POTENTIAL SOLAR POWER ASSEMBLY FACILITY FOR GREEN GIANT SOMALILAND

RATIONALE FOR A SOLAR ASSEMBLY FACILITY IN SOMALILAND

Somaliland is part of Somalia and the larger Horn of Africa region. It has hundreds of miles of coastline along the Gulf of Aden to the north, and it borders Ethiopia to the south and west and Djibouti to the northwest. Somaliland declared independence after the overthrow of Somali military dictator Siad Barre in 1991.

In post-conflict Somaliland, electricity prices are some of the highest anywhere in the world, peaking at a dollar per kilowatt-hour. (In the US, by comparison, the average price is nearer 12 cents). For poor families and small businesses, where the average household salary is less than $2 a day, the impact can prove crippling. Despite Somaliland having substantial energy resources – especially wind and solar – consumption per capita is among the lowest in Sub-Saharan Africa. This is due to the prohibitive cost.

SOMALILAND AT A GLANCE

Area
68,000 square miles
(about the size of Uruguay)

Form of Government
Elected president and legislature; appointed judiciary

Population
4 million (estimated)

GDP
$2 billion

Major Languages
Somali, Arabic, English

GDP Per Capita
$500 (estimated)

Primary Religion
Islam

Sources: World Bank; Somaliland Ministry of National Planning and Development.

RATIONALE FOR A SOLAR ASSEMBLY FACILITY IN SOMALILAND

Through a phased approach, the UK-funded Energy Security and Resource Efficiency in Somaliland (ESRES) in partnership with the Somaliland's Ministry of Energy and Minerals (MoEM) is addressing the high costs of electricity in Somaliland.

- During **ESRES Phase 1** (September 2015 - August 2018), the programme supported the Ministry of Energy and Minerals (MoEM) to develop a policy and regulatory framework and implemented a pilot to establish six hybrid mini-grids that are now fully operational across Somaliland. These hybrid mini-grids which have made over 10,000 new connections while providing electricity at a reduced rate of 42% percent in those areas targeted for lower tariffs. Overall, Somaliland's generating capacity has increased by 1.9 MW as a direct result of ESRES which reduced the reliance on diesel-powered generation and cut carbon emissions

- The **Phase II** of ESRES (ESRES II) (September 2018 to 2021) will expand its investment in renewable energy through the Somaliland Renewable Energy Fund (SREF). This investment will help increase affordability and accessibility through lower tariffs and more connections. ESRES II will partner with local energy service providers to develop hybrid mini grids through a cost sharing arrangement.

- Banking and the Financial Sector
  - The region counts 5 branches of commercial banks and 8 insurance companies.

SPECIAL ECONOMIC ZONES (SEZ) IN SOMALILAND

To promote the development of SEZ, Somaliland has established Somaliland Special Economic Zones Law, No: 93/2021. There are special incentives that are afforded to investors that invest in the Special Economic Zones and some of those special incentives are listed below. These include

Article 43: Tax concession

1. Each SEZ Eligible Enterprise shall be exempted from the payment of any taxes payable on its revenue, profits, including any corporation tax, capital gains tax, withholding tax or income tax.
2. Any shareholder of an SEZ Eligible Enterprise shall be exempt from the payment of withholding taxes on dividends.
3. Interest payments made by an SEZ Eligible Enterprise to foreign lenders in the respect of activities carried out in the SEZ shall be exempt from all applicable taxes (including but not limited to withholding tax).
4. Employees of the SEZ Developer, SEZ Administration Manager and SEZ Development Manager who are foreign nationals shall not be subject to personal income taxes.

Article 44: Investors

1. A foreign investor may take and hold up to 100 per cent of the shares in any SEZ Eligible Enterprise.
2. A domestic investor may take and hold up to 100 percent of the shares in any SEZ Eligible Enterprise.
3. Foreign and domestic investors shall have equal status within Special Economic Zones.
4. Any imports into the Special Economic Zone by an SEZ Eligible Enterprise shall be exempted from:

   (i) any customs duty and

   (ii) any indirect taxes (including any sales taxes, import taxes or VAT).

5) Activities undertaken by SEZ Eligible Enterprises are exempt from VAT.

6) All exports by an SEZ Eligible Enterprise shall be exempt from direct and indirect taxes and duties.

7) SEZ Eligible Enterprises shall also be exempted from quotas or other restrictions or prohibitions on Import or Export trade with the exception of SEZ prohibited or other illegal goods.

Article 45: Rights of SEZ Eligible Enterprises

1. The full protection of its property rights against all risks of nationalization or expropriation;
2. The right to fully and freely repatriate all capital and profits, without any foreign exchange impediments or charges;
3. The right of protection of industrial and intellectual property rights, in particular patents, copyrights, business names, industrial designs, technical processes and trademarks;

SPECIAL ECONOMIC ZONES (SEZ) IN SOMALILAND

Somaliland is an autonomous region in the Horn of Africa that unilaterally declared independence from Somalia in 1991. Not only has Somaliland maintained democratic governance, but it has also made continual efforts to improve this governance and recently passed the "Somaliland Special Economic Zones Law. The Law came into force on its publication in the Official Gazette on February 6, 2021. The Law creates a framework for Somaliland to establish and administer special economic zones within the rule of law.

Berbera

- The port of Berbera is located on the Red Sea. It has been involved in international trading networks with other East African cities and Arabia, including Mecca. This is a place at which much international aid is received.
- DP World of Dubai has signed a US$442 million agreement with Somali government for a 30-year contract to manage Berbera Port and build a special economic zone (SEZ) there, while the UAE government will build a nearby military base to provide additional security from terrorist groups.
- The Berbera Free Zone is modelled on DP World's Jebel Ali Free Zone (Jafza) in Dubai, which does not have the level of autonomy of a charter city but does have a higher level of autonomy than many other SEZs.
- Berbera Port, which has historically been an important trading center linking East Africa and West Asia.
  - 90% State revenue (Budget)
  - Creates Employment

    Direct workers 2000

    Indirect workers over a 2600.
  - Feed land locked region in Ethiopia and central Somalia. Can also do the same to South Sudan, Juba.

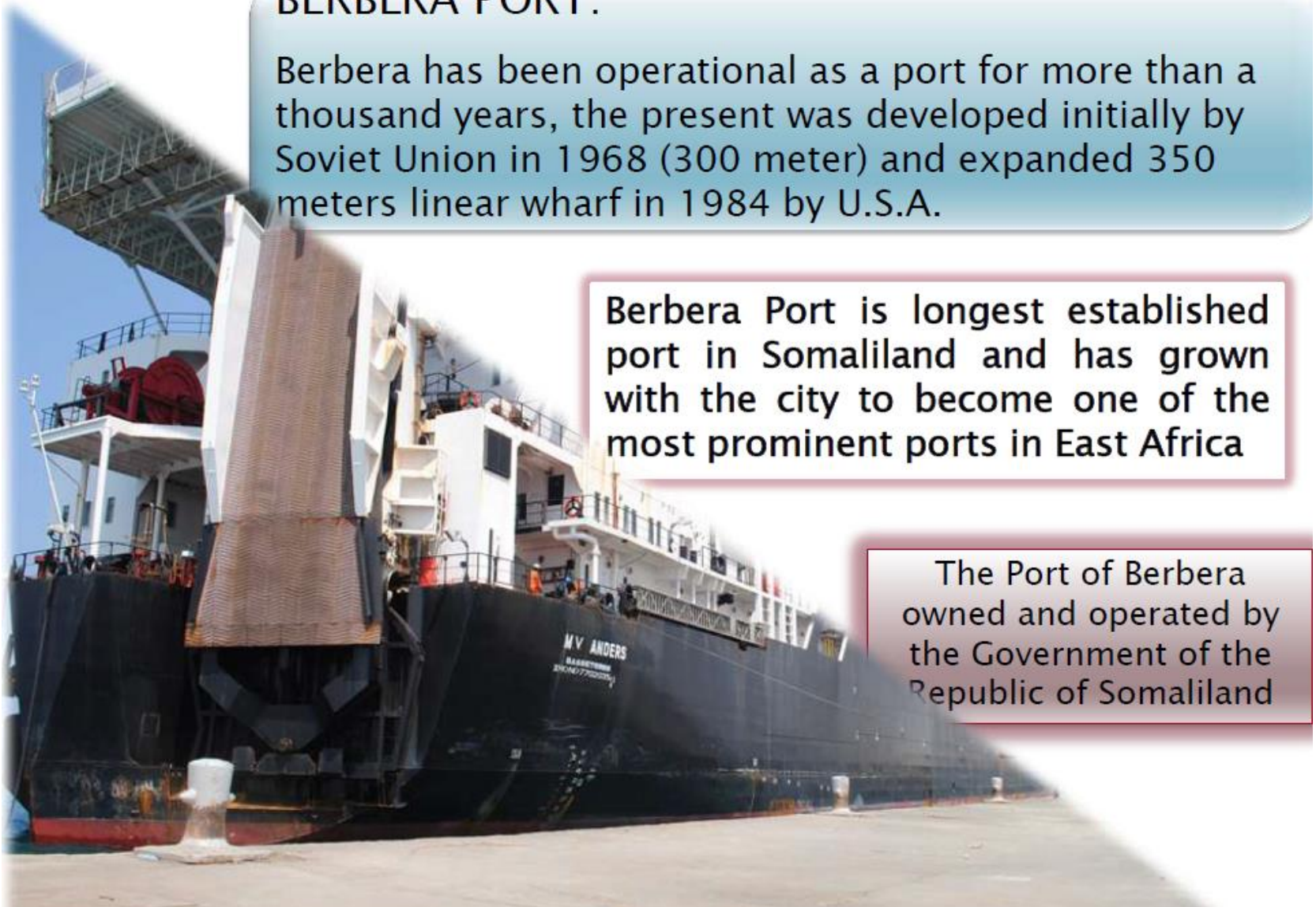
Hargeisa

- A special economic zone is also planned in Hargeisa.

SPECIAL ECONOMIC ZONES (SEZ) IN BERBERA

New DP World Berbera Masterplan

SPECIAL ECONOMIC ZONES (SEZ) IN BERBERA



BERBERA PORT:

Berbera has been operational as a port for more than a thousand years, the present was developed initially by Soviet Union in 1968 (300 meter) and expanded 350 meters linear wharf in 1984 by U.S.A.

Berbera Port is longest established port in Somaliland and has grown with the city to become one of the most prominent ports in East Africa

The Port of Berbera owned and operated by the Government of the Republic of Somaliland

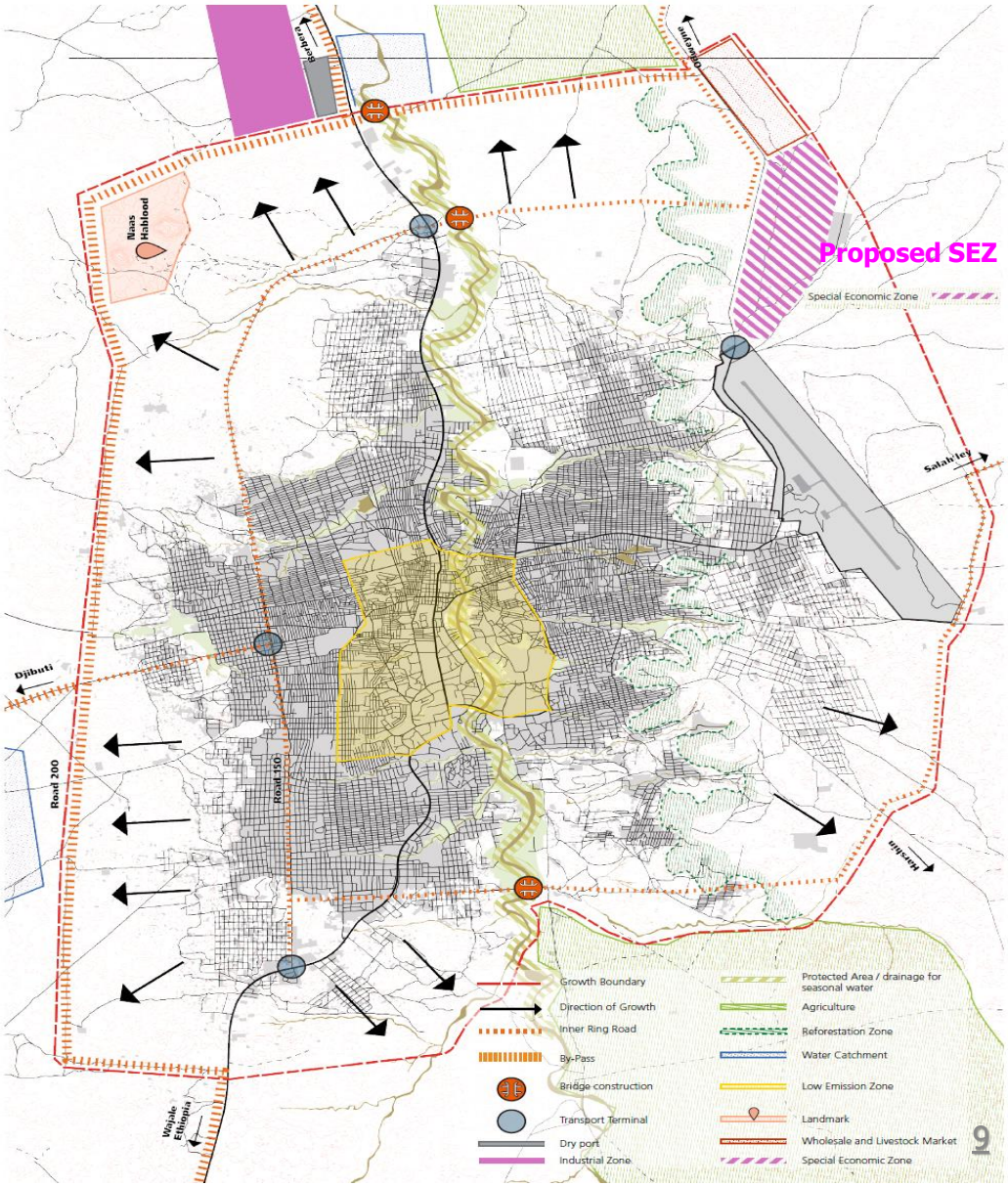
PROPOSED SPECIAL ECONOMIC ZONES (SEZ) IN HARGESIA

Hargesia

Hargeisa is the largest economic center of Somaliland. It sits on the Horn of Africa, 50 kilometres from Ethiopia, and 160 kilometres from the closest port in Berbera on the Gulf of Aden.

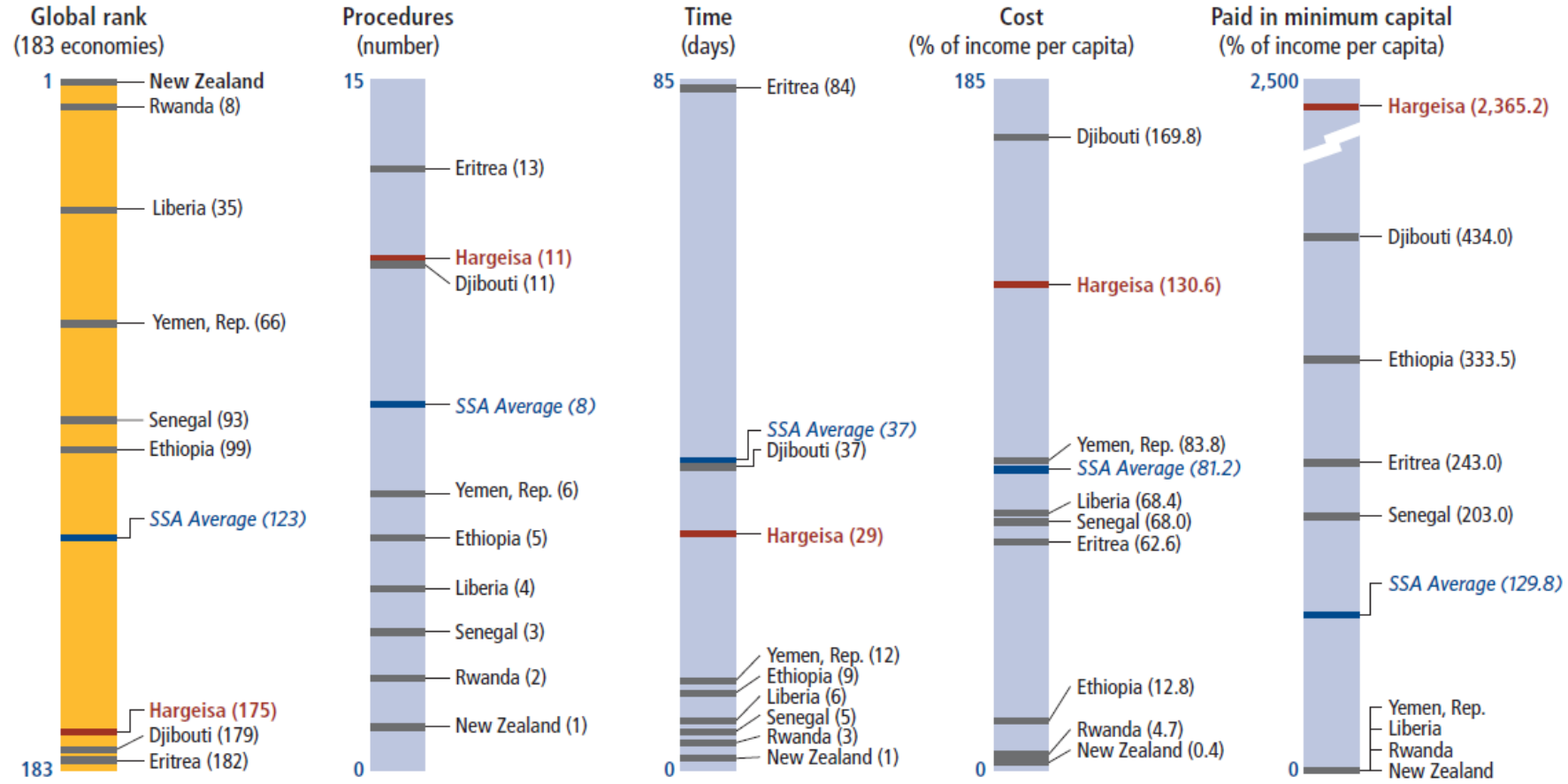
Ease of Doing Business (Rank)	
Singapore	1
United Arab Emirates	33
Rwanda	45
Kenya	109
Sudan	135
Djibouti	170
Hargeisa	**174**
Eritrea	180
Chad	183

Source: Doing Business database. 2012



EASE OF DOING BUSINESS IN HARGESIA

FIGURE Starting a business in selected African and Middle Eastern economies: Hargeisa has the highest paid-in minimum capital requirement in the world

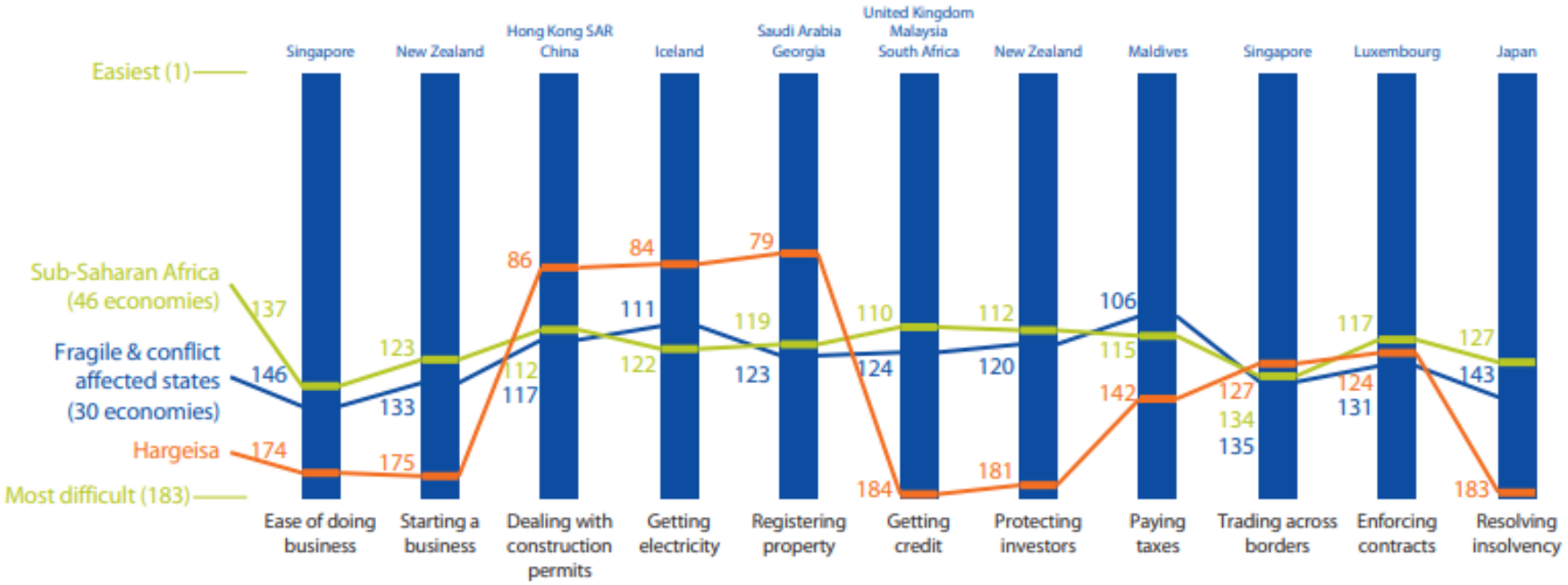


Notes: SSA denotes the Sub-Saharan Africa region. Rankings are based on the average economy percentile rankings on the procedures, time, cost and paid-in minimum capital requirement to start a business. See the data notes for details.

Source: Doing Business database.

EASE OF DOING BUSINESS IN HARGESIA

Figure Hargeisa's Performance on the *Doing Business* Indicators Compared with Sub-Saharan African Economies and Fragile and Conflict-affected States



Source: World Bank and IFC 2012.

FACTORY DATA

PV MODULE PRODUCTION PROCESS

RAW MATERIAL PREPARATION	STRING & LAYUP	INTERCONNECTION & MONITORING	LAMINATION	FRAMING	TESTING
GLASS WASHER	STRINGER MACHINE	BUSSING STATION	LAMINATION	AUTOMATIC FRAMING	I-V MEASUREMENT
CELLS TESTING	LAYUP STATION	AUTOMATIC BUSSING	COOLING	CORNER PUNCHING	POWER CLASSIFICATION
EVA FOIL CUTTING	BREAKAGE TEST	EL-TEST	GEL CONTENT TEST	SILICONE DISPENSER	EL TESTER
BACKSHEET CUTTING	PEEL TEST	DARK I-V TEST		J-BOX APPLICATIONS	HI-POT TESTING
RIBBON CUTTING		ELECTRICAL TESTING			SUN SIMULATOR
		BREAKAGE MONITORING			

RAW MATERIAL

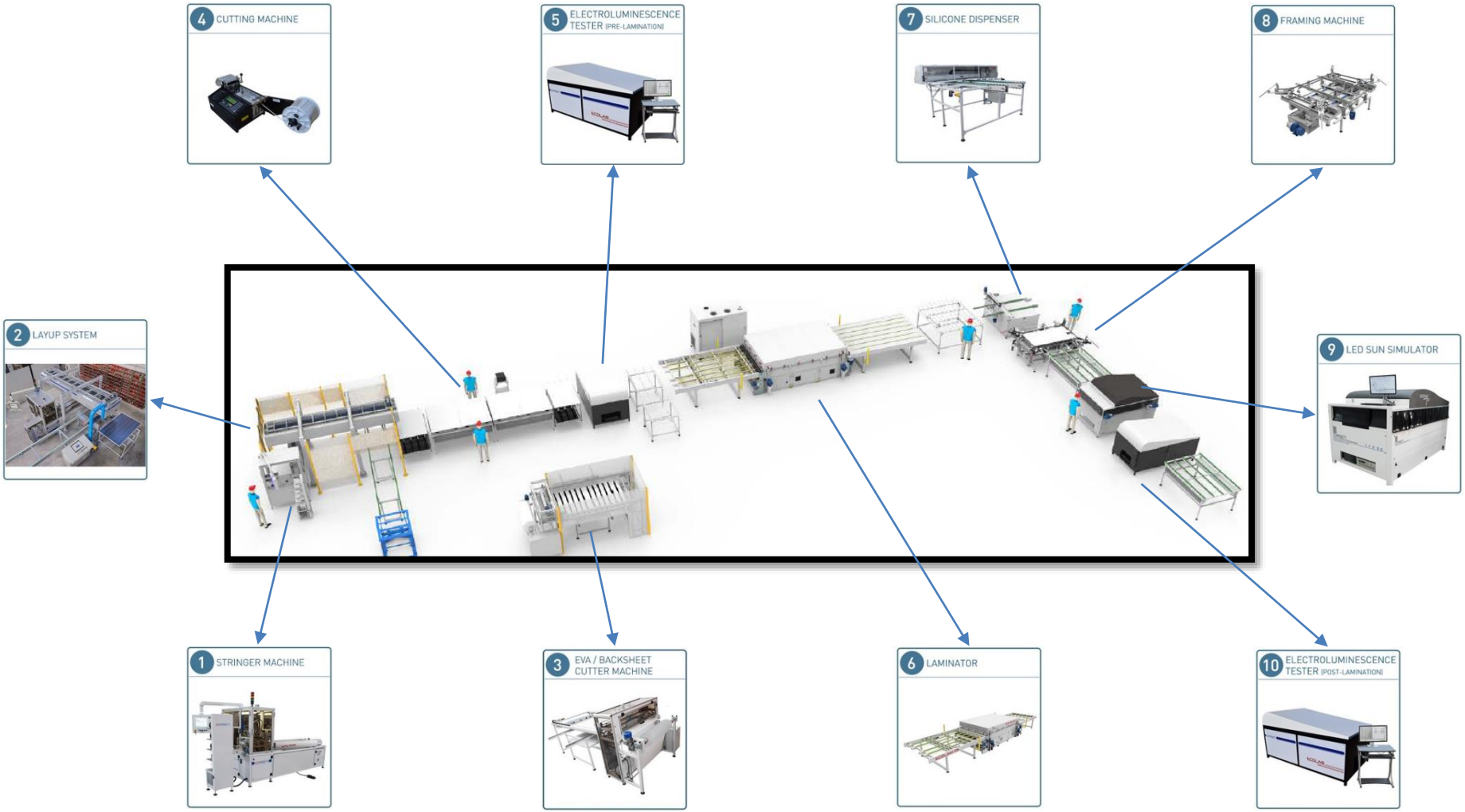
STRINGING

LAY-UP

BUSSING

EL TESTING

MACHINERY REQUIRED FOR MODULE ASSEMBLY



200MW ASSEMBLY LINE (400Wp Modules)

LINE CAPACITY		
WORKING CONDITIONS:		
hours per day	*23*	*hours/day*
days per year	*350*	*days/year*
hours per year	*8050*	*hours/year*

TABBER AND STRINGERS:		2
soldering throughput (1 machine)	3000	Full Cell
soldering throughput (gross)	6000	Full Cell
technical availability (VDI 3423)	95%	%
72 Full cells panels per hour	83.3	panels/h
time for 1 panel 72 Full cell	43.2	sec
net capacity:		
Maximum capacity obtainable	254.9	MWp net

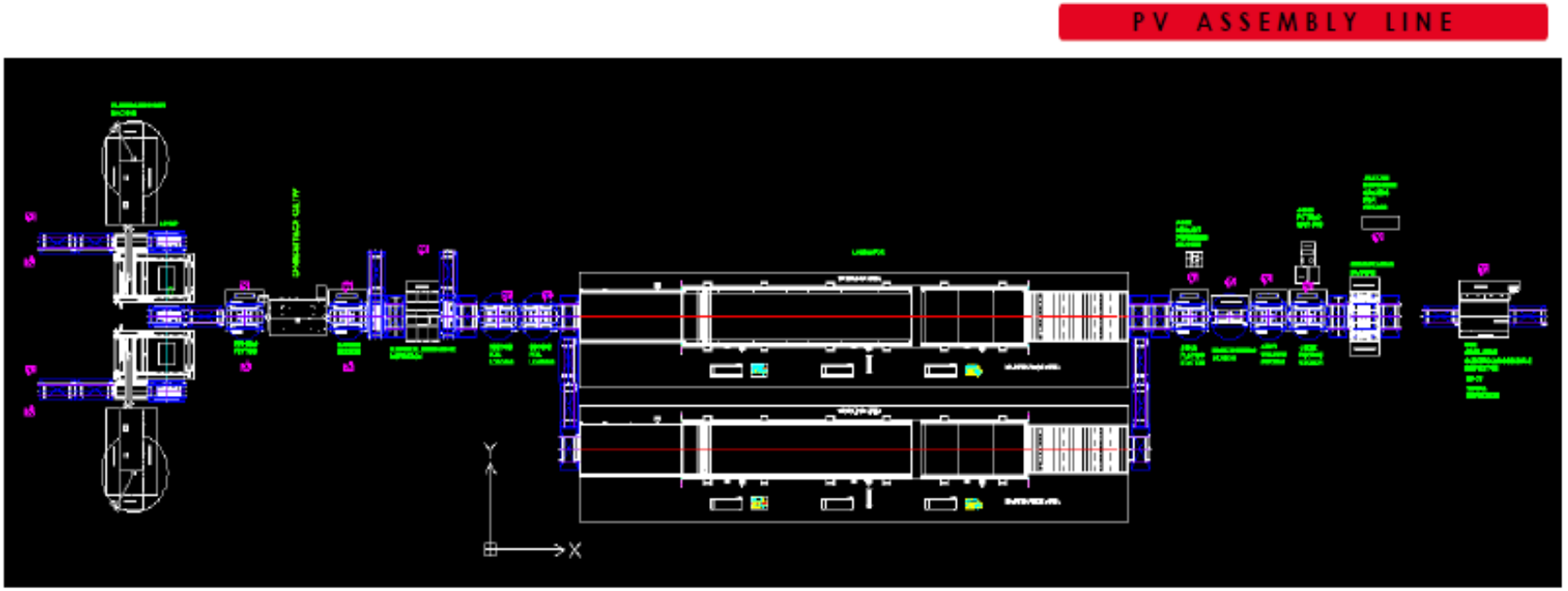
INTERCONNECTION		1
soldering capacity (1 machine)	100	modules/hour
soldering capacity (gross)	100	modules/hour
time for 1 panel	30,0	sec
technical availability (VDI 3423)	99%	%
net capacity:		
400 Wp Full Cell module	318.8	MWp net

LAY-UP:	2	unit
lay-up capacity (gross)	5.25	sec/string
uptime	99%	%
time per panel	31.5	sec
modules per hour	114.3	mod/h
net capacity:		
400 Wp Full Cell Module	364.3	MWp net

LAMINATORS:		2
Lamination cycle time	440	sec
72 Cell modules per cycle (1 machine)	5	modules/cycle
modules per cycle (gross)	10	modules/cycle
72 Cells panels per hour	81.8181818	panels/h
time for 1 panel	44	sec
technical availability (VDI 3423)	95%	%
net capacity:		
400 Wp Full Cell module	250.3	MWp net

Capacity will vary if no. of days, hours and wattage of module changes.

LAYOUT: 200 MWp



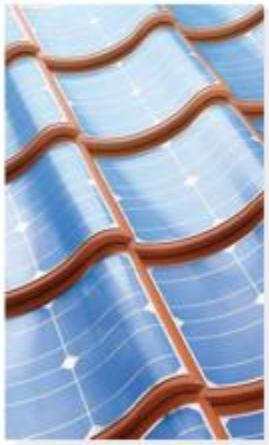
- State-of-the-art technology
- Fully automated industrial solution
- Area Required for equipment – 2500 sqm
- Area Required for Raw Materials & Finished Goods- 2000 Sqm
- Area required for Utilities- 250 sqm
- Installed Power- Equipment-600 KVA
- Average Power-Equipment-270 KWH
- Air Consumption-8000 nl / min
- Module Assembly- 114.3mod/hr
- Manpower- 22 operators per shift, 66 operators considering 3 shifts.

TECHNOLOGY

CELL TYPES

MODULE ARCHITECTURES

NEW TECHNOLOGIES



Module technology:

The PV module assembly line described in this document is **compatible** with the following technologies and types of modules:

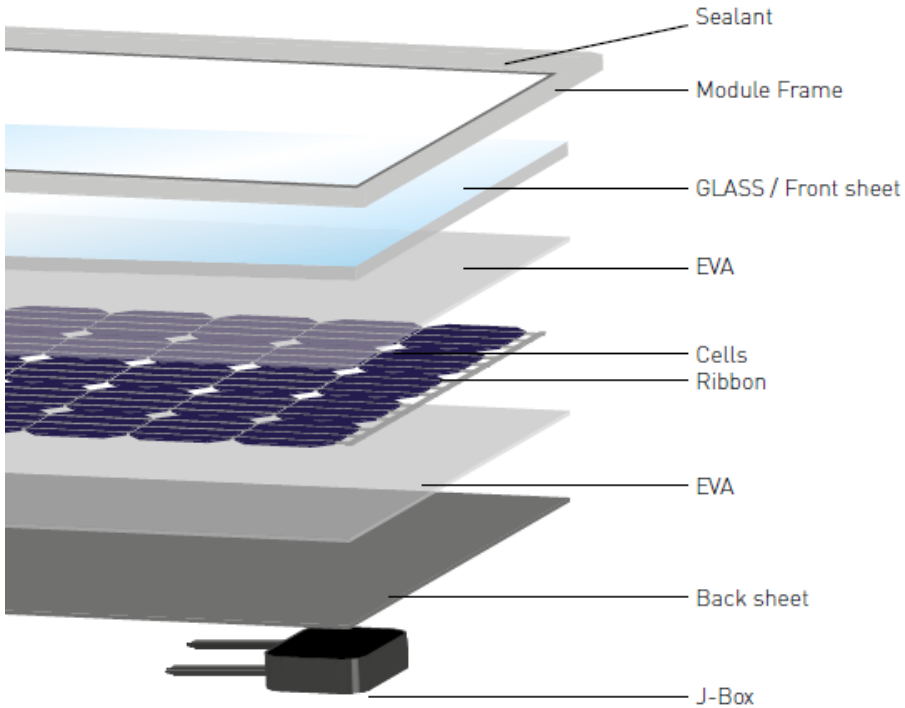
- **CELL TYPES:**
  - Monocrystalline and polycrystalline
  - PERC/PERT/TOPCon
  - Monofacial and bifacial
  - 5 to 12 BB, flat ribbon and round wire PERC/PERT/TOPCon
  - Monofacial and bifacial
  - 4 to 12 BB,
  - Cell sizes:
    - M3, M4, M6, M10 and M12 full and cut cells
    - M12 third (210mmx70mm)

- **MODULE ARCHITECTURE:**
  - Maximum module size: 2,4 x 1,4 m
  - Half cut and triple cut cell modules (central interconnection line)
  - Glass/backsheet and glass/glass modules
  - Framed modules

- **OTHER TECHNOLOGIES:**
  - Compatible with shingling
  - Compatible with ECA interconnection technology
  - Compatible with other multiwire technologies

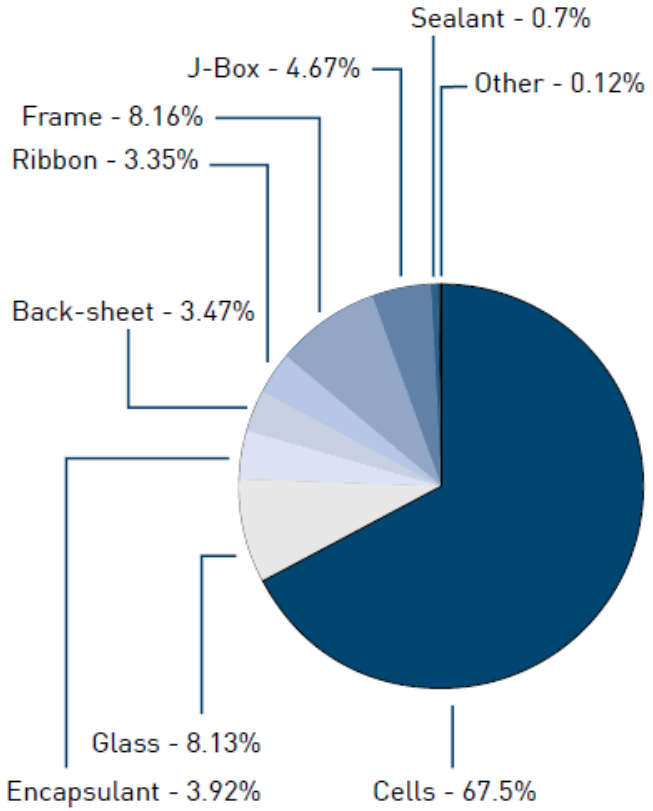
TYPICAL PV MODULE COMPONENTS

STRUCTURE OF PV MODULE

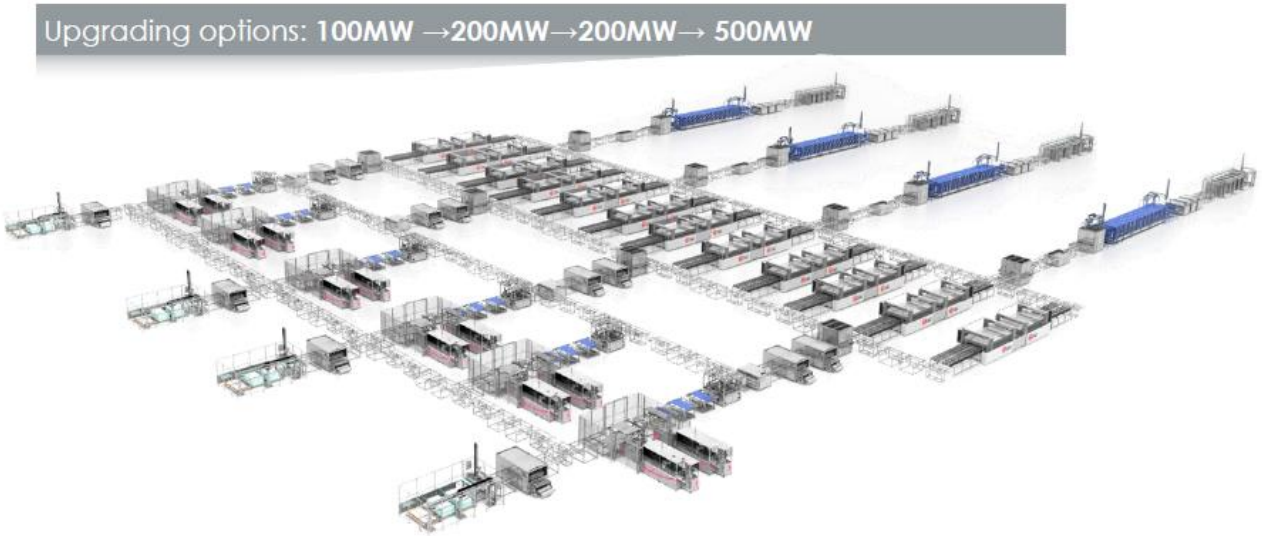


MATERIAL CONTRIBUTION

Based on data from June 2018



POTENTIAL LINE MODULARITY



- The lines can be upgraded from an automation point of view. Automatic machinery can be added to the lines in order to substitute manual operations.
- Interconnection will be at point of park.
- Buyer of power will be the government of Somaliland.
- The production lines can simply be upgraded to increase production capacity.
- 500MW will be executed in 3phases : 200MW assembly line will be utilize in each phase.
  - ✓ Year 1 - 100 MW in Berbera and 100 in Hargeisa
  - ✓ Year 2 - 200 MW in Hargeisa
  - ✓ Year 3 - 100 MW in Hargeisa
- The most suitable locations for setting up these module line will be Hargeisa, berbera, Burao, Erigavo and Gabliey.
- **The estimated total size required for the facility is 5,000 m2.**
- **The estimated cost of the facility is USD 7m.**

ENVIRONMENTAL IMPACT

Management of socio-economic aspects will be implemented through the project's Health, Safety and Environmental Management Process.

In order to gauge community values and opinions, social impact assessments will be carried out. This includes interviews with stakeholder groups, government authorities, business and community groups. Relevant feedback from this consultation process will identify impacts and mitigation measures.

The potential assembly facility will comply with all local environmental standards.

The plant will comply with all local Environmental Standard such as:

- Reduction of emissions and ambient air quality
- Energy conservation
- Reduction in wastewater and ambient water quality
- Water Conservation
- Hazardous Materials Management
- Waste Management
- Noise Reduction

SOCIO-ECONOMICAL IMPACT

Somaliland Population (2021): 5.7 million.

Ethnicity Of Somalia:

Hawiya 25%,
Ishaak 22%,
Rahanwein 17%
Dir 7%
Ethinic minorities 6%
Digli 3%

Somaliland is considered internationally to be part of Somalia. Somaliland lies in the Horn of Africa, on the southern coast of the Gulf of Aden. It is bordered by Djibouti to the northwest, Ethiopia to the south and west, and the uncontested part of Somalia to the east.

The capital and largest city is Hargeisa ; other major cities include Hargeisa, Berbera, Burao, Erigavo and Gabiley.