Chlorivin Corporation

Chemicals | Green Hydrogen | Energy Generation | Energy Storage

1.Introduction

Chlorovin Corporation: Our Business Model

- The overall business model of Chlorovin can be described as a Green Energy Complex to be located in Malindi.
- In addition to the primary products, Chlorovin will invest in a fully integrated, end-to-end Renewables Energy (RE) ecosystem.

Chlorovin Corporation: Introduction

- Chlorovin Corporation is a Kenyan based company with interest in electrochemistry and green hydrogen technologies.
- The company will produce chemicals based on electrochemistry process and water electrolysis by products.
- By products of the corporation will include chlorine, caustic soda, hydrogen gas, Ethylene Dichloride (EDC).
- Further process integration will see production of green ammonia and urea using excess hydrogen gas produced during the chlor - alkali process.
- A very energy and capital-intensive sector. However, new technologies, mathematical optimization and process integration techniques are being incorporated to achieve energy efficiency.

Chlorivin Corporation : Introduction…..con't

- The company will investigate further potential of extending Power to X business model by maximizing hydrogen production through chlor-alkali process.
- The key objects of the project are;
  i. import substitution.
  ii. provide a foundation for creation of sustainable local value chains in chemical industry.
  iii. targeting expanding global market.
  iv. boost downstream chemical manufacturing
  v. Production of green fertilizer
  vi. An anchor for launching Power-To-X (P2X) technologies in Kenya.
  vii. optimize local raw materials (sodium chloride)
  viii. contribute to alleviation of chronic portable water supply in the Coast region.
  ix. job creation with a focus in STEM disciplines.

Chlorivin and Sustainable Development Goals

SDG No.	Title	Impact
3	Good Health and Well being	Use in pharmaceutical industry
6	Clean Water and Sanitation	Water sanitization
7	Affordable and Clean Energy	Use in manufacture of solar panels and in Li-ion batteries
9	Industry, Innovation and Infrastructure	Chlor Alkali by products are base chemicals/feed stock to a number industries
11	Sustainable Cities and Communities	Contribution to Green Economy
12	Responsible Consumption and Production	Use of chlorine in recycling of aluminum beverage cans
14	Life Below Water	Treatment of ship ballast water to maintain status quo of marine life
15	Life on Land	Manufacture of pesticides

Chlorivin Direct Contribution to Kenya

SDG No.	Title	Impact	Contribution
3	Good Health and Well being	Use in pharmaceutical industry	Export earnings
6	Clean Water and Sanitation	Water sanitization	Import substitution
7	Affordable and Clean Energy	Use in manufacture of solar panels and in Li-ion batteries	• Catalyst for growth of solar panel manufacturing • Export earnings targeting Li-ion batteries supply chain
9	Industry, Innovation and Infrastructure	Chlor Alkali by products are base chemicals/feed stock to a number industries	• Catalysts for establishment of Alumina refinery. • Export earnings from PVC • Import substitution through local availability of PVC by products
11	Sustainable Cities and Communities	Contribution to Green Economy	• Hydrogen electricity generation • Hydrogen fuel and Fuel Cell Electric Vehicle (FCEV) for urban public transit.

Chlorivin Direct Contribution to Kenya

SDG No.	Title	Impact	Contribution
12	Responsible Consumption and Production	Use of chlorine in recycling of aluminum beverage cans	• Catalyst for a commercial recycling industry of aluminum cans • Export earnings
14	Life Below Water	Treatment of ship ballast water to maintain status quo of marine life	• Import substitution • Export earnings
15	Life on Land	Manufacture of pesticides Manufacture of green fertilizer	• Import substitution • Export earnings

Production Focus

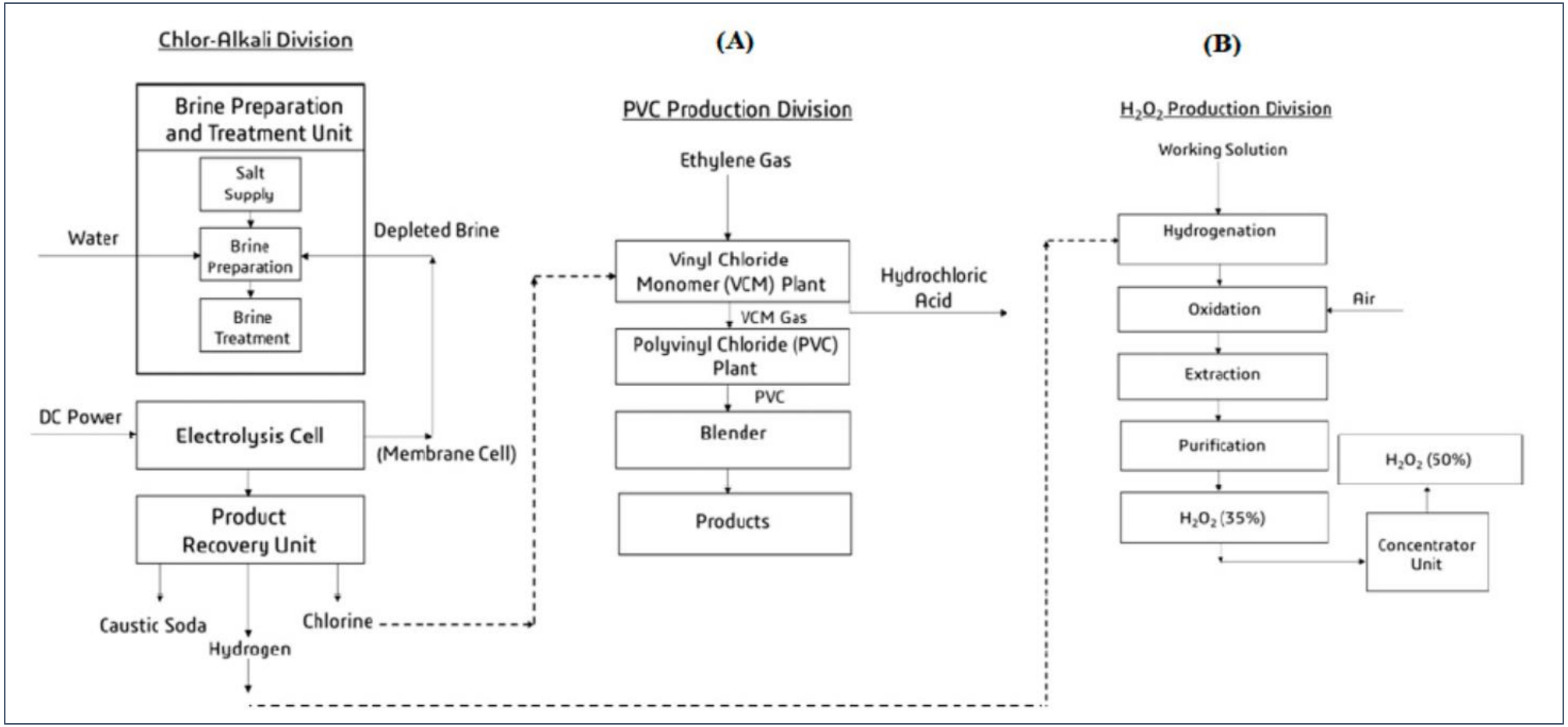
Basic Products

- Chlorine (Cl_2)
- Caustic soda (NaOH)
- Hydrogen (H_2)
- Hydrogen Chloride
- Portable water (H_2O)- by product of desalination process to harvest brine.

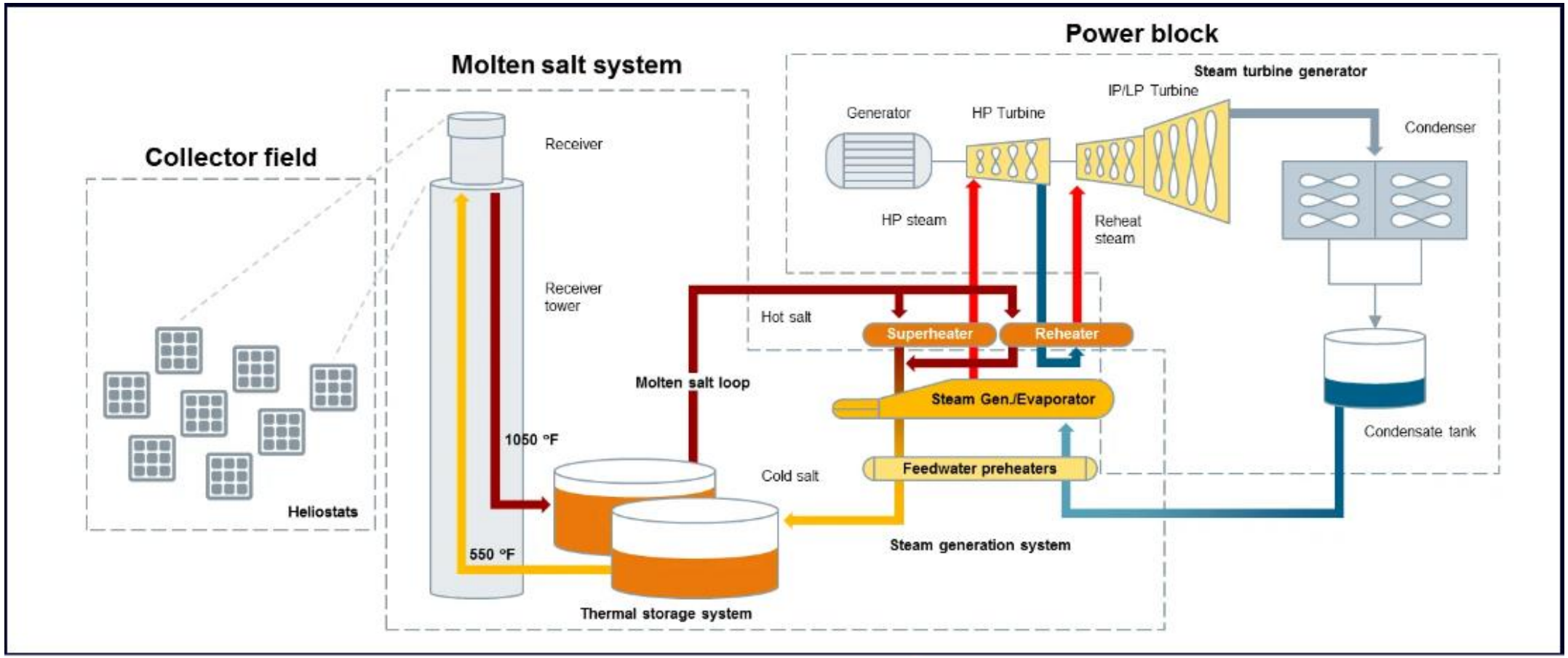
Advanced

- Ethylene Dichloride (EDC)
- Polyvinyl Chloride (PVC)
- Isocyanates
- Hydrogen Peroxide (H_2O_2)
- Fuel Cell Electric Vehicle (FCEV)
- Hydrogen power generation
- Green ammonia and urea

Strategic Business Unit I - Basic

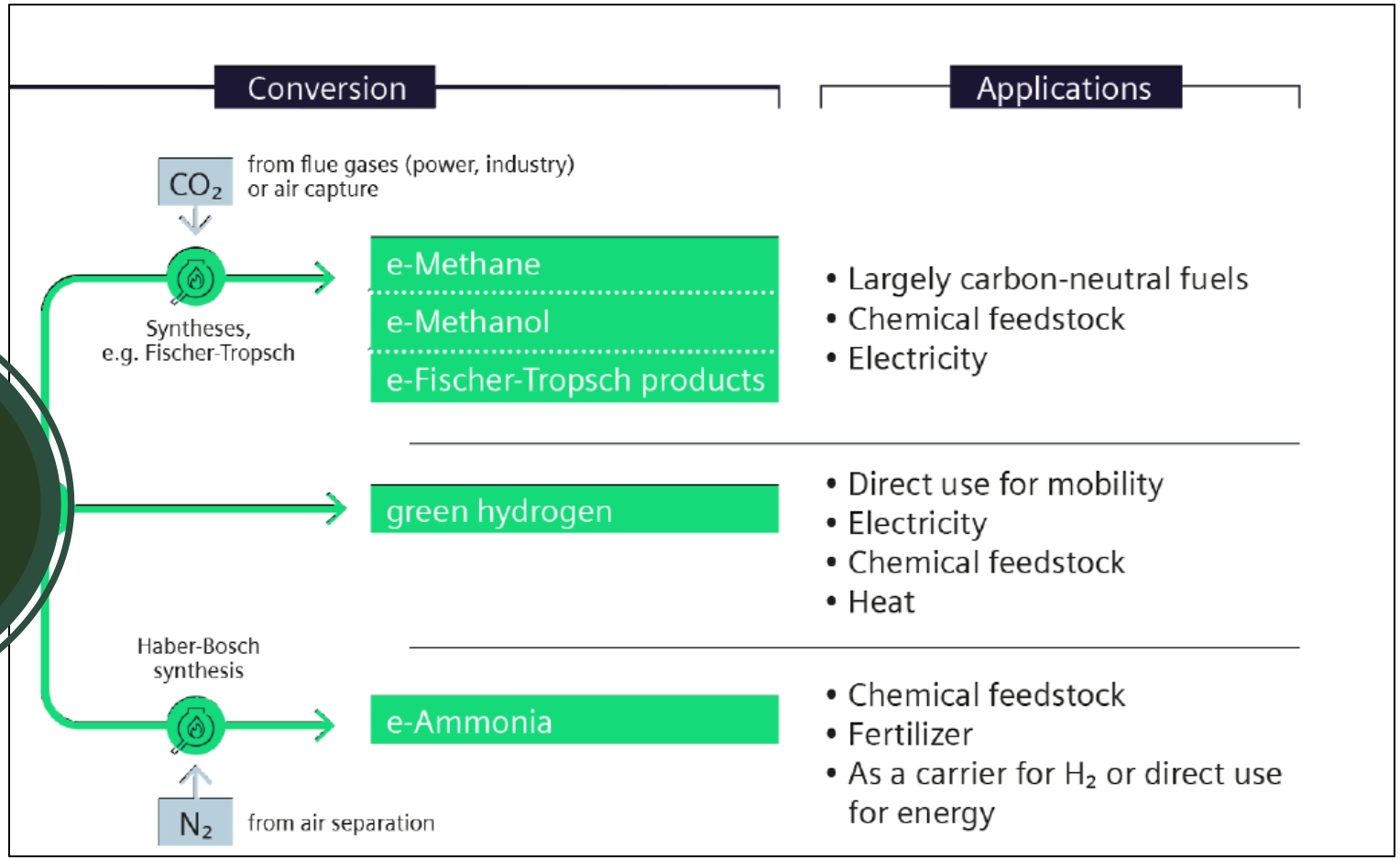


Strategic Business Unit II- Incorporating Concentrated Solar Power



Strategic Business Unit III: P2X

Hydrogen Gas



4. Plant Technical Considerations

Proposed Plant

- 300,000 metric tons per year (52 mt/d)
- Technology – membrane
- Incorporation of hydrogen recovery system to generate steam – hydrogen boiler and alkaline fuel cell technologies to be evaluated.
- Unwavering focus on operational efficiency, cost management and asset optimization.

5. Location

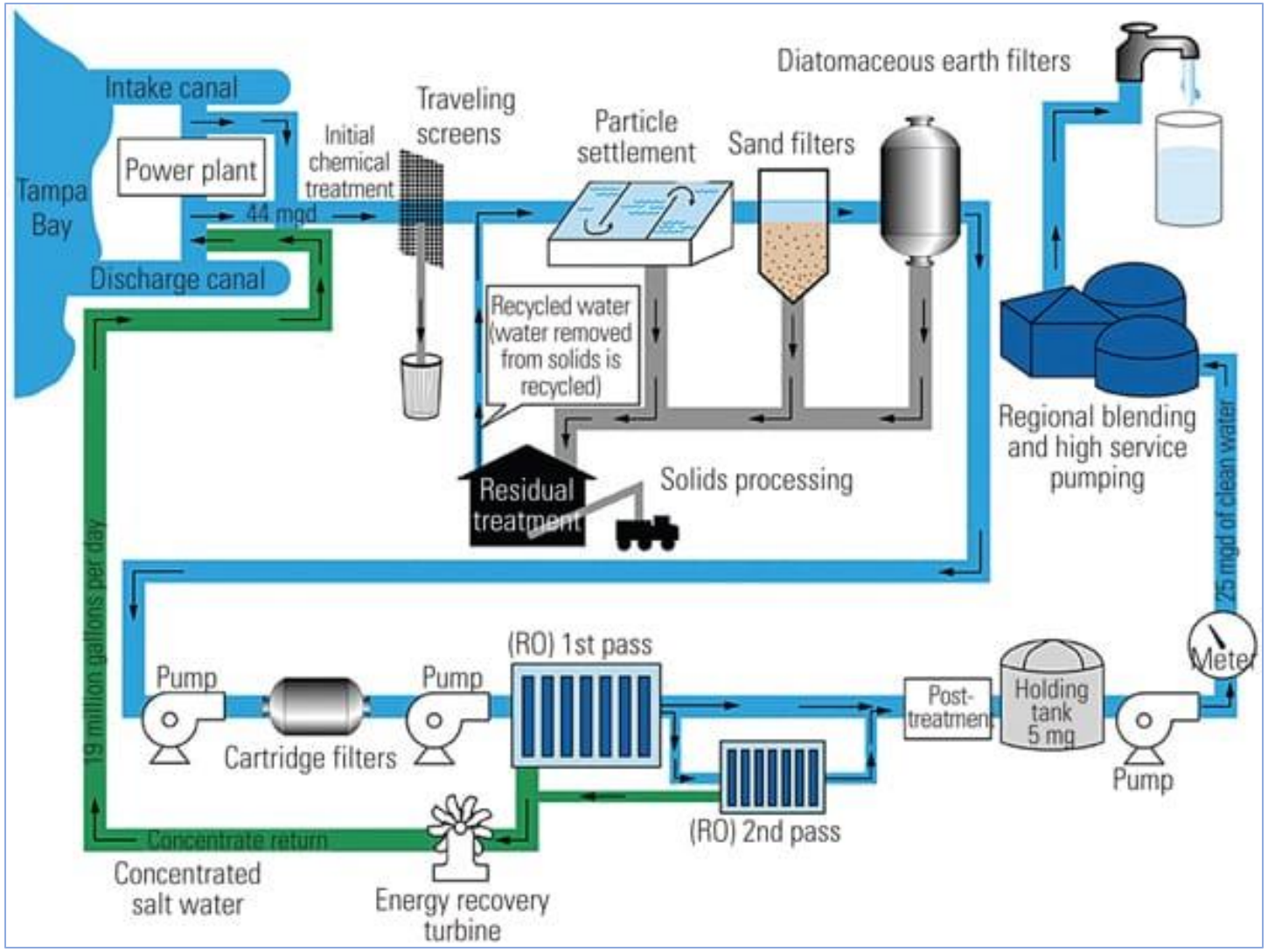
Location

- Preferred location is Kilifi County.
- Proximity to port and salt (sodium chloride) (NaCl), the main raw material. Kilifi also has ample sources of renewable energy.
- Sources of salt will be the salt manufacturing companies and salt harvesters in Malindi.
- Salt harvesting is seasonal. February, March and September.
- Harvested salt will be supplemented with brine harvested from desalination process of sea water.
- Alternative to desalination will be importation of industrial salt. Importation will only be considered in advent of local shortages in event that desalination as a source is not considered.

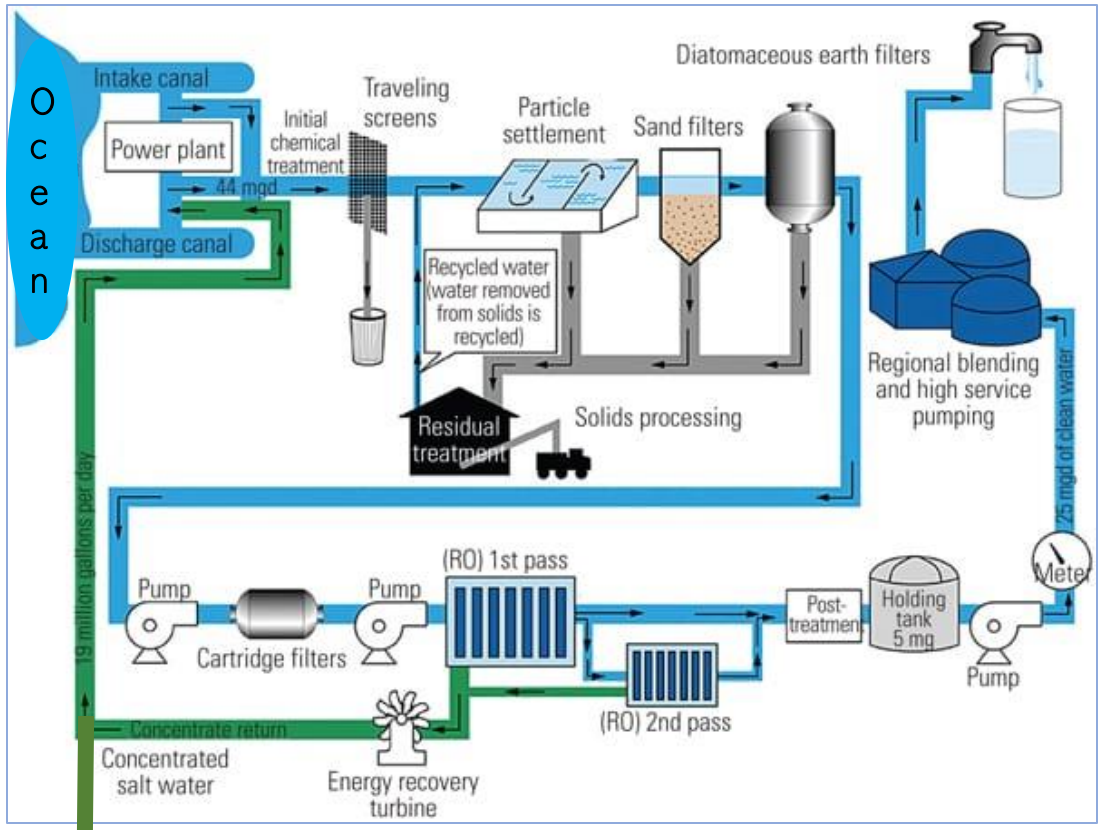
Salt Deposits in Kenya

- There are five (5) salt producing companies in Kenya, with established salt works along Magarini salt belt area in Kilifi County.
- The companies are Ken Salt Ltd, Krystalline salt Limited, Malindi Salt Works Limited, Kurawa Industries and KEMU Salt Packers.
- The industry has the capacity to produce 850,000 MT per year.
- Solar salt production is the method in production.

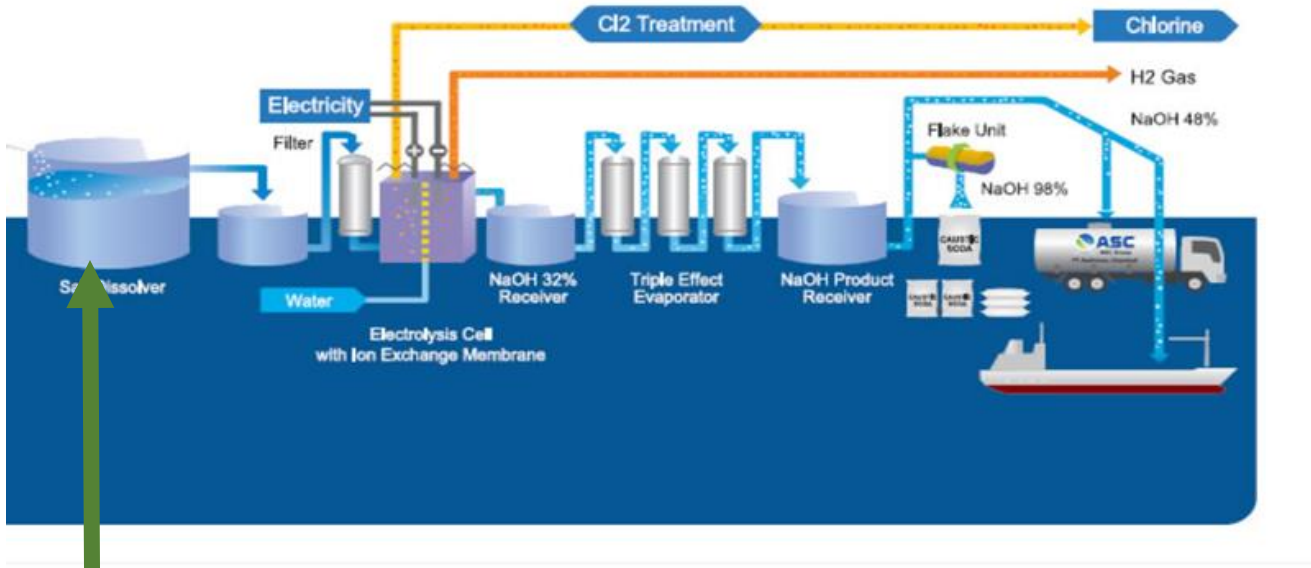
Raw Material Source - Desalination Process – Raw Material Source



Desalination + Chlor Alkali Processes



Tampa Bay Desalination Plant



Concentrated salt (brine)

6. Market Size & Growth Analysis

Industry Reach

Product	Applications
Production of metals and resource	Used in Alumina refining, propylene oxide, polycarbonate resin, epoxies, synthetic fibres, soaps, detergents, rayon and cellophane production
Pulp and paper industry	Caustic soda is used for pulping of wood chips. Chlorine and compounds are used in wood pulp bleaching in paper industry.
Petroleum and natural gas	Caustic soda is used as a drilling fluid.
Manufacture of organic chemicals	Chlorine is used for making ethylene dichloride, glycerin, glycols, chlorinated solvents and chlorinated methane.
Plastic industry	Used for making plastics, most notably polyvinyl chloride (PVC), used extensively in building and construction.
Pesticides	96 per cent of all pesticides are produced using chlorine
Industrial solvents	A variety of chlorinated compounds are used as industrial solvents, including the main ingredient used in dry cleaning.
Water treatment	Chlorine is used in 98 per cent of the water treatment plants in the world
Pharmaceuticals	85 per cent of all pharmaceuticals use chlorine
Green economy	Excess hydrogen can be used in power generation and Fuel Cell Electric Vehicle. Caustic Soda plays a role in entire Li-ion batteries value chain.

Size

- The Chlor-Alkali market is expected to generate USD 90.34 Billion by the end of 2028, up from USD 66.89 Billion in 2021.
- The global growth of the wider chemical industry will propel the expansion of chlor-alkali market.
- Asia-Pacific (APAC) is the largest market globally – in production and consumption terms. APAC accounts for 50% of global consumption.
- The APAC market share is due to regional growth of end user industries.
- China is the biggest producer and consumer. Other major producers are India, Japan and South Korea. Indonesia, Thailand and Vietnam are emerging as major players.
- After China, EU and USA are next major consumers.

8. Competitive Analysis

Competition

- Republic of South Africa producers – Sasol Polymers, NCP Chlorchem and Mondi.
- Upcoming plant based in Tanzania.
- Global producers especially Asian-Pacific (APAC) based. UAE is also emerging as a chemical production hub through joint ventures with APAC producers.
- The global top 15 major producers are listed next item;

	Company	Country
1	Olin Corporation	USA
2	Westlake Chemical Corporation	USA
3	Tata Chemicals Limited	India
4	Occidental Petroleum Corporation	USA
5	Formosa Plastics Corporation	Taiwan
6	Solvay SA	Belgium
7	Tosoh Corporation	Japan
8	Hanwha Solutions Corporation	South Korea
9	Nirma Limited	India
10	AGC, Inc.	Japan
11	Dow Inc.	USA
12	Xinjiang Zhongtai	China
13	INOVYN	United Kingdom
14	Ciner Resources Corporation	USA
15	Wanhua-Borsodchem	Hungary

SWOT Analysis

- Add clean tech as part
- Add technical consultancy from Wits as strength

9. Sustainability Commitment

Addressing Environmental Concerns

- Kilifi area has abundant solar and wind energy potential. The factory will be set up proximal to an area with access to renewable energy sources.
- Our preferred technology is membrane which is more energy efficient.
- Excess hydrogen will be used as a source of energy.

Reference

- https://www.adnoc.ae/en/news-and-media/press-releases/2021/adnoc-and-reliance-sign-strategic-partnership-for-world-scale-chemical-projects-at-taziz-in-ruwais
- ACWA Power
- Concentrated Solar Power (CSP)