Electrosep, Inc.
Corvallis, Oregon 97330 (USA)

Low Cost Sugars From Lignocellulosic Biomass Feedstocks

Sustainable Production of Advanced Biofuels and Hydrogen

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Ricardo F. Caro, PE, Electrosep Inc.

1.) "**Production** of **low cost sugars** from **recalcitrant** ligno-cellulosic biomass fiber to provide feedstocks for sustainable production of advanced biofuels and hydrogen"

2.) **Electrosep**, **Inc**. provides engineering design of a novel **alkaline pretreatment** technology using **proprietary** non-fouling membrane cells for **caustic** recovery and production of electrolytic **hydrogen**.

3.) **The cellulosic sugars** are produced at low cost by providing electrolysis **byproducts** such as renewable hydrogen, hemicelluloses (**xylose**, etc.), **lignin** powder, and others.

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The Electrosep, Inc. Technology:

The technology includes the following three (3) unit operation processes:

1.) **Alkaline Pretreatment**

2.) **Electrolytic Recovery of Caustic (NaOH)**

3.) **Enzymatic hydrolysis**

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The Electrosep, Inc. Technology:

1.) Alkaline pretreatment

Alkaline pretreatment breaks into the recalcitrant fiber of cellulosic biomass feedstocks and allow more efficient production of sugars.

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The Electrosep, Inc. Technology:

2.) Electrolytic recovery of caustic (NaOH)

Electrosep's proprietary electrolytic membrane technology provides low voltage operation at 3.7 to 4.3V for caustic recovery and H_2 production.

See note 1 below

Note 1. The electrolytic membrane technology is based on Electrosep's US patents 5334300, 4787982, and European patent EP0685005.

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The Electrosep, Inc. Technology:

3.) Enzymatic hydrolysis

The clean fiber after pretreatment allows for more efficient sugar production obtained with commonly used enzymes.

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Summary of The Electrosep Technology:

1) Alkaline pretreatment

Alkaline pretreatment breaks into recalcitrant fiber of biomass feedstocks and allow more efficient production of sugars.

2) Electrolytic recovery of caustic

Electrosep's proprietary electrolytic membrane technology provides low voltage operation at 3.7 to 4.3 volts for caustic recovery and H_2 production. **See note 1** below**.**

3) Enzymatic hydrolysis

Sugar production is obtained with commonly used enzymes.

Note 1. Electrolytic membrane technology is based on Electrosep's US patents 5334300, 4787982, and European patent EP0685005

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Types of Biomass Feedstocks:

-Wood saw dust

-Sugarcane bagasse

-Sweet sorghum bagasse

-Corn stover

-Wheat straw

-Switchgrass

-Rice straw

-and any other lignocellulosic biomass feedstocks

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Alkaline Pretreatment of Wood saw dust Fiber

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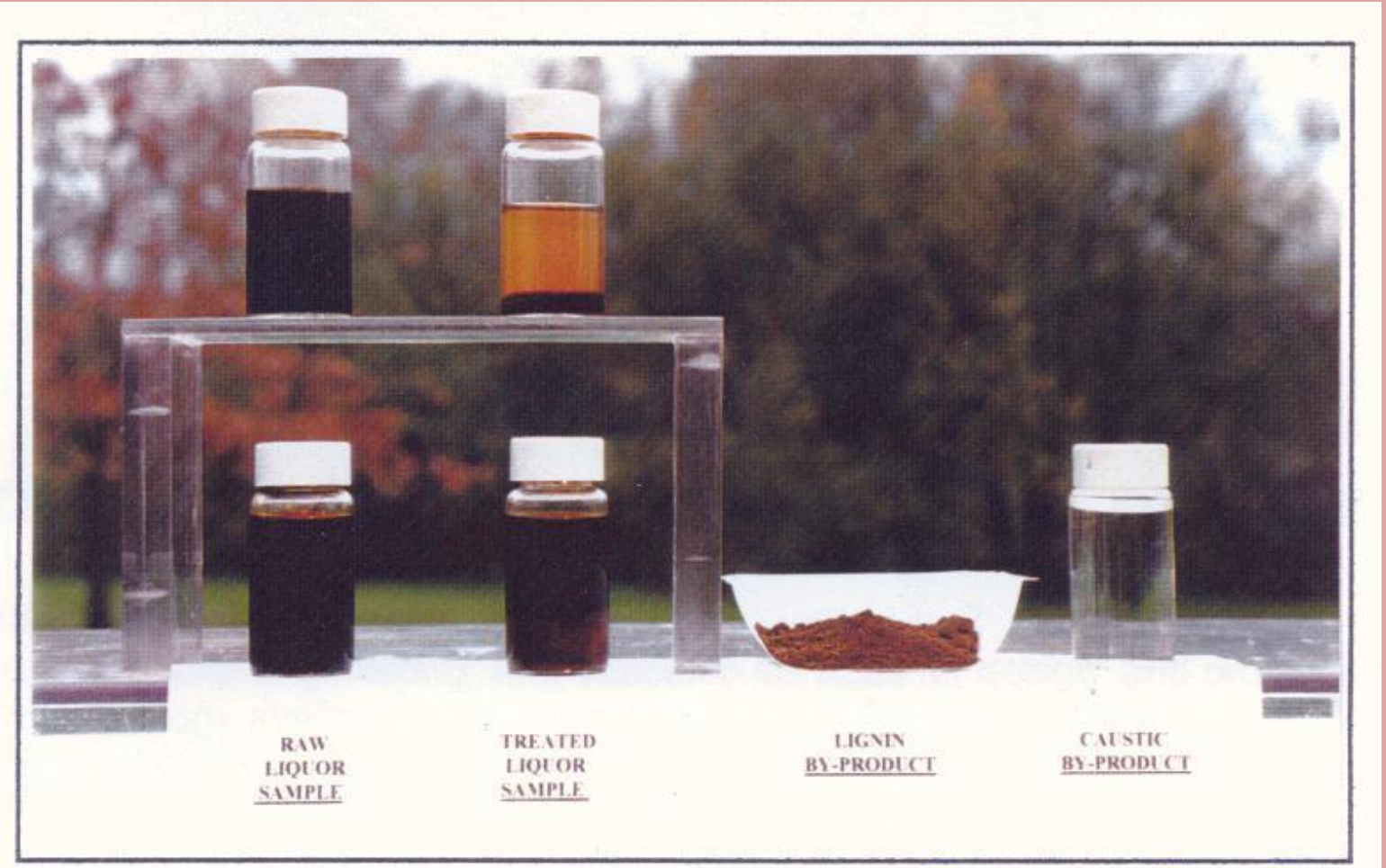
Electrolysis of Liquor from Wood saw dust Pretreatment



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A Summary of PRODUCTS and byproducts:

1.) **Glucose sugar** (to fermentation for advanced biofuels production)

2.) **H_2 gas product (**this is **renewable** hydrogen to be used to upgrade diesel and other fuels and for energy storage in solar/wind power installations**)**

3.) **Xylose sugar** (xylitol as a high valued product)

4.) **Lignin powder** (as fuel or as specialty chemical)

5.) **Caustic soda** (reused in pretreatment process)

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Advanced biofuels produced from sugars:

-Cellulosic ethanol (fermentation)

-Cellulosic butanol (fermentation)

-Renewable Diesel and Aviation Jet fuel

These fuels are produced via oleaginous lipids from sugar fermentation

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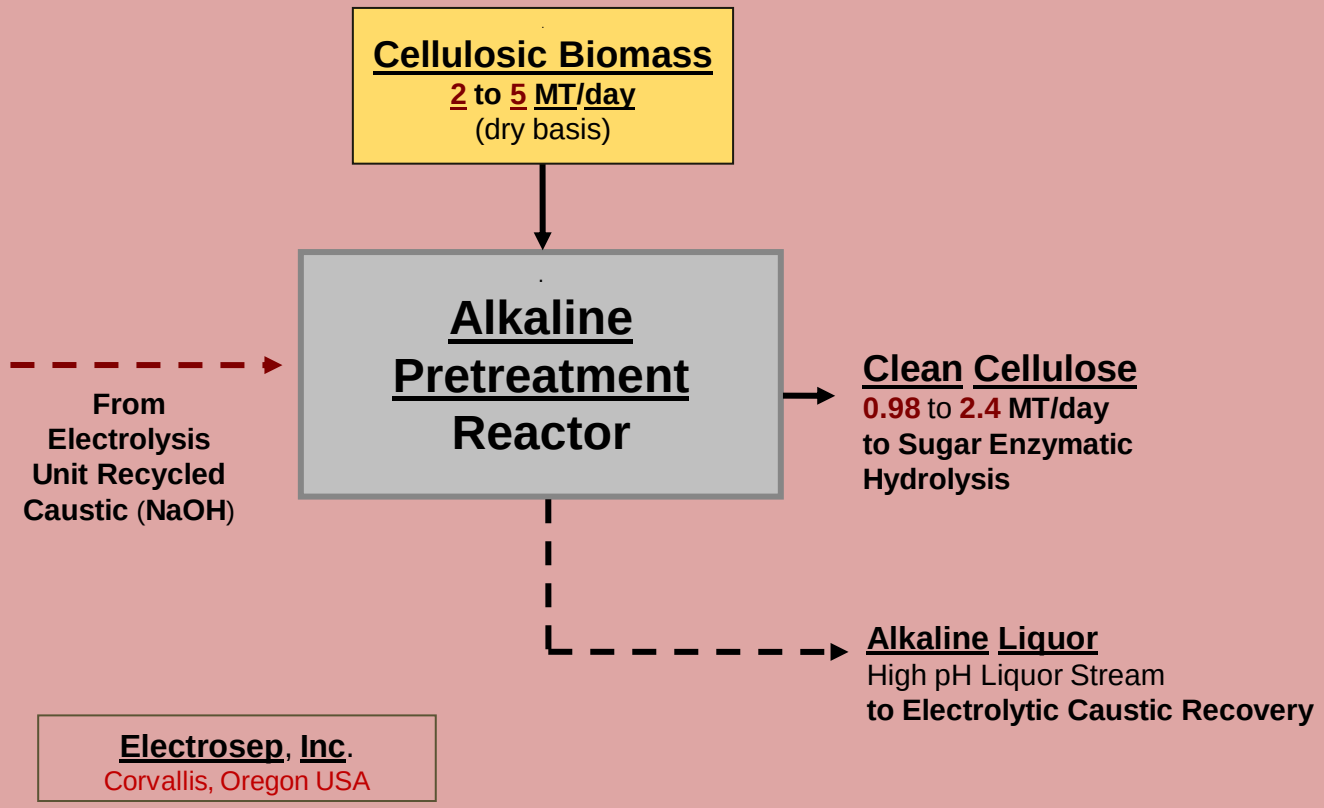

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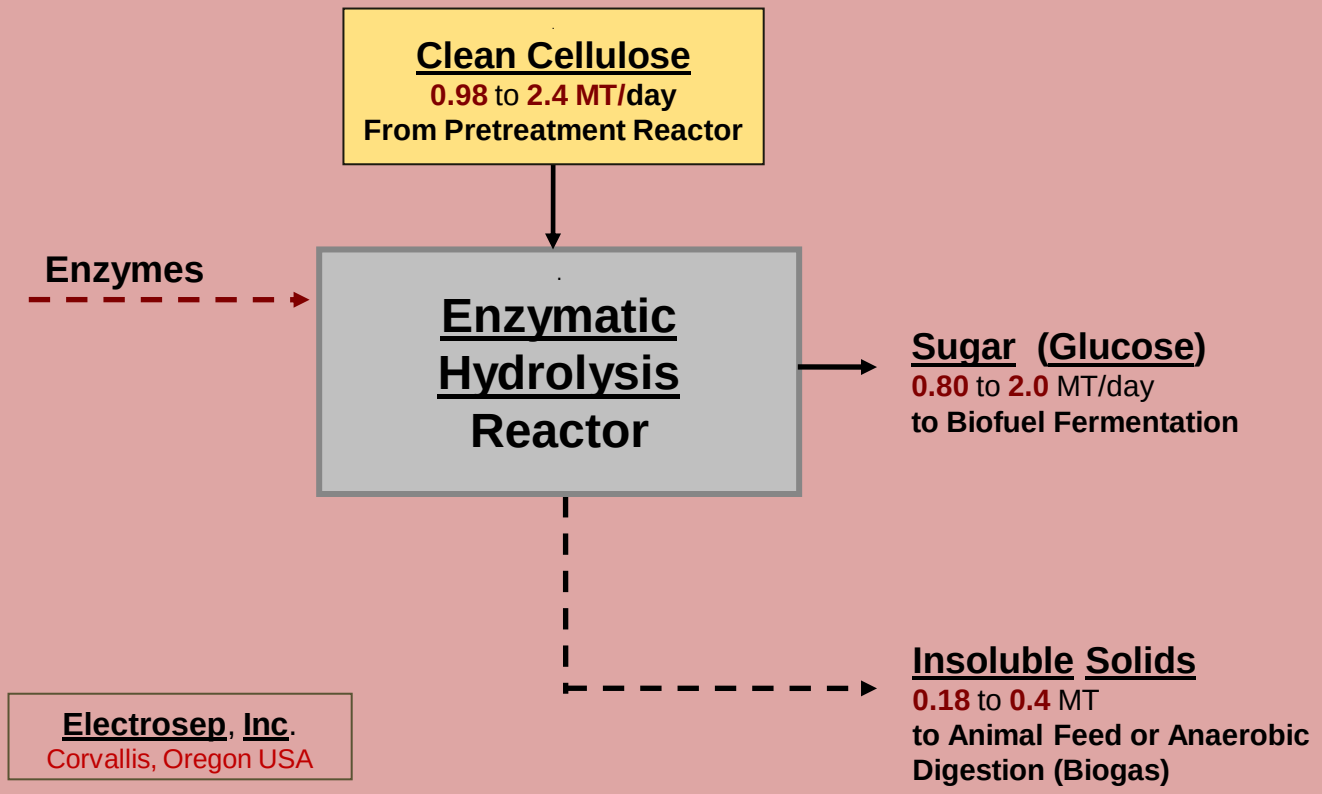

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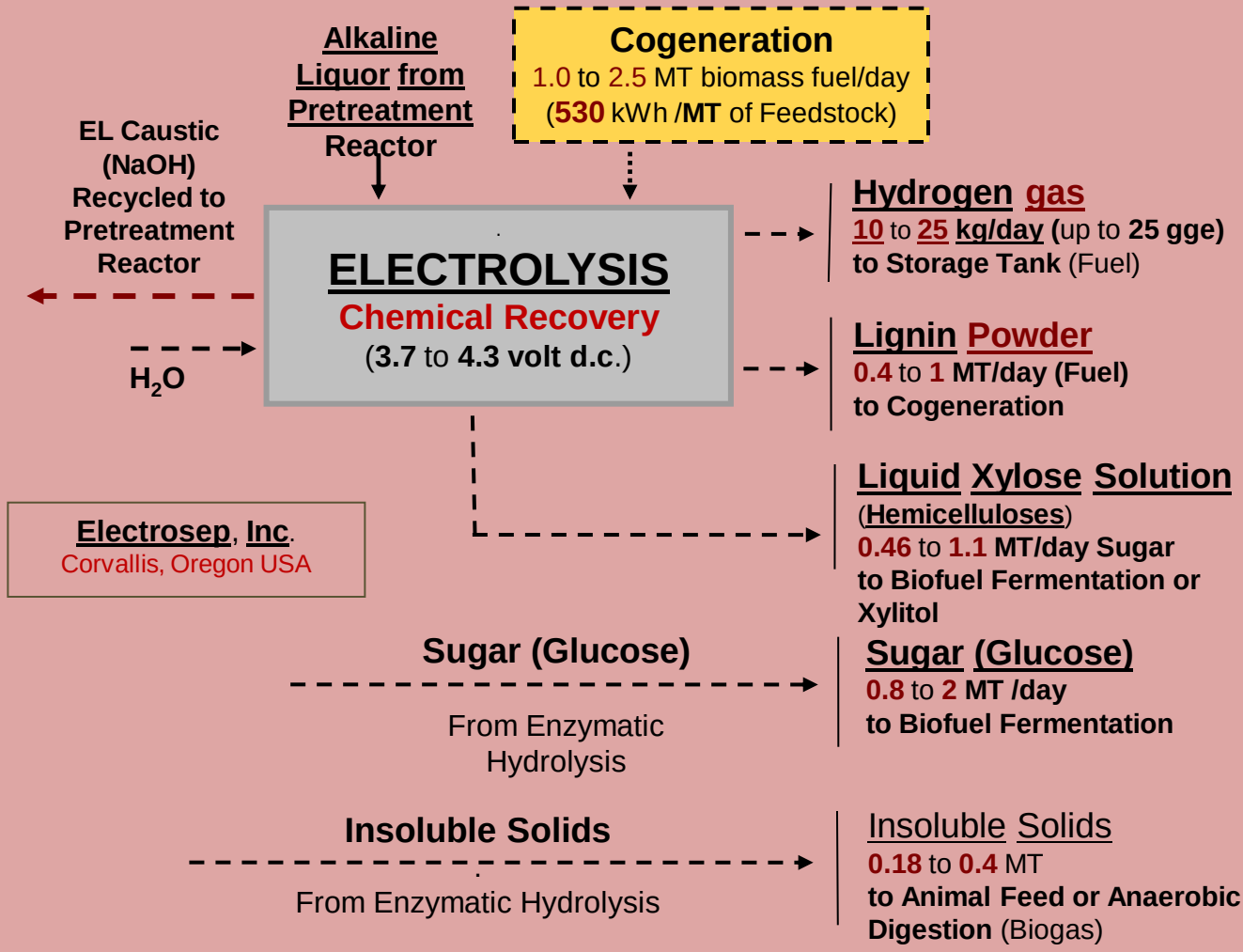

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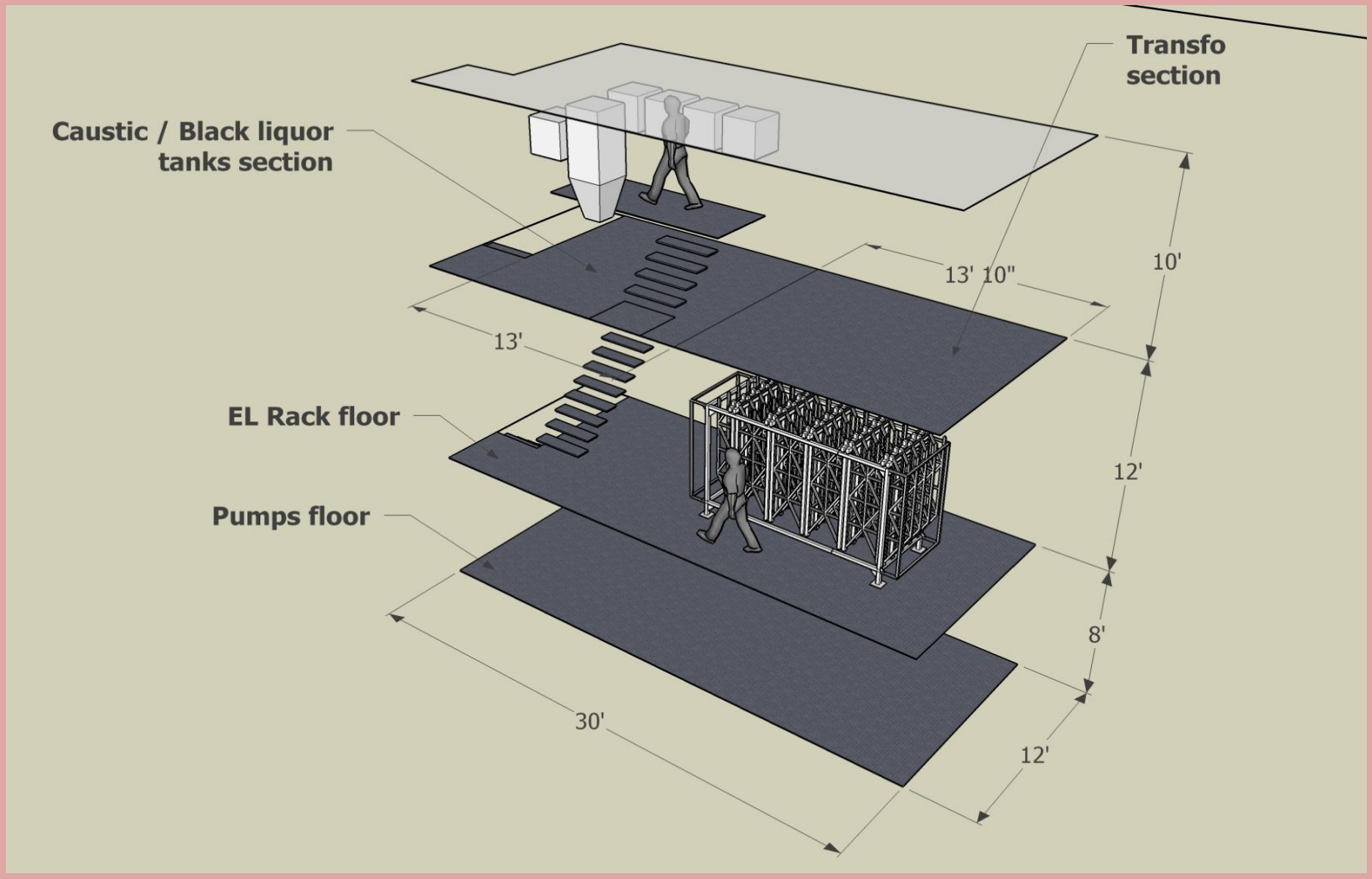
Electrosep, Inc. Design of Commercial Size Electrolysis Module



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Manufacturing Subcontractor Fabs Commercial Size Electrolytic Cell

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Commercial Size Electrolytic Membrane Cell for Shipment

Electrosep, Inc.

Preliminary Cost Estimates For Pretreatment/Electrolysis Module Rated for 2 to 5 MT/day Biomass Feedstock w/ $0.10 lbs Sugar

Line Item Description	EL Module w/ Wood Saw Dust Feedstock In Annual US $
1. Revenue Estimate from Sugar sales and Byproducts (Glucose, H2, Xylitol, etc.)	$ 324,000
2. Operating Cost Estimate	$ 160,000
3. Net Income	$ 164,000
-Capital Cost Estimate	US$ 600,000
-Payback Time Estimate	3.7 years

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What now:

1.) Installation of Pilot for Optimization

2.) Pilot Demonstration

3.) Commercial Plants Installation

4.) Licensing Technology, Partnering, and Acquisition in biofuels production

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Thank You

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