SynSel Enviro Industrial Parks:
Leveraging process waste byproducts to create value-add jobs, products & services
SynSel Biorefineries serve as the anchor to *Enviro Industrial Parks (EIPs)*, where process waste byproducts are leveraged to create value-add products & services.

SynSel partners with leading technology providers, business leaders, & local stakeholders to build *community resiliency* & further solve the local issues of:

- Long-term job creation
- Waste mitigation
- Local food production
- Combating Climate Change

Complementary technologies are integrated with SynSel Biorefineries to approach near zero-waste, end-to-end waste mitigation systems.
Biochar has a multitude of uses both in the agriculture and industrial sectors. Biochar is also used as a soil enhancer. It can also be used to produce oil and other byproducts that can be used for producing clean, renewable energy.

This feedstock is the cheapest “BTU per dollar” available. It has been shown 7 times the corresponding value of urban grease.
Choose local feedstock that is economically viable and has consistent, long-term availability.

Select technologies that maximize the value of the available feedstock & waste heat of the biorefinery.

Finalize core technologies & support equipment into the final system design.

Integrate downstream business opportunities based on available outputs.

**EIP Mission:** to develop turn-key, closed-loop, & carbon neutral systems that provide zero-waste solutions.
SynSel is committed to incorporating best-in-breed technologies into its Enviro Industrial Parks that:

- Sensibly use the biorefineries’ waste heat, biochar, water, & CO₂
- Maximize the return from available local feedstocks
- Create more jobs

Technologies under consideration include:

- H₂ Generation Plants
- Anaerobic Digesters (AD)
- Gasification
- Gas-to-Liquid Micro Plants
- Composting Operations
- Geothermal Facilities
- Fuel Cells: H₂ to Electric
- Heat-to-Electric Plants
- Solar/Wind-to-Electric
- Microturbines: Methane-to-Electric
- Ag Waste-to-Alcohol
- Absorption Chilling
The clustering of manufacturing & service businesses near a SynSel plant allows for the sharing of resources: infrastructure, and inputs while utilizing free waste heat.

A few of the ancillary businesses include:

- Data centers
- Industrial Vertical Greenhouse
- Aquatic Farming
- Renewable fuel refill station
- Organic soil amendments & fertilizer
- Biogenic CO\textsubscript{2} production plants
- H\textsubscript{2} generation facilities
- Food & meat processing plants
- Ag CAFOs & crop fields
- Animal feed production facilities
- Re-forestation with hybrid poplars
- Renewable fuel blending terminal
Key Opportunities: Data Centers

- SynSel Enviro Industrial Parks hold the keys to economically efficient Data Centers due to utilization of biorefinery waste heat, electricity, diesel fuel and $H_2$
- Security and Reliability are vital criteria for Data Centers: On-site production of electricity, diesel fuel and $H_2$ is highly desirable and unique
- Target Clients: Google, Facebook, Amazon, Microsoft, Apple, IBM, Oracle, Intel, eBay, Cisco Systems, Yahoo, AMD, HP, Netflix, Tesla Motors, etc.

In a bit of irony, the life cycle goes full circle as SynSel Biorefineries are constructed on former paper mill sites closed due to the digital transformation age. Thus, data centers now become the new “factories of the paperless/digital age”.

High-tech job creation and data storage contributes to greater Community Resiliency and Diversity
Key Opportunities: Greenhouses

Vertical Industrial Greenhouses in SynSel Enviro Industrial Parks benefit from:

- **Available Energy**: Heat from the SynSel Biorefinery & Biogas from Anaerobic Digesters, Electric from Wind, Solar, Methane and Waste Heat, Alcohol from Ag Waste/Ethanol plants
- **Nutrients**: Liquid fertilizer from Anaerobic Digesters & silage from Distillation Plants, animal feed from alcohol plant output, biochar and ammonia water from SynSel plant
- **Carbon Dioxide**: Excess CO$_2$ from the SynSel Biorefinery & Distillation Plants to enhance the growing atmosphere for higher production
- **Waste Mitigation**: Anaerobic Digestion, Distillation, & composting of vegetable waste

On-site production of vegetables contributes to greater Community Resiliency
Heat produced by the SynSel Evolution renewable energy parks benefits from:

- Nutrient rich water from Anerobic Digestion processes which is ideal for aquaponic applications
- Waste mitigation of processing waste from PEM AD. This oil rich waste is an excellent co-substrate for increasing biogas yield
On-site production of transportation and generator fuel contributes to greater Community Resiliency.

Key Opportunities: Renewable Fuel Refill Stations

- Synthetic gasoline for ICE via SynSel biorefinery; ICE = internal combustion engine
- Synthetic diesel fuel for ICE and data center standby generators via SynSel biorefinery
- Biogas fuel for modified ICE via PEM anaerobic digester (AD)
- Electricity for EVs via renewable sources
- Alcohol for blending/ICE via distillation
- \( \text{H}_2 \) for Hydrogen engines via biorefinery \( \text{H}_2 \) generation plant
Summary of Potential On-Site EIP Initiatives

- **Data Centers**: Serves as anchor to SynSel EIP's and takes advantage of ultra-high reliability & security of onsite, inexpensive energy sources
- **Greenhouses**: Uses inexpensive heating, CO\(_2\), & low cost electricity for lighting; consumes onsite produced soil amendments & fertilizer; produces locally grown produce
- **Aquatic Farms**: Uses inexpensive heating; contributes fish waste to soil amendment production; produces locally raised high demand proteins
- **Vehicle Re-Charge and Fuel-Blending Stations**: Uses onsite H\(_2\), biomethane, alcohol, gasoline, diesel and electricity
- **Anaerobic Digesters**: Uses inexpensive heating to process local wet waste; biogas to produces heat/electricity; and to generate nutrient-rich liquid fertilizer & biogas
- **Alcohol Production**: Converts agriculture waste to alcohol
- **Wind & Solar**: Supplements electric & heat needs
- **Fuel Cells**: Uses onsite H\(_2\) to create electricity
- **Geothermal**: Supplements cooling and heating needs
Other Benefits: Water Reclamation

- In addition to SynSel’s commitment to biorefinery greenhouse gas emission reduction, onsite water reclamation technologies will be implemented to process waste water at the SynSel Biorefinery & throughout the Enviro Industrial Park
- This onsite waste water processing will minimize any impact for treatment by local waste water treatment plants
- Nutrients and any heavy metals will be separated from waste liquids
- Waste liquids may be further processed into reusable water or land-applied for irrigation
The combination of Biochar, Digestate, Silage, Ammonia Water & Compost creates a superior organic soil amendment with:

- Enhanced soil structure
- Increased water holding capacity
- Rich nutrient concentrations

This valuable soil amendment has direct application in conventional greenhouse growing operations, agricultural field application, & retail sale.
Other Benefits: Wild Fire Mitigation

EIP's:

- Create a platform for implementing SynSel’s Fire Hazard Community Outreach initiative
- Businesses (data centers, greenhouses and aquatic farms) utilize wood-to-fuel waste heat: wood can displace hazardous kindling
- Classroom education:
  - Master Planning with local colleges and forestry industry groups to identify dangerous dry kindling within 75-mile radius
  - Implement plan of action to cull dry kindling/biomass
- Structures are designed to fire-proof specifications: improves **Community Resiliency**
- Water reclamation and irrigation keeps site vegetation watered and vibrant – not prone to kindling
- Integration with State and Federal Forest officials as well as Sierra Club to implement a cohesive “plan of action” to suit all stakeholders

- Live tree benefits: photosynthesis converts $\text{CO}_2$ to sugar, cellulose and carbohydrates
- Dead tree dangers: No longer converting $\text{CO}_2$ to growth, dry kindling/biomass is fire risk to the community
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