energy efficiency. This accompanied by proper installation and maintenance of the system result in high yield of the solar system, providing LC Packaging with a higher net income compared to the solar system provided by the Chinese supplier.
- As potential intervention, Dutch companies could tap into this opportunity and demonstrate the business case for their high-quality equipment leading to higher yield and consequently, a lower payback term.

Business case

- LC Packaging has a rooftop space of 1.24 acres that can facilitate 442 KW solar system. The cost of installation for a solar system would be EUR 210,650. The total system capacity would be 586,092 KWh per annum, covering 4.9% of the total electricity demand in the factory.
- Taking into account an electricity rate of EUR 0.092/kWh, implementation of the solar system will save EUR 53,920 per year. Hence it will take approximately 4 years to break-even the cost of installation. The solar panels can mitigate the need for diesel generators and reduce the dependency on grid connectivity.

LC Packaging current energy demand	kWh per year
Gas Generator	772,205,5
Diesel Generator	68,577.23
Grid connection - REB	4,134,926.5
Total	11,925,558.73

*Note: The breakeven point is determined by dividing the total fixed investment costs by the revenu per annum – the variable costs.

Market entry guidelines

The apparel and textile industries: Setting up rooftop solar system

Business case: more than 40% of the PV project costs can be attributed to the solar PV module

PV project costs per component and share of total project costs, in EUR '1000 and %, in 2022

Project cost components	Price (EUR 1,000)	% of project cost
Solar PV module (1 MWp)	220.9	46%
Module Mounting Structures	75.1	16%
Solar Grid Connected Invertor	71.5	15%
Hybrid/Fuel save Controller for PV-Generator Grid	7.3	2%
Monitoring and Communication System	4.6	1%
Energy Meter	0.9	<1%
Cleaning System and Cable Trays	11	2%
Combiner Box	5.5	1%
Earthing/Lightning Protection, with High Voltage, 500 KV Cable	8.2	2%
Cables and Connectors	36.7	8%
Spares	3.7	<1%
Service Walkways	5.5	1%
Safety Equipment for O&M	4.6	1%
Transportation, Installation and Interconnection	9.2	2%
Design and Consultancy	7.3	2%
Legal and other costs	2.7	<1%
Environmental Consultancy	2.7	<1%
Total Project Cost	**475.6**	**100%**

Setting up a rooftop solar system

- The area requirement for installing 1 MW of solar PV panels is approximately 8,000 square meters. However, this is subject to variation depending on the pattern of the roof.
- Under the net metering policy, the capacity of a solar PV system can be up to 70% of its sanctioned load and the maximum output alternate current capacity of the installed RE system for net energy metering can be up to 10 MW. Furthermore, the installed capacity of the RE system is maximum of 70% of the rated capacity of the distribution transformer.
- The key components (solar PV panels, inverters, DC cables, etc.) of solar PV systems are generally imported from different countries in Europe, China, India etc. Other components such as protection systems, combiner boxes, AC cables etc. are generally acquired from the local market. The lead time for foreign procurements is typically around 30 to 90 days from the opening of the Letter of Credit. The development process the for 1 MWp solar PV project is approximately 1 year.
- Key information required for the implementation of the Solar PV systems are:
  - Total suitable area for the installation of solar PV panels.
  - Type of roof available in the premise for the solar PV panels installation
  - Sanctioned load of the factory.
  - Factory's hourly (day) and monthly (year) load profile.
  - Load shedding frequency and duration.
  - Feasible evacuation points of solar power in the factory.
  - Net metering requirements and eligibility.
  - Previous 12 months' electricity consumption including bills.

**Note: Energy price is on average EUR 0.088/kWh. Prices deviate upon amount of energy consumed. Low energy consumption results in lower price per kWh. 1 BDT = 0.0091 Euro.*

The apparel and textile Industry: case Study - CAPEX versus OPEX

CAPEX model:

- In the CAPEX model, the client buys the solar system outright and pays the entire cost upfront. The offtakers own the solar power system and the required investment is generally made through a combination of debt and equity. A solar EPC company is usually hired to provide turnkey (ready-to-use use) solutions to these industries. The cost of electricity generated from rooftop solar PV systems can be 20~30% less when compared to grid electricity.
- Operation and maintenance can be outsourced to the EPC contractor under an O&M agreement or is done by the owner.
- Possible sources for funding:
  - SREUP credit line: EUR 1 MN (interest 7%/year).
  - IDCOL: loan tenure is around 10 years, maximum 80% of project cost (interest 6%/year)
- Since, the CAPEX model requires large upfront investment, only larger players such as conglomerates mostly opt for this model. It is also relatively doable to obtain a bank loan given the payback period is less than five years.
- The OPEX model is popular as there is no initial capital needed. However, calculations show that in the long run the CAPEX model demonstrates higher net savings with a payback period less than 5 years.
- Net savings (20 years project life span) is BDT 251 MN (EUR 2.3 MN) , based on an investment size of 1.1 MW (EUR 475,600).

CAPEX Model	
Energy yield from PV system (KWH per year)	1,250,000
Tariff of electricity: BDT 8.97 [Industrial tariff of REB at 11 kV]	BDT 8.97 (Euro 0.082)*
Tariff escalation	5% per year
Project life	20 years
Performance degradation of solar PV system	Degradation for Year 1- 2.5% Linear degradation each year onwards- 0.7%
Maintenance cost	Year 1- 2% of the initial investment cost Cost escalates at a rate of 5% per year onwards
Accumulated (cumulative) savings in electricity bill in project life (in 20 years)	BDT 303,764,407 (Euro 2,733,880)
Net Savings in project life: (Savings in electricity bill – project cost)	BDT 251,764,407 (Euro 2,265,880)

OPEX model:

- Capital investment made by a third-party investor, technology provider or OPEX operator. A Power Purchase Agreement (PPA) is signed between the technology provider and consumer where the consumer agrees to purchase the generated output from the solar PV system at a pre-agreed tariff during the PPA tenure. The customer only pays for the electricity supplied to it under the long-term PPA.
- Large players with factory rooftops feasible for solar panel installation that don't have the initial capital usually opt for the OPEX model, so they rely on financial institutions such as IDCOL. However, high levels of bureaucracy lower the incentive of players to take loans from IDCOL. On the other hand, banks in Bangladesh generally do not have the technical expertise to evaluate renewable projects. This results in a financing gap in the system.
- There are broadly two types of solar OPEX model: BOOT (Built-Own-Operate-Transfer) and BOO (Built-Own-Operate). The difference is that no transfer of ownership after certain years at a depreciated value with BOO model.
- Advantages of OPEX model:
  1. No upfront capital investment
  2. No additional leverage by taking a loan
  3. In-house technical capacity for operation and maintenance of the solar plant is not required until the end of the PPA tenure (typically around 12 years).
- Net savings (20 years project life span) is BDT 220 MN (EUR 2 MN)

OPEX Model	
Energy yield from PV system (KWH per year)	1,250,000
Tariff of electricity: BDT 8.97 [Industrial tariff of REB at 11 kV]	BDT 8.97 (Euro 0.082)
Tariff escalation	5% per year
Fixed tariff for solar PV electricity for 12 years	BDT 0.06
Project life	20 years
Performance degradation of solar PV system	Degradation for Year 1- 2.5% Linear degradation each year onwards- 0.7%
Maintenance cost	Year 1- 2% of the initial investment cost Cost escalates at a rate of 5% per year onwards
Accumulated (cumulative) savings in electricity bill in project life (in 20 years)	BDT 220,497,729.05 (Euro 1,984,479.56)

**Note: Energy price is on average EUR 0.088/kWh. Prices deviate upon amount of energy consumed. Low energy consumption results in lower price per kWh. All the assumptions regarding degradation and maintenance cost are taken into account. The models do not incur any external funding source so no interest rate is considered in the models.*

The Agricultural Sector: Poultry and Aquaculture

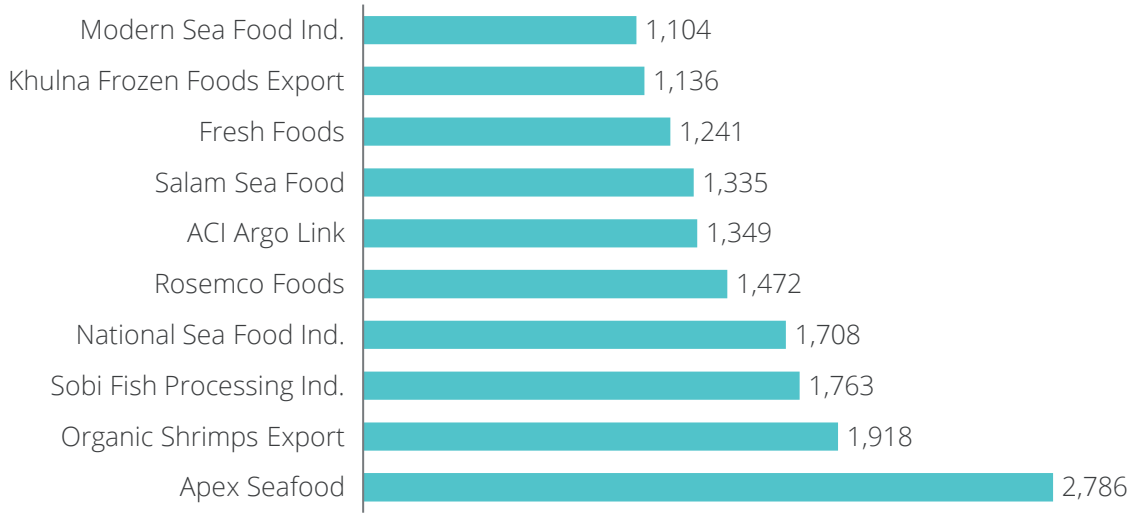
Adoption of solar energy in the poultry and aquaculture sector

- A substantial part of the livestock and aquaculture farms and processing facilities are located in the northern part of Bangladesh, where access to stable grid electricity is relatively low, farmers and processors rely on diesel-operated generators.
- The current global fuel price hike has created shockwaves in the agricultural industry as it operates at relatively low margins. Hence, industrial players (e.g., Kazi group, Paragon group, and Quality Feeds) are opting for solar-powered facilities.
- Solar-driven technological interventions have improved efficiency in production. E.g., shrimp farms incur high mortality rates of 60% to 80% due to irregular grid supply and dependency on diesel fuel. A pilot project showcased by SREDA has portrayed the potential of improved farming by maintaining a constant oxygen level through solar power-driven aeration and a circular water system.

Business Case: Kazi Farms

- Kazi farms have set up solar plants at seven of its subsidiaries, producing around 3 MW of electricity.
- Five of its farms jointly generate 12,500 kWh of electricity every day of which 20% gets distributed to the national grid.
- The farm is supplied by a 370 kWh plant (46,000 kWh/month), while the everyday energy requirement is 300 kWh.
- The farms are already self-sustainable with the current system, however, the group is planning to be able to generate 20 MWh.

Leading shrimp processors export, in MT, in 2021



Top Frozen Finfish Exporters	Top Price Earners in the Shrimp Sector
BD Sea Food	Sobi Fish Processing Ind.Ltd
Seven Star Processing	Primus Frozen Foods Ltd
Virgo Fish & Agro Process	Gemini Sea Food Ltd.
Seven Oceans Group	Farid Nine Stars Agrofoods
Anraj Fish Products Industry	Fahim Seafood Processing
Mashud Fish Processing & Ice Complex	Int'l Shrimp Export (pvt.) Ltd

Source: Larive-LightCastle Partners Primary Insights, Scoping Study on Integrating Renewable Energy into Shrimp Value Chain in Off-Grid Areas, GIZ, BFFEA Khulna 2022

Recommendations

SWOT analysis

Innovative Dutch technologies in design & integration of solar applications are vital to overcome power challenges in Bangladeshi

Strengths Bangladesh

- ✓ Sizeable and growing population (166 MN), with a growth rate of 1.1% (2021 – 2022).
- ✓ GDP growth rate of 7.2% in 2022 and average growth rate of 6% over 2018-2022.
- ✓ Growing demand for solar energy due to rapidly increasing and volatile fuel prices.
- ✓ Private sector investments drive growth of the solar sector.
- ✓ Low-cost labor access.
- ✓ Government incentives for foreign investment (taxation exemption opportunities and citizenship).
- ✓ No limitations on foreign ownership (100%).
- ✓ Favorable policies pushing companies to solar adoption.
- ✓ Pilot and demonstration programs of niche initiatives have been executed successfully which offer opportunities for further scale-up.

Weaknesses Bangladesh

- X Economy is heavily dependent on the RMG sector with over 81% of total exports in 2021, shifting sustainability focus in this sector, leaving other priority sectors behind.
- X Price-sensitive business culture leading to integration of lower-quality equipment
- X High credit dependency due to high CAPEX of solar equipment accompanied with loans being difficult to obtain.
- X Lack of grid structure to entail off-grid DRE solutions (irrigation, water purifiers etc.) under the net-metering guideline.
- X Vulnerability to natural disasters might cause a threat to the solar infrastructure.
- X Lack of systems check and transparency by power distributors regarding installation, maintenance, and compliance factors.
- X Limited technical knowledge at financial institutions reduces the issuing of loans to companies.
- X Structural gaps in grid connectivity in the last mile.
- X Scarcity of available land to build solar parks.
- X Lack of transparency and slow bureaucratic processes hamper effective replacement of conservative energy sources by solar.

Matching Dutch strengths to opportunities

- ✓ Replace low-quality PV-panels, invertors and transformers by high-quality equipment, leading to increased yields in the Bangladeshi agri-food sector.
- ✓ Design and integration of solar into different products and buildings including cold chain storage for perishable products (e.g. agri-food, pharmaceuticals), solar rooftops and solar water desalination.
- ✓ Improve non-effective inspection mechanism/quality control of captive rooftop solar opportunities to integrate solar rooftop into the aquaculture sector, fostering sustainable production and storage.
- ✓ Use Dutch R&D of high-tech solar panels with high productivity/yield integrated into greenhouses to foster sustainable protected cultivation in Bangladesh.
- ✓ Use Dutch solar and storage solutions to provide off-grid elektricity to Bangladeshi processors in the food and feed industries to foster sustainable development of the food and feed sectors.
- ✓ Facilitate integration of (lithium) battery technologies to reduce grid volatility and improve the EV-charging network, to further develop the Bangladeshi EV-mobility sector.
- ✓ Enhance trade and investment in the Bangladeshi solar sector by facilitating integrating of OPEX financing models, reducing dependency on CAPEX models.
- ✓ Contribute to integration of solar in the aquaculture sector, by fostering the development of large solar powered fish farms, and development of floating solar parks combined with sustainable growth of fish and other water species.
- ✓ Increase awareness regarding the potential business case and benefits of solar installation among smaller and medium-sized players.
- ✓ Increase current limited technical knowledge at financial institutions reduces the issuing of loans to companies.

Threats Bangladesh

- X Vulnerable to global economic dynamics and uncertainties (e.g. currency depreciation).
- X Economic attractiveness of fossil fuels hamper growth of the renewable energy sector.
- X Discontinuity of policies might hinder the flow of investment in the renewable energy sector.
- X Increasing import tariffs on solar equipment make exports from the Netherlands relatively expensive.

Recommendations for potential interventions

Dutch solar companies have a competitive advantage in the development of high-quality battery storage systems with reduced charging time and increased battery lifespan enabling the development of off-grid solar charging stations

Sector specific interventions

- **Food & feed processing.** While the Bangladeshi market is currently saturated with Chinese solar equipment, large conglomerates with high purchasing power have an appetite for investing in European panels for their brand value and marketing strategy. Potential Dutch interventions could tap into this opportunity, focusing on integrated solutions with high-quality inverters, battery storage and monitoring systems leading to a higher energy-efficiency and productivity, reducing the monthly cost for energy consumption. Especially in rural areas, the opportunity to integrate these solutions is high, as it constitutes an effective mechanism to replace the currently used expensive diesel generators crucial for constant power.
- **Cold-storage in the aquaculture, food and horticulture sector.** The demand for cold storage products in agri-food sectors in Bangladesh is high. Dutch solar integrators are experts in facilitating cold storage solutions with solar energy. Interventions should tap into the opportunity of solar-powered cold storage for perishable products (especially those catered for export markets). This could reduce post-harvest losses and contribute to sustainable food production and storage.
- **Challenges for successful interventions.** At current, the two main challenges in the Bangladeshi market include the Bangladeshi customer preference for cost competitive options (low CAPEX investments) and the limited skilled capacity to a) install and maintain high-tech solar equipment properly and b) technical knowledge to evaluate the financial model of solar systems, hampering loan provision and subsequently, development and installation of solar systems in Bangladesh. To overcome the first challenge, interventions should consider transferring knowledge from Dutch suppliers to Bangladeshi customers, to create a proper understanding of the (long-term) benefits of Dutch equipment over Chinese alternatives (high-quality, productivity, energy efficiency). To overcome the second challenge, interventions should contain a capacity building component to foster skill development for proper installation and maintenance of the equipment, and to create a better understanding of the CAPEX and OPEX financial models behind solar systems, stimulating loan provision and ultimately, stimulating private sector investments in solar products and services.

Policy level interventions

- Advocating to reduce the import tariffs on solar equipment to enhance local manufacturing and enhance trade and investment in the Bangladeshi solar sector.
- Emphasizing the importance of installing smart grid connections in the last mile to incorporate DRE solutions in the net-metering system.
- Enhancing implementation and control of regulations on power distributors to ensure proper monitoring of solar rooftop installations in residential and commercial spaces.
- Strengthen the regulatory framework to ensure that minimum percentage of the total loan to be green initiatives (5%) is achieved. Provide tax rewards for meeting the targets and penalties for not achieving the target.
- Conduct assessments of alternative solar energy solutions including floating solar, solar over canals etc. to understand their feasibility.

Financial level interventions

- Incorporating training programs for financial institutes to enhance their technical knowledge on solar energy will facilitate improved evaluation of solar projects including the income streams and business case associated with it. This will stimulate loan provision by financial institutions to private entities, enhancing investment into the solar sector.
- Dutch players can invest in solar projects and operate through an OPEX model, allowing them to use Dutch technologies and equipment whilst simultaneously obtaining direct returns from Bangladeshi customers.
- Introducing a leasing model in the sector will allow Bangladeshi customers to pay small amounts per month for their solar equipment.
- E.g., FMO previously (2016) partnered with IDCOL to provide a senior corporate loan to Summit Alliance Port Ltd. (SAPL) to build a private sector inland container river terminal facility.

Appetite of Dutch companies for doing business in Bangladesh

Dutch companies have recognized the immense potential of expanding into the Bangladeshi market.

- There is an appetite amongst Dutch companies active in the solar energy industry to do business in Bangladesh. Despite the high demand for solar solutions in Western Europe, Dutch companies have recognized the immense potential of expanding into the Bangladeshi market.
- Although there are challenges to doing business in Bangladesh, the potential rewards cannot be overstated. Bangladesh has a rapidly growing energy demand, and its government is committed to increasing the share of renewable energy in its energy mix. This presents a tremendous opportunity for Dutch solar companies to enter a new and high-growth market.
- In addition, Bangladesh boasts a favourable climate and geographic location for solar energy production. With abundant sunlight throughout the year, the country offers ideal conditions for solar projects, which could be leveraged by Dutch companies to drive growth and create new revenue streams.
- The Dutch companies Larive-LIghtCastle interacted with have expressed enthusiasm and optimism about the opportunities in Bangladesh. They recognize that this market offers a unique chance to leverage their expertise and contribute to a burgeoning renewable energy sector. Yet at this stage, Dutch companies require (governmental) support to facilitate market entrance. The feedback received from Dutch interviewees showed that they would like to cooperate in a group of companies (sharing risks & costs), rather than through independent (organic or inorganic) growth ambitions. By establishing partnerships with local companies and investing in local infrastructure, Dutch companies can overcome logistical challenges and create a sustainable and profitable business model in Bangladesh.
- Despite some challenges, the country's high energy demand, favourable climate, and government commitment to renewable energy make it an attractive destination for investment and growth. By taking a strategic and forward-thinking approach, Dutch companies can establish themselves as key players in Bangladesh's rapidly growing renewable energy market.

Impact on socio-economic development of Bangladesh

Solar panel adoption enhances the reduction of poverty in rural and underdeveloped parts of the country.

PV and socio-economic development

- To ensure sustainable economic development, the availability of clean, reliable and affordable energy sources is essential. Increasing solar panel adoption has the potential to enhance the reduction in poverty and bridge the gap in inclusion that continues to persist in rural and lesser developed parts of the country.
- The Bureau of Manpower Employment and Training (BMET), Grameen Shakti and other service providers have conducted training for 100 Master trainers. Moreover, a 15-day women training programme on Solar home systems (SHS) was also provided by Grameen Shakti in cooperation with ILO Green Jobs Programme. In this program, women learned to assemble solar accessories, install SHSs and provide maintenance services to users. This led to women gaining the skills to earn and provide for their families. According to an ILO report, women earned around EUR 95 per month on average, working as solar technicians. Approximately 1,500 beneficiaries were trained (with a focus on women) under this programme.
- Solar power in remote areas without grid connectivity has helped to increase children's education as it enabled them to study at night facilitated by the power of solar energy. It has also increased the safety of women and children at night as solar power can run streetlights at night in remote places. Furthermore, the development of captive solar, solar power plants and parks leads to employment creation for the youth. Increasing prospects in solar can lead to higher demand for EPC companies which then leads to further growth in the sector.
- As more and more factories are installing solar systems as part of the requirement to go green, they will slowly witness increasing orders from foreign buyers leading to increased employment creation. According to the Mujib Prosperity Plan 2030, power sector modernization through energy efficiency and renewable energy can lead to 6 times more job creation than fossil fuel generation, which is expected to result in 55,000 new jobs between 2016 and 2030.
- 30% renewable energy sourcing by 2030 will reduce EUR 1.7 BN per year on fossil fuel subsidies. The Bangladesh National Action Plan has set targets for reducing Short Lived Climate Pollutants by 2030. This plan is expected to reduce black carbon and methane emissions by 40% and 17%, respectively. The country has plans to cut nearly 89 MN MT of carbon emissions (equivalent to 22%) by 2030.
- Also, access to power is an important factor to become a digital and smart country. Since renewable energy sources have the capacity to provide uninterrupted power to remote areas.

Annexes

Annex A - Duty structure of solar components

- Solar PV system equipment have a relatively high Total Tax Incidence (TTI) even after it is one of the core components towards shifting from non-renewable to renewable energy.
- In FY 2022-23 budget, a 1% Customs Duty (CD) has been added on PV cells and modules (panels), making the systems even costlier.
- Domestic manufacturers have lobbied to increase the customs duty on solar components, however, due to increase in price of raw materials, domestic players have stopped manufacturing.

Legenda

- CD: Customs Duty.
- SD: Supplementary Duty.
- VAT: Value Added Tax.
- AIT: Advance Income Tax.
- RD: Regulartory Duty.
- ATV: Advance Trade VAT.
- TTI: Total Tax Incidence.

HS Code	Description	CD	SD	VAT	AIT	RD	ATV	TTI
84191200	Solar water heaters	0	0	15	5	0	5	25
84194020	Solar power operated water distillation plant	1	0	15	5	0	5	26.2
85012091	Motors of an output not exceeding 37.5 W but not exceeding 750 W	15	0	15	5	0	5	43
85017100	Photovoltaic DC generators	1	0	15	5	0	5	26.2
85017200	Photovoltaic DC generators	1	0	15	5	0	5	26.2
85018000	Photovoltaic AC generators	1	0	15	5	0	5	26.2
85023900	Generating sets (excl. wind-powered), nes	1	0	15	5	0	5	26.2
85030010	Parts Of Photovoltaic Generators Of Heading No 85.01 Or 85.02	1	0	15	5	0	5	26.2
85044020	UPS/IPS (Capacity upto 2000 VA)	15	0	15	5	0	5	43
85044090	Other Static converters	10	0	15	5	0	5	37
85063000	Primary Cells And Primary Batteries Of Mercuric Oxide	25	20	15	5	3	5	89.32
85064000	Primary Cells And Primary Batteries Of Silver Oxide	25	20	15	5	3	5	89.32
85065000	Primary Cells And Primary Batteries Of Lithium	25	20	15	5	3	5	89.32
85072090	Other Lead Acid Accumulators	25	20	15	5	3	5	89.32
85073000	Nickel-Cadmium Accumulators, Separators	25	0	15	5	3	5	58.6
85352100	Automatic circuit breakers for a voltage of less than 72.5 kV	10	0	15	5	0	5	37
85353000	Isolating Switches And Make-And-Break Switches, >1000 V	10	0	15	5	0	5	37
85354000	Lightning arresters	10	0	15	5	0	5	37
85359000	Other Apparatus For Switching. Electrical Circuits, >1000 V, Nes	10	0	15	5	0	5	37
85363000	Apparatus For Protecting Electrical Circuits	10	0	15	5	0	5	37
85411000	Diodes, other than photosensitive or light-emitting diodes (LED)	5	0	15	5	0	5	31
85412000	Transistors (Excl. Phototransistors)	5	0	15	5	0	5	31
85414200	Photovoltaic cells not assembled in modules or made up into panels	0	0	15	5	0	5	25
85414300	Photovoltaic cells assembled in modules or made up into panels	1	0	15	5	0	5	26
85415100	Other semi-conductor devices , Semiconductor-based transducers	5	0	15	5	0	5	31

CD: Customs Duty; SD: Supplementary Duty; VAT: Value Added Tax; AIT: Advance Income Tax; RD: Regulartory Duty; ATV: Advance Trade VAT; TTI: Total Tax Incidence

Annex B – Compliance policies in the apparel and textile industries

Required government certifications and global certifications (LEED)

Certifications and Licenses required for a Business Entity in Bangladesh	
Trade License Application	Local government
Membership with Industrial Association	BGMEA
Electrical Connection Document	REB, DESCO, DESA etc.
VAT Registration Certificate	National Board of Revenue
Export Registration Certificate	Chief Council of Import & Export
Bangladesh Investment Development Permission	Bangladesh Investment Development Authority
Import Registration Certificate	Chief Council of Import & Export
Chief Generator Operators Operating Certificate / Generator Installing permission / Waiver certificate / Permission for the generator	Bangladesh Energy Regulatory Commission (Original Copy) Council of Import & Export
Environmental Clearance Certificate	Ministry of Environment, Forestry Department
Boiler Certificate/Boiler Operators Operating Certificate/Competency Certificate-Office	Chief Inspectors of Boilers
Fire License	Bangladesh Fire Service and Civil Defense

Compliances that RMG factories must follow

- LEED provides RMG companies with a design guide and verification system. It works as a framework for identifying green building elements and implementing those elements through design, construction, operations and maintenance.
- LEED promotes action in 6 key areas, namely: location and transport, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and design process.
- Total cost for LEED including certification, design and consultancy costs approximately EUR 1,834, of which construction costs are the largest share. Examples of construction costs are materials and contractor costs such as solar panels, rainwater harvesting, energy efficiency measures, heat island offsets, etc.
- Examples of key LEED features of two of the world's top 10 Platinum Factory Ranking (Remi Holdings Ltd and Tarasima Apparels Ltd) include:
  - A roof garden that reduces the heat island effect inside the building;
  - 56% of water savings through efficient water fixtures;
  - Energy efficient lighting system, air compressors, variable refrigerant flows system with energy recovery ventilation, high volume low speed fans to reduce energy consumption of the building;
  - Recycling of construction materials such as concrete, bricks and wood;
  - Solar PV panels to reduce conventional energy;
  - Forest Stewardship Council certified wood and other renewable woods/carpeting

Annex C - Examples of Dutch players with solar energy solutions

Company name	Product or service	Website
1-2-3 Zone & Energie	Advisory and installation	https://123zonenenergie.nl/
365 Zon	Advisory and installation	https://365zon.nl/
4 Blue	Solar and logistic	https://www.4blue.nl/
4Solar	SDE+ Solar	https://4solar.nl/
AB Solar Total	General contractor for engineering, procurement and construction	https://ab-solar-total.com/
ABO Wind	Rooftop solar, battery storage	https://www.abo-wind.com/nl/
AEG	Solar panels brand	https://aegzonnepanelen.nl/
AgriSun	Rooftop solar	https://agrisun.nl/
Alfen	EV chargers, energy storage, smart grid solutions	https://alfen.com/
AP Systems	Transformer & Installation	https://emea.apsystems.com/
aQysta	Renewable hydro-powered pumps for irrigation.	https://www.aqysta.com/
Atradius	Financing	https://atradius.nl/
Battolyser Systems	Batteries	https://www.battolysersystems.com/
BayWa r.e.	Rooftop solar and floating solar	https://www.baywa-re.com/en/
BeSolar	Rooftop solar	https://besolar.nl/
BonGo Solar	Sun panels, transformers	https://www.bongosolar.nl/
Dawson	Cold storage provider	https://www.dawsongroup.nl/
DENS	Liquid fuel generator supplier	https://www.dens.one/
DMEGC Solar Energy	Installations	http://www.dmegcsolar.com/
E3	Fund manager	https://www.e3partners.nl/
E-ATEPS	Storage solutions	https://ateps.com/nl/home/
Elestor Electricity storage	Batteries	https://www.elestor.nl/
Floating Energy	Floating solar parks	https://floatingenergysolutions.com/
Floating Solar	Floating solar panels	https://www.floatingsolar.nl/
Green Generators	Solar generator	https://thegreengenerators.com/
Green Giraffe	Renewable energy financial advisors	https://green-giraffe.eu/
GreenBattery	Batteries	http://green-battery.nl/
Groenleven	Floating solar parks	https://groenleven.nl/

Company name	Product or service	Website
Hydro PV Technologies	Combi Hydrogen & Solar solutions	https://www.hydropv.eu/
Independent Energy	Energy solutions provider	https://www.independent-energy.nl/
Iwell Batteries	Batteries	https://iwell.nl/
Koolen Solar Projects	Installations	https://koolensolarprojects.com/nl/
Kraftblock	Batteries	https://kraftblock.com/en/
Lumos	Energy solutions provider	https://www.lumos-global.com/
MgEnergy	Batteries	https://www.mgenergysystems.eu/
Mitosolar	Solar applications	https://mitosolar.com/
NieuweWeme	Production of PV-panels	https://www.nieuweweme.nl/
Rexel	Electric wholesaler	https://www.rexel.nl/nln/
Scatec Solar	Panel development	https://scatec.com/
SEECE	Knowledge institution	https://www.han.nl/onderzoek/centres-of-expertise/seece/
Shell	Financing, investment	https://www.shell.com
SHV Energy Renewable	Carport solar parks, floating solar, solar & storage	https://www.shvenergy.com/what-we-do/renewable-solutions
SmartGrid	Energy solutions provider	https://www.smartgrid.com/nl
SolarEdge	Smart energy solutions	https://www.solaredge.com/nl
SolarWorks!	Developer and supplier of solar lightening and charging products, B2C.	https://www.solar-works.co.za/
Sopowerful	Electrification medical faciliaties	https://sopowerful.org/
Spark Energy	B2C solar applications supplier	https://sparkenergy.io/
Super B	Batteries	https://www.super-b.com/nl
TCX	Global solution for local currency	https://www.tcxfund.com/
TPEE	Innovator	https://www.tpee.nl/
Victron Energy	Energy solutions provider	https://www.victronenergy.com/
VDH Solar	Solar products and energy-efficiency	https://www.vdh-solar.nl
Voltiq	Financing	https://voltiq.com/
Zenon Energy	Batteries	https://www.zenon.energy/
Zernike Inst. for Advanced Materials	Knowledge institution	https://www.rug.nl/research/zernike/

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