

Fw: CCSMM Request for Comment and Solutions

RE

Robert Ehlers <Robert.Ehlers@lodestar-llc.com>
Thu 10/15/2020 16:59
To: DEEP RecyclingProgram

10-10-20 EcoHub Waste Free America.pdf
2 MB

EcoHub CCSMM PRESENTATION.pdf
5 MB

CCSMM Comments and Solutions.pdf
112 KB

EcoHub is pleased and excited to respond to the Connecticut Coalition for Sustainable Materials Management's (CCSMM) request for input, concepts and considerations in support of its intention to identify solutions for reducing waste disposal. EcoHub is eager to work with CCSMM to build an entirely Waste Free™ Connecticut.

EcoHub's proposed solution will result in zero waste disposal, while spurring explosive economic growth; with 100% private financing and fully guaranteed results. We do this by co-locating environmentally benign manufacturing facilities with our MaxDiverter™ sorting system; all in a beautifully designed LEED platinum-rated campus. Additionally, our eco-industrial campus will incorporate a Center of Excellence to interface with local learning institutions to provide STEM education and foster research into innovative sustainable materials management technologies.

The MaxDiverter is the world's most **Advanced Material Recovery System** which is also the world's only **High Diversion Organic Waste Processing System** – IT'S A 2-IN-1 SYSTEM.

All MaxDiverter components are proven by years of commercial operation. Unique sequencing is the key to EcoHub's exceptional performance. We create up to 40 clean and consistent material streams, repurposing 100% of processed MSW, **including recyclables and organics**, into new sustainable consumer products and packaging, renewable power and fuels, 100% organic food, potable water, soil amendments and construction materials by using decades old, commercially proven manufacturing and conversion technologies.

I have attached two documents for your consideration, in addition to a copy of this introductory message.

The first document, "EcoHub Waste Free America", is a brief overview of EcoHub and its potential transformational impact on America's Sustainable Materials Management practices and economics.

The second document, "EcoHub CCSMM Presentation", is a more detailed description of:

- EcoHub's MaxDiverter waste processing system, its component equipment and systems integrator
- The pure, uniform, sorted resource streams produced by the MaxDiverter, the back-end manufacturing technologies that use these resource streams and associated partner companies
- NASA-licensed wastewater discharge and air emissions elimination/control equipment
- EcoHub's Center of Excellence for research and education
- EcoHub's world class partners and associated guarantees for project financing, facility engineering and construction, systems integration engineering and recyclable products and commodities brokerage
- EcoHub IP Platform and Patent Portfolio

For a complete description of our answer to CCSMM's Question No.1, please follow the imbedded video links while reviewing the "EcoHub CSMM Presentation". A full scale EcoHub complex will comprehensively address CCSMM's Focus Areas No. 2 – Organics and No. 4 - Increased Recycling.

Regarding CCSMM's Question No.2 (b), realization of EcoHub's full economic and environmental benefits will require a multi-town or regional waste supply approach. Processing of at least 2,000 tons per day of MSW provides optimal benefit opportunities.

Regarding CCSMM's Question No. 3, sustainability, environmental benefits and reduced costs are described in detail in the attached documents.

Regarding CCSMM's Question No.4, **we are highly interested in presenting to CCSMM or a CCSMM working group, answering all questions, and discussing possible synergies with elements of other CCSMM focus areas and initiatives.**

Regarding CCSMM's Question No. 5, we would welcome the opportunity to discuss DEEP's role in advancing EcoHub's sustainable materials management solutions (i.e. facility siting, long-term energy contracts, collection route optimization, CNG or electric vehicles, permitting assistance. etc.).

At this time, we have no response to CCSMM's Questions No. 6 and No. 7.

Please don't hesitate to call me if you have any questions or require additional information.

Bob Ehlers
EcoHub
203-216-6935



EcoHub: Creating a Waste Free™ America and World

EcoHub has created a revolutionary new technology and business model that unlocks the potential of today's waste stream to produce sustainable paper and plastic consumer goods, soil amendments, renewable energy and fuels, pure drinking water, and 21st century carbon-based materials and products. Converting all discarded materials to beneficial use, EcoHub is an eco-industrial park designed to fully monetize the waste stream, turning an expensive nuisance to a driver of economic development.

Recycling Crisis. The closure of China's market and the collapse of the global recycled materials market mean that a new approach to waste is needed. EcoHub has the technology, the partners, and the vision to be the breakthrough 21st century waste-free™ solution to the American problems of rising waste management costs and collapsing recycling performance.

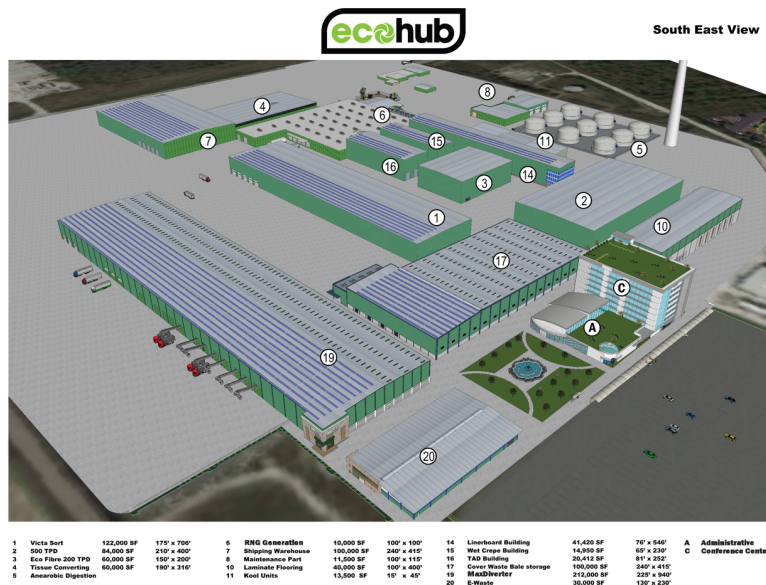


Figure 1: Gen1 EcoHub Campus

thereby reducing pressure on municipal and personal budgets.

EcoHub Will Revitalize American Manufacturing. Each EcoHub will attract up to \$550 million in private investment, directly employ up to 500 people and indirectly employ up to 1,500 people, while creating \$900 million to \$2.2 billion of annual macroeconomic activity for the country.

Hope for the Developing World. EcoHub believes that unregulated trash is a significant impediment to human and economic development. By transforming waste from an expensive nuisance needing removal to a valuable feedstock worth recovering, EcoHub's vision for a Waste-Free World will result in more economic opportunity, growth in dignity and a cleaner,

The End of Garbage. When materials are comingled, they are garbage; when they are separated, they become valuable feedstocks. EcoHub's process—covered by 26 patents—is guaranteed to separate comingled waste and process it into both everyday consumer products and advanced materials/products. By diverting America's MSW to productive use, EcoHub can significantly extend the life of the country's remaining landfills. In addition, EcoHub's convenient One Bin™ system puts fewer heavy garbage trucks on residential streets, reducing traffic, lowering emissions and saving 25% to 40% on collection costs,

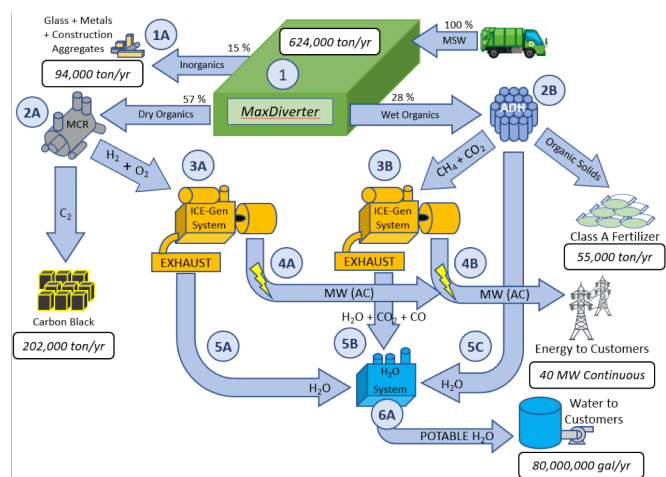


Figure 2: Gen2 EcoHub Schematic Layout



better environment for future generations, including a plastic-free ocean. EcoHubs in the developing world will prevent plastic from making its way into the ocean in the first place, thereby making the cleanup manageable. EcoHub is also developing technology that can collect and process marine plastic pollution on the water.

EcoHub will Reduce Landfilling and/or Recycling Costs by 30% or more. EcoHub fully monetizes the discarded materials stream through an onsite closed-loop backend manufacturing and conversion technology suite, delivering to existing waste companies and government agencies additional new free cash flow per ton processed.

EcoHub is Reliable. At the heart of the EcoHub is the MaxDiverter™; the first true automated mixed waste separation system. EcoHub's MaxDiverter is guaranteed and bonded to mechanically separate and recover all elements of the waste stream at 95%+ performance efficiency to 95%+ purity with 97% operational reliability. Value-added manufacturing processes, which are co-located with the MaxDiverter on our eco-industrial campuses, utilize proven, well-established manufacturing and conversion technologies and NASA-originated technologies repurposed for civilian application.

Environmental Solution. Each 2,000 ton/day EcoHub will reduce greenhouse gas emissions by approximately 2.5 million tons of CO₂e. Coupled with emissions reductions from processing recovered vs. virgin materials, these reductions are equivalent of taking up to 800K cars off the road. Eliminating extra collection routes and minimizing the transport of recycled products further reduces emissions and energy use, as well as reduces wear and tear on residential streets.

Experienced Team. EcoHub's principals have almost 280 years combined experience in solid waste management, manufacturing, conversion technologies, advanced technology development and deployment, and environmental market transformation. They possess excellent contacts throughout the industry, as well as with municipal and national governments across the world.

Significant Partners. EcoHub is backed by some of the world's largest companies, including Grupo ACS, IBM, Morgan Stanley, CellMark and Stadler.

- Each EcoHub comes with a full EPC Wrap (performance guarantees) from **Grupo ACS**, the world's largest private construction company that does over \$40 billion in infrastructure each year: <https://www.grupoacs.com/activities/industrial-services/>
- **Morgan Stanley** has worked with EcoHub since 2013 to act as lead arranger for project financing on qualifying EcoHub projects: <https://www.morganstanley.com/what-we-do/investment-banking>
- We have multiple patents and unprecedented performance guarantees from the world's best component manufacturers and the world leader in mixed waste and recyclable systems integration, **Stadler**: <https://www.w-stadler.de/en/index.php>
- One of the world's largest materials brokers, **CellMark** (www.cellmark.com) has agreed to purchase and market all outputs of EcoHub on a long-term off-take basis.
- We are partnered with **IBM** on control optimization for our facilities and operation of our Centers of Excellence. In addition, they may provide licensing of conversion technologies, instrumentation, measurement, controls management, logistics optimization for collection routes and smart bin services. https://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/

Conclusion: America can lead the way in developing a Circular Economy where public-private partnerships drive economic development, meaningful employment and a clean environment. This leadership can be extended worldwide with tremendous economic, social and environmental benefits.





Waste-Free™ America: EcoHub Gen1/Gen2 Technology Platforms vs. Business As Usual

Vs. 100% Landfill	Waste-Free™ America (1)
Annual Tons	450 million
# EcoHubs (2,000 tpd)	Up to 720
Gen 1 Technology	
<i>Private Investment</i>	Up to \$500 billion
<i>Direct Jobs</i>	Up to 360,000
<i>Macro Jobs</i>	Up to 2.2 million (2)
<i>Macroeconomic Activity</i>	Up to \$990 billion/year (2)
<i>Recovered Paper Fiber</i>	Up to 116.6 million tons
<i>Recovered Plastic</i>	Up to 55.4 million tons
<i>Clean Electricity Production</i>	Up to 84,000 GWh
<i>Renewable Fuels</i>	Up to 129.6 million bbl. diesel
<i>Recovered Organic Material</i>	Up to 144 million tons
<i>Metal & Glass Commodities</i>	Up to 62.6 million tons
<i>Clean Drinking Water</i>	Up to 36.7 billion gallons
Gen 2 Technology	
<i>Private Investment</i>	Up to \$309 billion
<i>Direct Jobs</i>	Up to 241,000
<i>Macro Jobs</i>	Up to 936,000 (2)
<i>Macroeconomic Activity</i>	Up to \$1.66 trillion/year (2)
<i>Eco-Carbon Black</i>	Up to 237.6 million tons
<i>Clean Energy Production</i>	Up to 261,000 GWh
<i>Soil Amendment/Fertilizer</i>	Up to 25.2 million tons
<i>Metal & Glass Commodities</i>	Up to 62.6 million tons
<i>Clean Drinking Water</i>	Up to 130.3 billion gallons
<u>Diversion Rate</u>	Up to 100% diversion
Annual CO2e reductions	Up to 1,800 million tons
Equivalent fewer cars on road	Up to 570 million cars
Water Savings	Up to 2.15 trillion gallons
Tree Savings	Up to 1.96 billion trees
Landfill Capacity Freed	Up to 1.3 billion cu. yards

(1) Technical potential based on based on EcoHub modeling for US waste flows according to Waste Business Journal and EPA waste characteristics.

(2) Based on econometric study conducted for EcoHub by IBM.





Waste-Free™ World: EcoHub Gen1/Gen2 Technology Platforms

Vs. 100% Landfill	Business As Usual	Waste-Free World (4)	
Annual Tons	1.78 billion tons (1)	1.78 billion tons	
# EcoHubs (2,000 tpd)	0	Up to 2,858	
Gen 1 Technology			
Private Investment	Not Available	Up to \$1.6 Trillion	
Direct Jobs	Not Available	Up to 1.66 million	
Macro Jobs	Up to 4.5 million (2)	Up to 6.5 million (5)	
Macroeconomic Activity	\$290 billion (3)	Up to \$1.71 trillion (5)	
Recovered Paper Fiber	Not Available	Up to 245 million tons	
Recovered Plastic		Up to 109 million tons	
Clean Electricity Production		Up to 523,000 GWh	
Renewable Fuels		Up to 750 million bbl. diesel	
Recovered Organics		Up to 845 million tons	
Recovered Metal & Glass		Up to 184 million tons	
Clean Drinking Water		Up to 283 billion gallons	
Gen 2 Technology			
Private Investment		Not Applicable	Up to \$827 billion
Direct Jobs			Up to 1.25 million
Macro Jobs	Up to 4.89 million (5)		
Macroeconomic Activity	Up to \$5.47 trillion (5)		
Eco-Carbon Black	Up to 756 million tons		
Clean Energy Production	Up to 1.11 terawatt-hours		
Soil Amendment/Fertilizer	Up to 106.3 million tons		
Metal & Glass Commodities	Up to 184 million tons		
Clean Drinking Water	Up to 672.5 billion gallons		
Summary			
Diversion Rate	Not Available	Up to 100% diversion	
Annual CO2e reductions		Up to 5.8 billion tons	
Equivalent fewer cars on road		Up to 1,176 million cars	
Water Savings		Up to 2.7 trillion gallons	
Tree Savings		Up to 1.78 billion trees	
Landfill Capacity Freed		Up to 10.9 billion cu. Yards	

(1) World Bank 2015 What a Waste report,

https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf

(2) World bank says 1-5% urban workers involved with all aspects of Waste. Assumes 1/2 urban population is working; 2.5% involved with all waste jobs; disposal/recycling = 10% of all waste employment

(3) Average of 2012 & 2025 total waste management costs. Includes collection. Annex E WB Report

(4) Global technical potential. EcoHub modeling based on World Bank waste flows and waste characteristics plus EcoHub technology configurations tuned to waste characterizations of Low & Mid-Low Income and Mid-High & High Income countries as defined by the World Bank.

(5) Based on econometric modeling done for EcoHub by IBM.



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scale EcoHub complex will comprehensively address CCSMM's Focus Areas No. 2 - Organics and No. 4 - Increased Recycling.

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EcoHub - Waste Free™ Connecticut

*Leading Connecticut and the World
in Sustainability and the Circular Economy*



EcoHub - Waste Free™ Connecticut

[Introductory Video](#)

Our Offer in Brief

- Utilizing our (25) process patents EcoHub will develop an **integrated system that will provide guaranteed diversion rates for the absolute lowest processing fee**
- We operate manufacturing and conversion technologies on the EcoHub campus that will produce consumer products from the recovered resources to **provide 100% Recycling™ of the MSW stream** - with guaranteed 20-year off-take contracts with rated purchasers
- We will build a closed-loop environmental campus with 100% private financing of up to \$750MM - **NO CAPITAL from state or local agencies**
- We are **backed by a \$40B per year company** that will provide a full EPC Wrap on the EcoHub (performance guarantee of the entire project)
- **We are taking 100% of the risk** - (6) levels of performance guarantees to the project finance team and contracting entity
- Our **MaxDiverter™v1.5 and v2 are the only patented and operating hybrid (combined) Advanced Materials Recovery Facilities and High Diversion Organic Waste Processing Facilities in the world** - operating in Granada, Spain since 2013 (highly automated) and Oslo, Norway since 2016 (fully automated)
- We are eager to work with CCSMM and other stakeholders to **can bring this transformational environmental solution to Connecticut**

EcoHub - Benefits to Connecticut, its Residents & Businesses

- Provide an MSW processing fee that will enable Connecticut residents to benefit from lower Residential Can Rates, while greatly EXCEEDING waste disposal reduction expectations
- Save Connecticut municipalities significantly from current waste and recycling costs & potentially add \$ millions in back end manufacturing and tax revenues
- Bring EcoHub's 100% Recycling™ Program to ALL Connecticut Residents and Businesses w/o cost increase
- Our advanced NASA wastewater and air emissions elimination technologies facilitate siting and permitting, and provide great economic benefit to surrounding communities with no adverse environmental impacts
- Economic development (\$Billions per year) and environmental sustainability (zero waste) benefits brought by EcoHub will increase property values for residents and businesses
- New direct and indirect jobs added
- Center of Excellence to interface with local learning institutions to provide STEM education and sustainable materials management research
- Connecticut can become the “NASA Johnson Space Center” for the Environmental Revolution and lead America and the world into the Circular Economy

MSW Is Carbon Gold

- The 450MM tons per year of MSW generated in America is 85% carbon-based resources
- When the individual resource materials are recovered and used as feedstock to manufacture new sustainable products or converted into renewables, as much as 4 tons or more of carbon emissions per 1 ton of MSW are saved
- Literally EVERYTHING in MSW can be made into valuable finished goods and products
- It's like burying GOLD ..., which makes no sense whatsoever

MORE ON THIS LATER ...

Key Facts: United States

\$ 1 trillion

Estimated value of the solid waste industry in the United States

\$ 11.4b

Commodity market value of wasted packaging materials in the U.S.

450m

Tons of waste annually in the U.S.

\$ 675b to 1.6t

Market value of finished products made from these wasted materials

Sources: Columbia University Earth Institute, As You Sow, EcoHub calculations

Value of wasted packaging materials

Total \$ 11,402,020,357




“Landfills shunned, recycling programs stalled and the country’s record-setting trash output unyielding“

New York Times 1/1/15

Market Opportunity: Recycling Market Collapse

WASTEDIVE Home Events Library Jobs Opinion Topics



BRIEF

China scrap imports projected to drop nearly 95% from 2017 levels

By Kristin Musulin • May 18, 2018

The New York Times

Plastics Pile Up as China Refuses to Take the West's Recycling



EcoHub's Three Visionary Breakthroughs

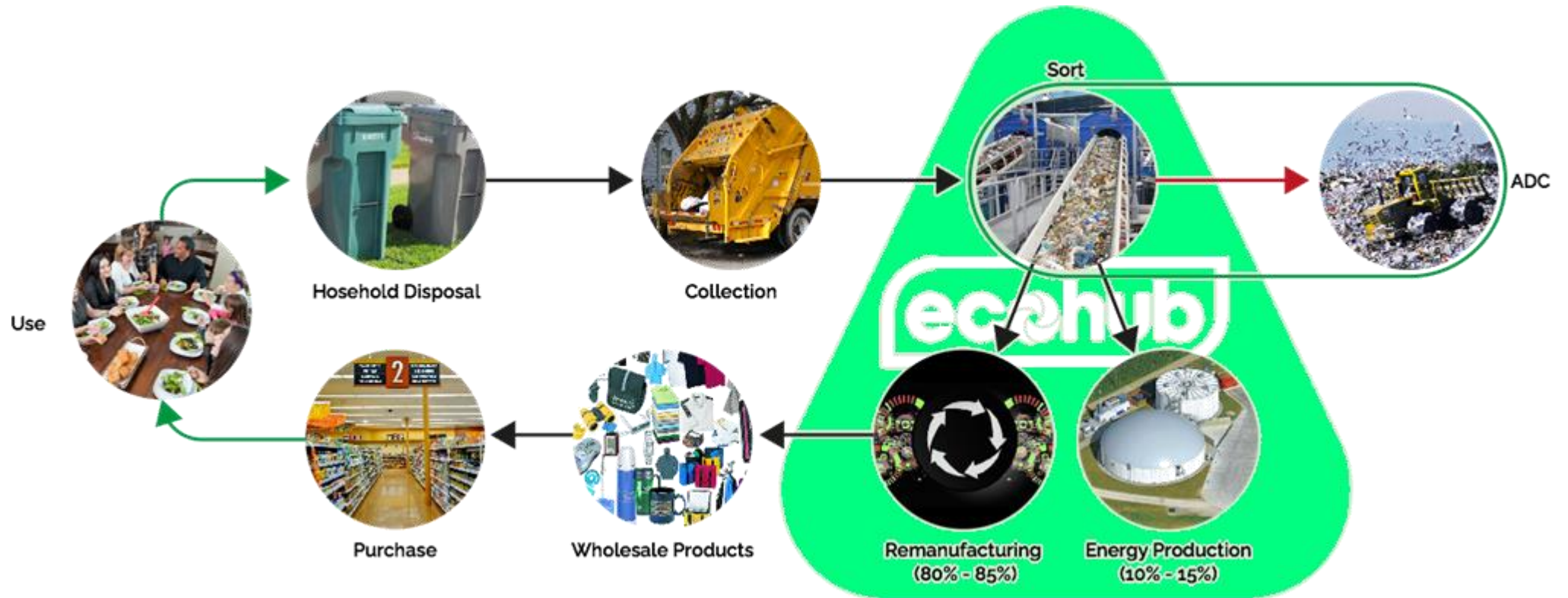
1. **Conceptual**: When discarded materials are mixed, they are garbage. When they are separated, they are feedstock for sustainable manufacturing - EcoHub sees everything in the waste stream as valuable resources
2. **Technological**: The MaxDiverter™ is the only mixed waste processing system designed to separate and recover everything in the entire waste stream
3. **Business Model**: EcoHub co-locates closed-loop product manufacturing and conversion technologies with the separation and recovery technology to fully monetize the value of discarded materials

EcoHub Technology Overview

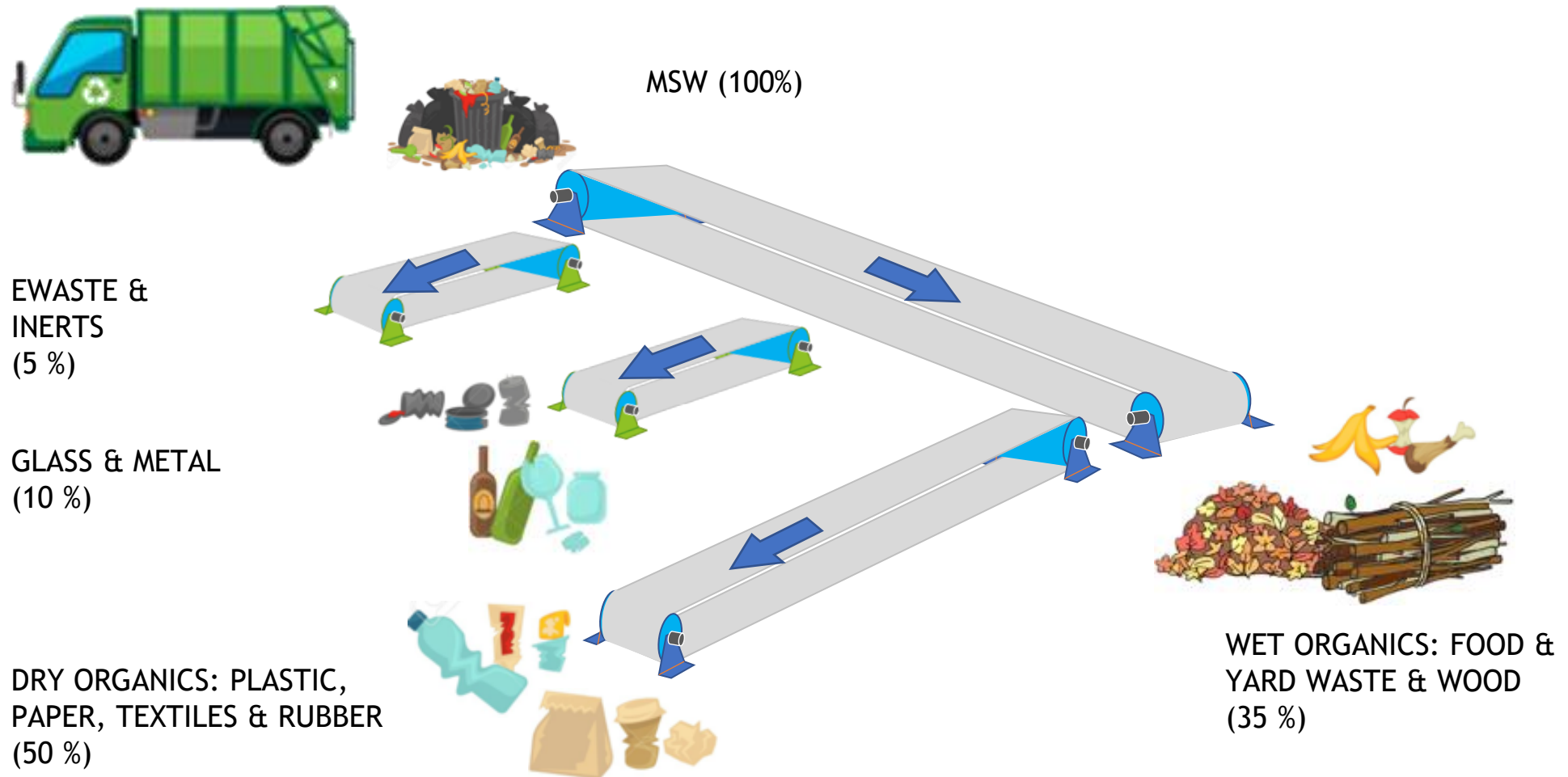
- Central to the EcoHub is the MaxDiverter™ which is the world's most **Advanced Material Recovery Facility** and is also the world's only **High Diversion Organic Waste Processing Facility** - IT'S A 2-IN-1 SYSTEM
- All MaxDiverter components are proven by years of commercial operation
- **Unique sequencing** is the key to EcoHub's exceptional performance
 - Creates up to **40 clean and consistent material streams**
 - **Repurposes 100% of processed MSW, including recyclables and organics**, into new sustainable consumer products and packaging, renewable power and fuels, 100% organic food, potable water, soil amendments, and construction materials, by utilizing decades old commercially proven manufacturing and conversion technologies

Circular Integration™

- Now that China's market is closed to recovered material, EcoHub's closed-loop Eco-Industrial Park infrastructure is the only system that makes economic sense:



MaxDiverter™: Ultimate Sustainability™



*Based on US EPA WCS

Stadler : The World Leader in Material Sorting Plants

- Exclusive Global MaxDiverter™ Systems Integrator

- Over 350 Material Sorting Plants and over 3,000 component machines sold worldwide
- 225-year old German family owned business - now 7th generation
- Corporate Video link: [click here](#)
- Sorting System Video Link: [click here](#)



MaxDiverter™ v1.5 - (40) Mechanical Recovery Steps

- Invented and patented by Gitschel - (12) U.S. and (13) PCT Patents (EU Patent #2750812)
- Designed and installed by Stadler - The World Leader for Integrated Waste Sorting and Recovery Systems
- 75% Automated MSW Mechanical Sorting and Recovery System
- Operating in Granada, Spain since 2013
- Actual Organics Recovery: 99%+ recovery of All organics contained in the MSW stream
- Actual Recyclables Recovery: 95%+ recovery of All recyclables contained in the MSW stream
- The world's ONLY highly-automated combination Advanced Material Recovery Facility and High Diversion Organic Waste Processing Facility

NOTE: The Industry Standard MSW Sorting and Recovery Systems have (12) to (20) Mechanical Sorting Steps

STADLER 120mt/hr. : Advanced MRF & High Diversion Organic Waste Processing Facility - Granada, Spain (EcoHub Patented MaxDiverter™ v1.5)



MaxDiverter v2 - (70) Mechanical Recovery Steps

- Designed and patented by Gitschel - (12) U.S. and (13) PCT Patents (EU Patent #2750812)
- Built and Performance Guaranteed by Stadler - The World Leader in Waste and Recycling Integrated Systems - See link: [click here](#)
- 100% Automated Mechanical Sorting and Recovery System
- Performance Guarantee: 95% recovery of All grades of materials contained in the MSW stream at 95% purity for each grade of material
- Plant Uptime Guarantee: 97% with Scheduled Maintenance
- The world's ONLY fully automated combination Advanced Material Recovery Facility and High Diversion Organic Waste Processing Facility

NOTE: The Industry Standard MSW Sorting and Recovery Systems have (12) to (20) Mechanical Sorting Steps

STADLER : World's 1st Fully Automated Advanced MRF and High Diversion Organic Waste Processing Facility - Oslo, Norway (EcoHub Patented [MaxDiverter™ v2](#))

STADLER® - high-tech References
ROAF, Oslo, Norway

STADLER®
Engineering at its best

World's first fully automated
household waste sorting plant,
Located in Oslo Norway



STADLER : World's 1st Fully Automated Advanced MRF and High Diversion Organic Waste Processing Facility - Oslo, Norway (EcoHub Patented MaxDiverter™ v2)



Paper & OCC to Pulp-Paper-Fiberboard Products Manufacturing:

27.8% of EcoHub Output + 1,750 TPD of RP

- EcoHub utilizes the best paper mill equipment in the world: [Voith](#)



Paper & OCC to Pulp-Paper-Fiberboard Products Manufacturing: 27.8% of EcoHub Output

- EcoHub utilizes the most advanced wastepaper to fiberboard manufacturer in the world:
Humankind



Plastics to Clean Flake, Pellets and Products Manufacturing:

12.9% of EcoHub Output

- EcoHub utilizes the best plastics recycling-cleaning-finished flake & pellets-products manufacturing equipment in the world: [KRONES](#)

-



[KRONES Supplied Plant - Japan](#)



Food-Green-Animal Waste to Renewable Energy and Food:

19.2% of EcoHub Output

- EcoHub utilizes the most advanced anaerobic digestion and organic food farming technology in the world: [ecoponex](#)



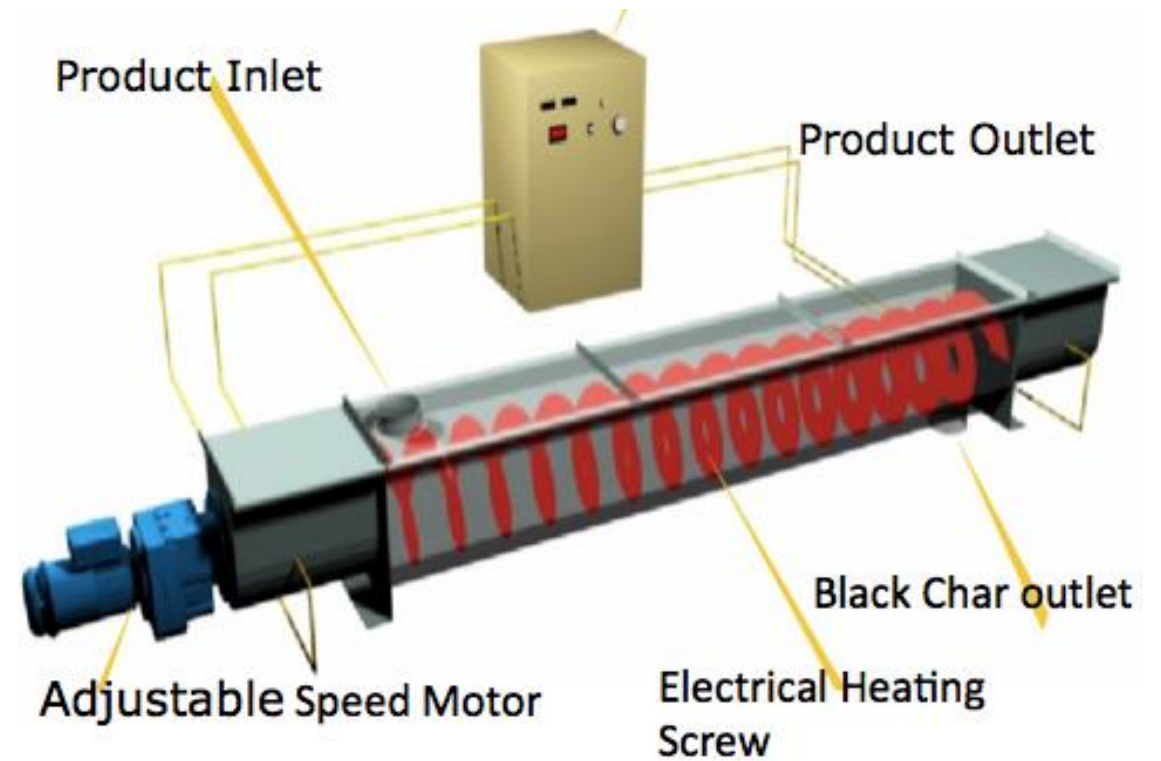
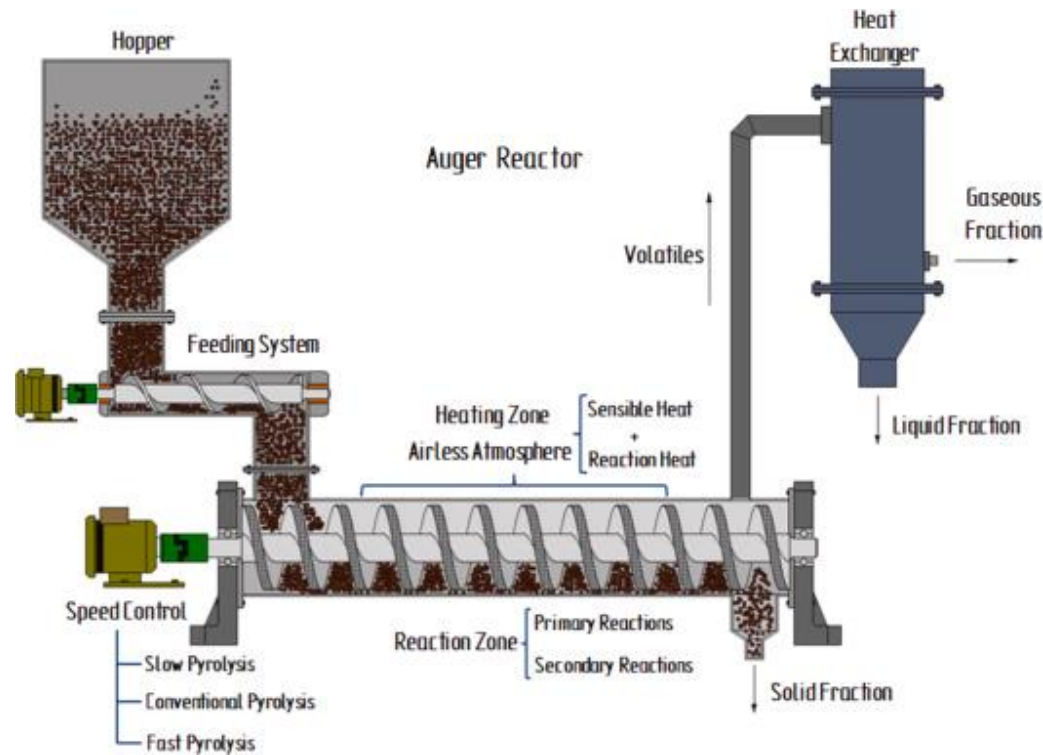
- Renewable Energy Efficient Farm Technology - REEF™
- Converts all recovered organics from MSW into RNG, renewable energy, fertilizer, purified water that is utilized to farm fish and organic produce in an indoor facility
- Net-zero/net-positive operation for food, energy, water, waste, nutrients, carbon



Wood to Renewable Energy and BioChar Soil Amendment:

8% of EcoHub Output

- EcoHub utilizes the best pyrolysis technology in the world: Biogreen



Textiles & Carpet to Renewable Energy & BioChar: 5.7% of EcoHub output

- EcoHub utilizes the best pyrolysis technology in the world: Biogreen



Mattresses and Furniture to Portable Shredder to Renewable Energy, BioChar Soil Amendment and Metal Sales:

3.5% of EcoHub output

- EcoHub utilizes the best mobile shredder technology in the world: [Metso](#)
- EcoHub utilizes the best pyrolysis technology in the world: Biogreen

- [Metso - Mattresses](#)

- [Metso - Carpet](#)



Diapers to PE/PP pellets, super absorbent material & cellulose:

2.6% of EcoHub Output



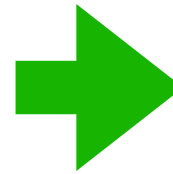
- EcoHub utilizes the best (and only) diaper conversion technology in the world: [FaterSmart](#) and P & G



Glass to Clean Furnace Ready Cullet:

3% of EcoHub Output

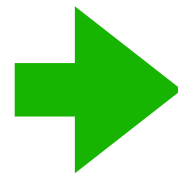
- EcoHub utilizes the best furnace ready cullet technology in the world: [Binder & Co](#)



Glass to Clean Furnace Ready Cullet:

3% of EcoHub Output

- EcoHub utilizes the best furnace ready cullet technology in the world: [Binder & Co](#)

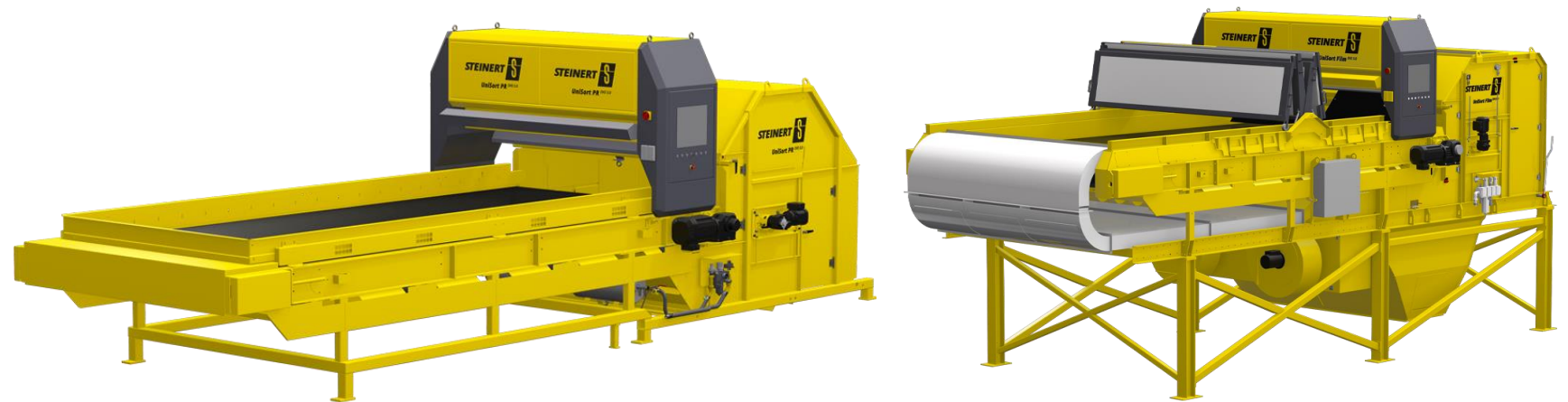


FE (Tin Cans & Mixed NF) & NF (UBCs, Aluminum, Copper, Brass & Stainless Steel) Metals Recovery to Sales:

6.8% of EcoHub Output



- EcoHub utilizes the best FE & NF metal recovery technology in the world: [Steinert](#)



Mixed Inert Materials to Construction Materials or ADC:

3.3% of EcoHub Output

- EcoHub utilizes the best mobile jaw crusher technology in the world: [Metso](#)



Electronic Waste Recovered to Sales or Processing:

0.6% of EcoHub Output

- EcoHub will either process/disassemble/recover (rare earth metals, precious metals, circuit boards, non-ferrous metals, ferrous metals, plastic grades, glass, etc.)/sell or market recovered materials through a co-location partnership with an established eWaste processor; or will package and sell the recovered eWaste to a third-party eWaste processor located in the U.S.
- On site processing versus off-site third-party processing will be a volume and geographic decision
- EcoHub will not export unprocessed eWaste outside of the U.S.



NASA Robots will Recover Household Hazardous Waste for Safe Temporary Storage

1.5% of EcoHub Output



NASA and SIEMENS Automation Systems will Control the MaxDiverter - Providing WCS Reporting in Real Time:

100% of the Output

- EcoHub can provide daily 100% accurate Recycling, Repurposing, and Diversion reporting through its [Automation Systems](#).



Material	Est. %	+ / -	Est. Tons	Material	Est. %	+ / -	Est. Tons
Paper	27.8%	2.3%	68,105	Glass	3.0%	0.5%	7,353
Clean newspaper	0.8%	0.2%	1,842	Clean recyclable glass - CRV	0.9%	0.3%	2,304
Clean cardboard	8.2%	1.9%	20,052	Clean recyclable glass - Non-CRV	1.5%	0.3%	3,702
Clean mixed paper	6.1%	1.0%	14,855	Contaminated recyclable glass	0.1%	0.0%	199
Contaminated recyclable paper	6.5%	0.9%	15,984	Remainder/composite glass	0.5%	0.3%	1,147
Compostable paper	3.5%	0.6%	8,653	Construction & Demolition	11.3%	2.3%	27,764
Remainder/composite paper	2.7%	0.5%	6,719	Concrete	0.6%	0.5%	1,355
Plastic	12.9%	1.4%	31,584	Asphalt shingles	0.1%	0.1%	277
Clean #1 plastic - CRV	0.5%	0.1%	1,105	Other asphalt	0.0%	0.0%	0
Clean #1 plastic - Non-CRV	0.4%	0.1%	1,093	Bricks and other aggregates	0.9%	0.6%	2,260
Clean #2 Natural plastic - CRV	0.0%	0.0%	52	Clean dimensional lumber	1.6%	0.9%	3,896
Clean #2 Natural plastic - Non-CRV	0.3%	0.1%	798	Clean engineered wood	0.5%	0.2%	1,213
Clean #2 Colored plastic - CRV	0.0%	0.0%	18	Painted, stained, treated wood	2.1%	1.0%	5,181
Clean #2 Colored plastic - Non-CRV	0.5%	0.2%	1,320	Wood shingles	0.0%	0.0%	0
Clean #5 plastic	0.4%	0.1%	1,052	Other wood	3.8%	1.7%	9,447
Clean #3, 4, 6, and 7 plastic	0.1%	0.0%	343	Clean gypsum	0.0%	0.0%	21
Clean recyclable film plastic	1.3%	0.5%	3,265	Painted gypsum	0.0%	0.0%	111
Contaminated recyclable plastic	0.7%	0.1%	1,827	Rock, soil, and fines	0.4%	0.3%	909
Other film	3.5%	0.5%	8,496	Remainder/composite construction debris	1.3%	0.6%	3,092
Polystyrene	0.6%	0.2%	1,511	Other Materials	19.0%	2.6%	46,593
Bulky durable plastics	1.9%	0.9%	4,578	Carpet	0.6%	0.6%	1,396
Semi-rigid plastic piping	0.0%	0.0%	80	Carpet padding	0.1%	0.1%	363
Remainder/composite plastic	2.5%	0.5%	6,046	Textiles	5.0%	1.2%	12,350
Metal	6.8%	1.3%	16,808	Diapers	2.6%	0.7%	6,329
Clean aluminum cans - CRV	0.2%	0.0%	454	Tanglers	1.0%	0.5%	2,340
Clean aluminum cans - Non-CRV	0.0%	0.0%	3	Electronics	0.6%	0.2%	1,380
Clean other aluminum	0.4%	0.1%	861	Motor oil	0.0%	0.0%	0
Clean other non-ferrous recyclable metal scrap	0.1%	0.1%	223	Oil filters	0.0%	0.0%	45
Clean tin cans	0.5%	0.1%	1,152	Paint	0.0%	0.0%	75
Clean ferrous metal	2.7%	0.8%	6,737	Other household hazardous waste	1.5%	1.4%	3,801
Contaminated recyclable metal	0.2%	0.1%	462	Tires	0.0%	0.0%	0
Remainder/composite metal	2.8%	0.9%	6,916	Mattresses	1.9%	1.2%	4,577
Organics	19.2%	2.3%	47,214	Furniture	1.6%	1.0%	4,023
Food waste	11.8%	1.6%	28,881	Mixed residue	4.0%	1.0%	9,914
Yard waste	4.2%	1.6%	10,311				
Animal waste	2.7%	0.8%	6,566				
Non-recoverable organics	0.6%	0.1%	1,456				
				Recyclable	26.1%	2.3%	64,045
				Compostable	19.5%	2.3%	47,845
				Recoverable C&D	7.5%	2.2%	18,470
				Potentially Recoverable	10.6%	2.3%	26,053
				Non-Recoverable	36.3%	2.7%	89,007
Sample Count			120	Totals	100.0%		245,420

EcoHub Demonstrates 95% Recovery, Repurposing and Diverting of the Inbound MSW Stream

- That leaves just 5% of “mixed residue” which is unclassified - We will also divert that material.

Material	Est. %	+ / -	Est. Tons	Material	Est. %	+ / -	Est. Tons
Paper	27.8%	2.3%	68,105	Glass	3.0%	0.5%	7,353
Clean newspaper	0.8%	0.2%	1,842	Clean recyclable glass - CRV	0.9%	0.3%	2,304
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Sample Count			120	Totals	100.0%		245,420

EcoHub's NASA Licensed Technologies

Discover Technologies for your Business

NASA Patent Portfolio



Patent Portfolio

NASA SOFTWARE



Software Catalog

2020 spinoff



Success Stories

Explore Additional Resources



T2 Analytics



New Technology Reporting



T2 University



How to License



Remote Sensing Toolkit



Inventions and Contributions Board



Inventors Hall of Fame



NASA TECHNOLOGY
TRANSFER PROGRAM

BRINGING NASA TECHNOLOGY DOWN TO EARTH



EcoHub's NASA Licensed Technologies

AI Sorting Robots : R2 (Robonaut-2)

VISION: Infrared cameras for depth perception and 4 visible light cameras to provide stereo vision

NECK: 3 degrees of freedom

HANDS: 12 degrees of freedom
4 in the thumb and 3 each in the index and middle fingers

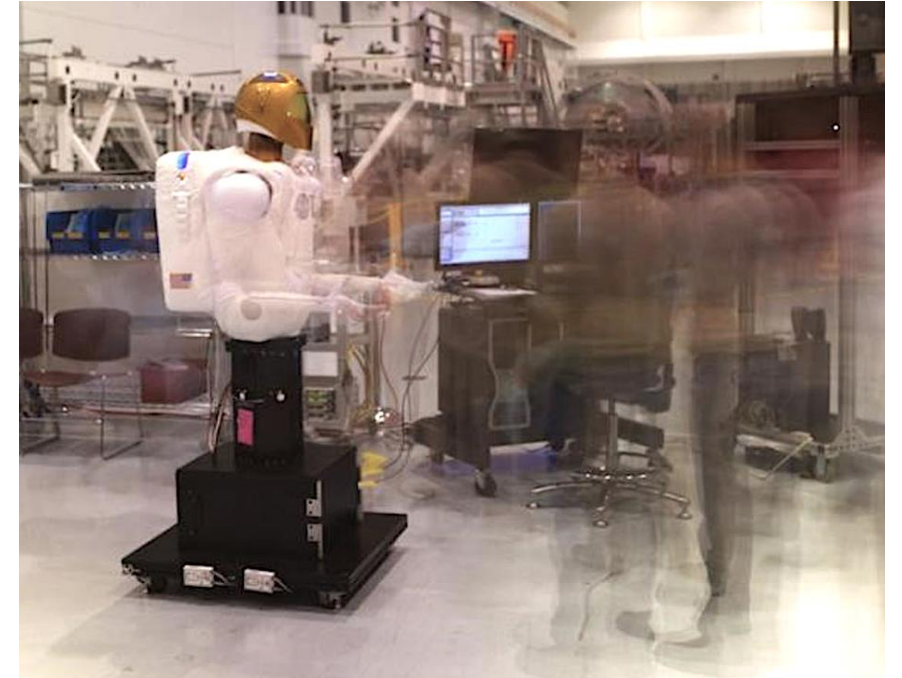
ARMS: 7 degrees of freedom and approximately 2'8" long

TORSO: R2's brain



FINGERS: 5 pounds grasping force/finger. A minimum of 20 lbs. across the hand.

R2 SYSTEM: 50 actuators, 350 sensors, and 42 independent degrees-of-freedom

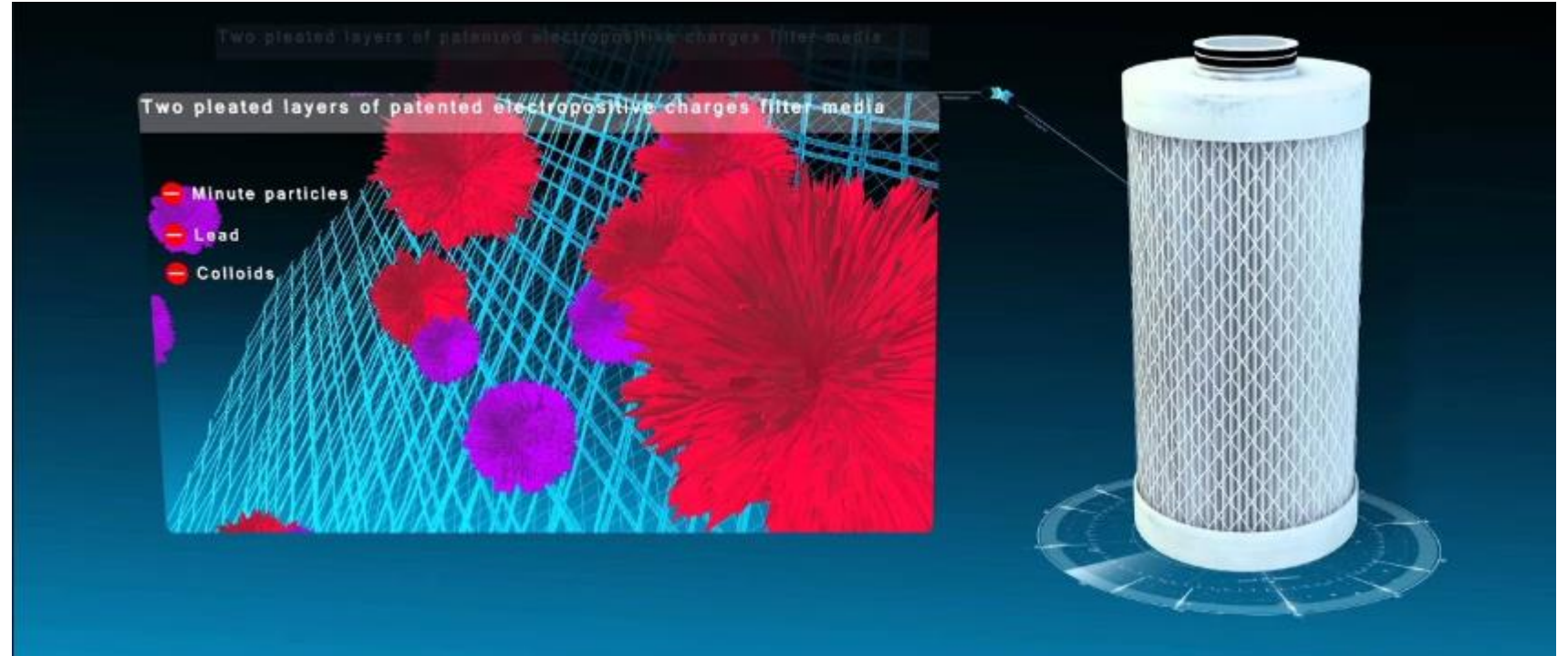
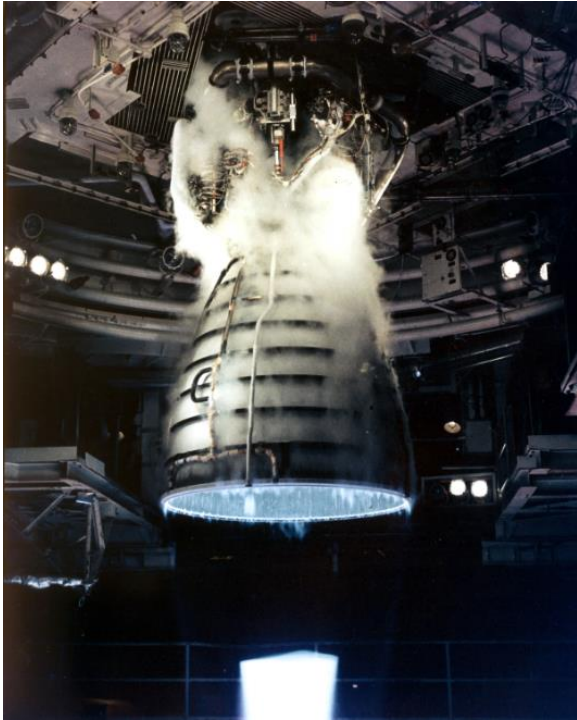


NASA TECHNOLOGY
TRANSFER PROGRAM

BRINGING NASA TECHNOLOGY DOWN TO EARTH



EcoHub's NASA Licensed Technologies EcoPure™ Water Purification System: Aerospace Technology for Clean Water Process



NASA TECHNOLOGY
TRANSFER PROGRAM

BRINGING NASA TECHNOLOGY DOWN TO EARTH



EcoHub's NASA Licensed Technologies

Wind Tunnel Technology for Air Handling and Odor Negation



NASA TECHNOLOGY
TRANSFER PROGRAM

BRINGING NASA TECHNOLOGY DOWN TO EARTH



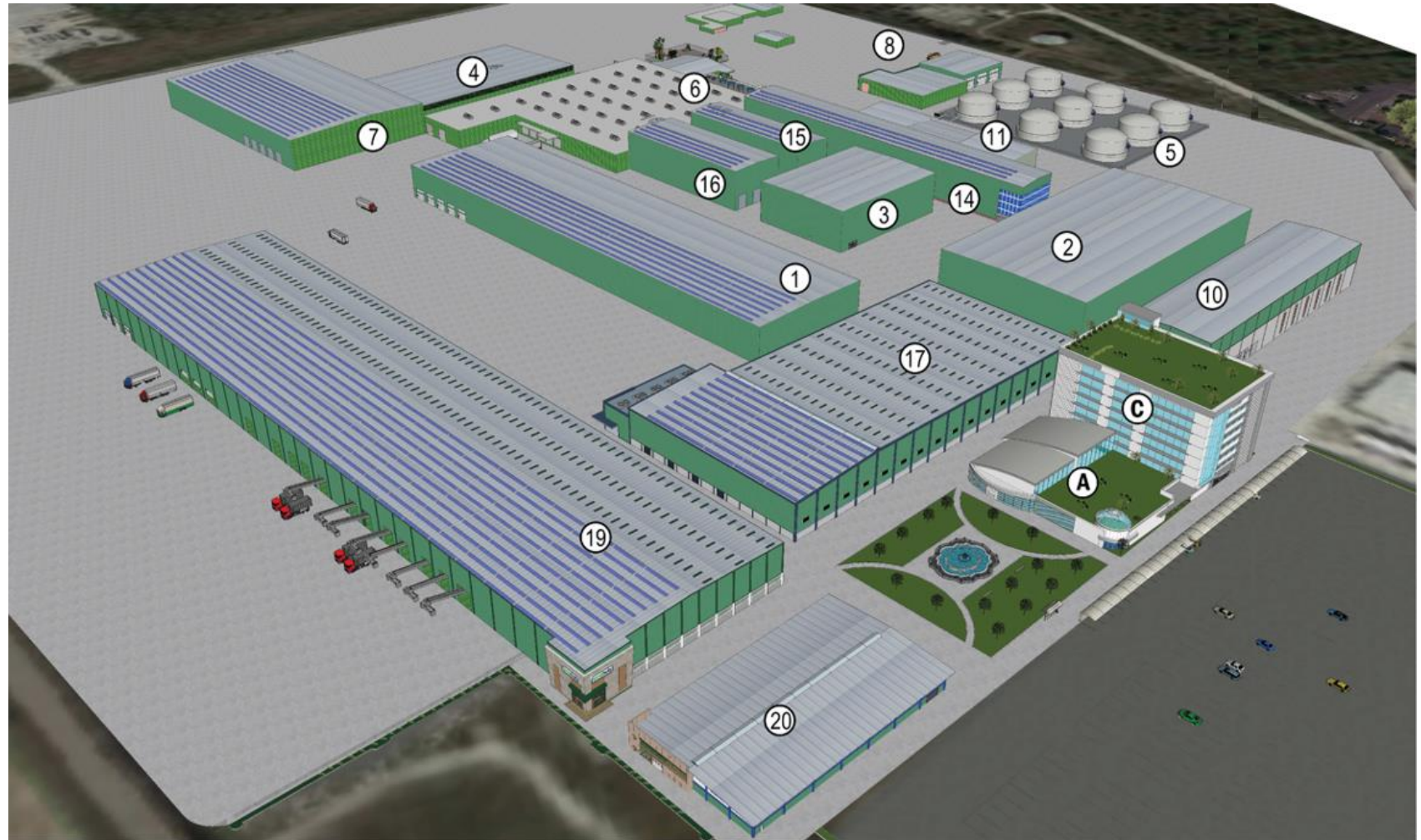
EcoHub - Anticipated Permitting Ease

- EcoHub will utilize and incorporate its NASA derived EcoPure™ Water Purification technology to purify ALL of the industrial wastewater produced from each manufacturing and conversion technology - There will be wastewater discharges from the complex
- All water utilized in the manufacturing processes will be purified to potable water standards and recirculated back through each system
- All water utilized and generated in the anaerobic digestion process will be purified to potable water standards and be used in the Ecoponex farm, with excess being sold for irrigation
- EcoHub will utilize and incorporate its NASA derived EcoPure™ Water Purification and EcoWind™ Wind Tunnel air filtration to negate odor and dust from escaping the MaxDiverter and manufacturing buildings - There will be NO offensive odor emissions
- EcoHub will have no problematic air emissions from ANY of its manufacturing technologies



EcoHub: Concept Level Site Layout

EcoHub Complex Concept



1	Victa Sort	122,000 SF	175' x 706'	6	RNG Generation	10,000 SF	100' x 100'	14	Linerboard Building	41,420 SF	76' x 546'	A	Administrative
2	500 TPD	84,000 SF	210' x 400'	7	Shipping Warehouse	100,000 SF	240' x 415'	15	Wet Crepe Building	14,950 SF	65' x 230'	C	Conference Center
3	Eco Fibre 200 TPD	60,000 SF	150' x 200'	8	Maintenance Part	11,500 SF	100' x 115'	16	TAD Building	20,412 SF	81' x 252'		
4	Tissue Converting	60,000 SF	190' x 316'	10	Laminate Flooring	40,000 SF	100' x 400'	17	Cover Waste Bale storage	100,000 SF	240' x 415'		
5	Anaerobic Digestion			11	Kool Units	13,500 SF	15' x 45'	19	MaxDiverter	212,000 SF	225' x 940'		

EcoHub's Center of Excellence -

Building Tomorrow's Skills Today Sustainability & Economic Development for a Smarter Planet



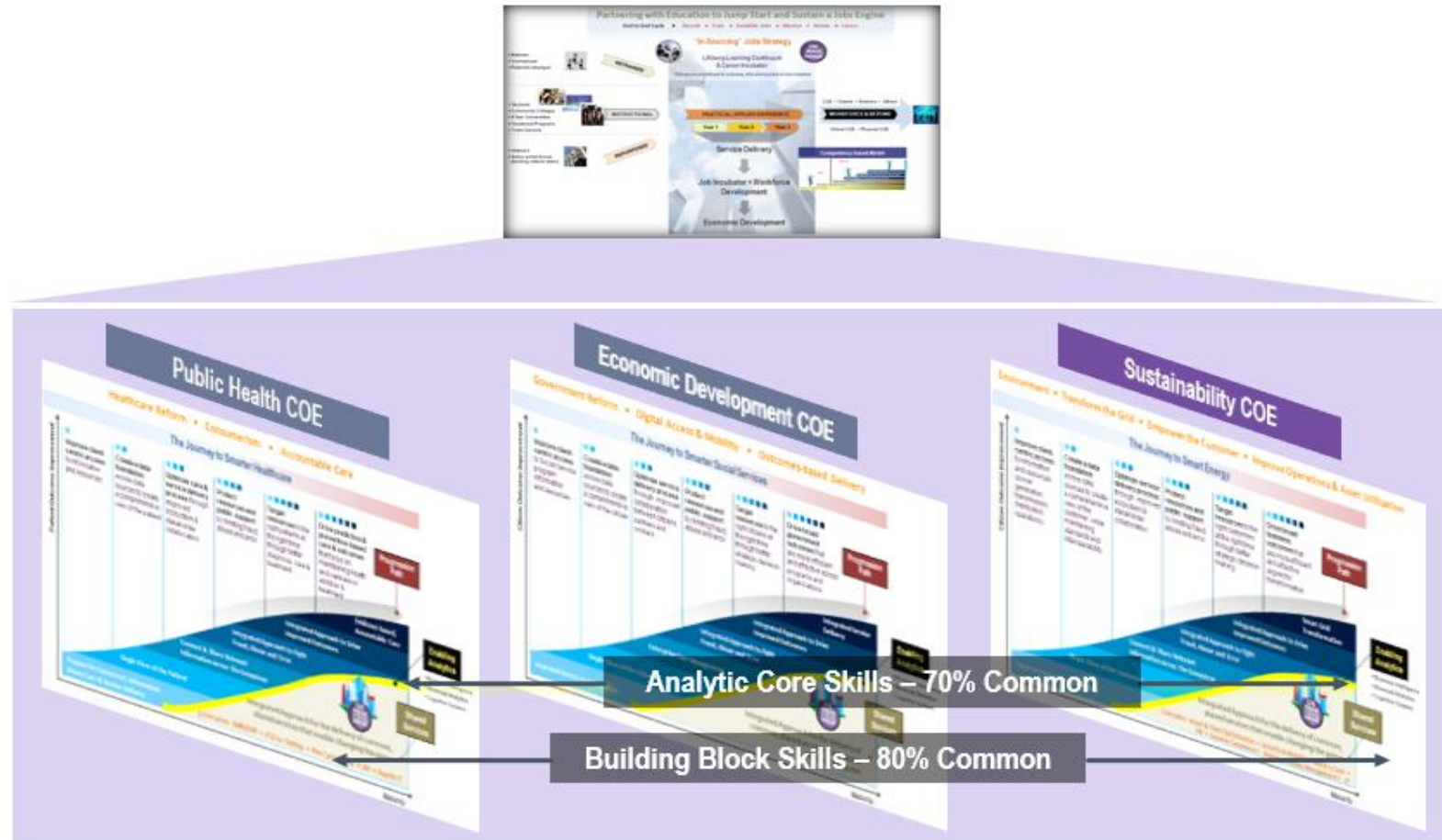
Economic Development and Growing Jobs with Education at the Core

Partnering with Education to Jump Start and Sustain a Jobs Engine

End to End Cycle ▶ Recruit • Train • Establish Jobs • Mentor • Retain • Career



From an Employment and Economic Perspective: Building Block Capabilities Enable Living Wage, Competency-Based, Career Paths and Sustainable Workforce Talent



Ecosystem Approach - Columbus 2020...

Driving Local Economic Development with an Advanced Analytics Center in Columbus, OH since 2012



EcoHub's Ultimate Technology and Project

Guarantee: The MaxDiverter and EcoHub EMC have a FULL EPC Wrap from the \$40B [Grupo ACS](#)

- Project Cost: ACS will guarantee to total capital cost of the entire project to the project investors and lending institutions
- Project Schedule: ACS will guarantee the project construction schedule and completion date to the project investors and lending institutions
- Project Equipment and Technology Performance: ACS will guarantee the project equipment and technology performance to the project investors and lending institutions

THIS DEFINES A FULL “ENGINEERING-PROCUREMENT-CONSTRUCTION (EPC)” WRAP. ACS WILL PROVIDE ALL ENGINEERING, PROCUREMENT, CONSTRUCTION AND PERFORMANCE GUARANTEE SERVICES FOR THE ECOHUB PROJECT.

This is the same type of mechanism that is utilized to construct major infrastructure projects like power plants, oil refineries, industrial plants, ports, electrical grids, manufacturing plants, highway construction, waste water treatment plants, etc. EPC Wraps are unprecedented in the waste and recycling industries.

EcoHub Technology and Project Guarantees -

Required for Project Financing the MaxDiverter & EcoHub have 4 Levels of Performance Guarantees:

- Equipment Level: Manufacturers of equipment installed in the MaxDiverter and EcoHub all bond and guarantee performance and reliability.
- Front- end System Level: Stadler, the world's largest and most experienced waste system integrator, guarantees and bonds MaxDiverter performance.
- Back-end System Level: All respective manufacturing technology providers will provide full performance guarantees for their systems to ACS
- Campus Level: Our General Contractor, \$40 b/yr. [Grupo ACS](#), will provide a full EPC wrap (performance guarantee) on all of the front-end and back-end equipment and systems, as well as the entire project.

EcoHub Performance Guarantees: EcoHub will Provide

(4) Levels of Performance Guarantees

- **Equipment Level**: Manufacturers of equipment installed in the MaxDiverter and EcoHub all bond and guarantee performance and reliability.
- **Front- end System Level**: Stadler, the world's largest and most experienced waste system integrator, guarantees and bonds MaxDiverter performance.
- **Back-end System Level**: All respective manufacturing technology providers will provide full performance guarantees for their systems to ACS
- **Campus Level**: Our General Contractor, \$40 b/yr. [Grupo ACS](#), will provide a full EPC wrap (performance guarantee) on all of the front-end and back-end equipment and systems, as well as the entire project.

CellMark Will Purchase EcoHub's Production Output: On 15-Day Terms over a 20-Year Term

- CellMark is a world leading broker for recyclable products and commodities
- CellMark will purchase the following goods from EcoHub: mixed ferrous metal, tin cans, aluminum cans, mixed non-ferrous metals, copper, brass, stainless steel, glass cullet, e-flute (boxboard), pulp and paper products, fiberboard, MDF, excess fiber grade not used in paper manufacturing, biochar, cellulose, super absorbant materials, eWaste, all plastic grades (#1-#7) in finished clean pellets, flake or briquettes
- This off-take agreement with CellMark is the key driver used by EcoHub to secure debt and equity project financing from Morgan Stanley or other financial institutions and strategic investors and off-takers
- CellMark will also work to secure and broker off-take purchase contracts with several MAJOR consumer products companies that are also talking to EcoHub about strategic partnerships

Other critical EcoHub Strategic Partners

- [IBM:](#) May supply specific licensed conversion technologies, project IT, data management, control systems, measurement, instrumentation, analytics and project marketing services
- [Morgan Stanley:](#) EcoHub has enjoyed an outstanding relationship with Morgan Stanley since 2013. They are one of several financial institutions that we may utilize to assist EcoHub in being the lead arranger in securing financing

Additional Backend “Value Added” Technologies: Optional License & Off-Take Agreements

- PET chemical conversion to 3 original chemical elements - provided by a major company
- Textiles chemical conversion and separation to original fiber elements - provided by a major company
- PP and HDPE chemical conversion to pure “virgin like” resin pellets - provided by a major chemical company
- Film plastic to “virgin like” resin pellets - provided by a major chemical company and a major environmental company



IP Platform

EcoHub Patent Portfolio

- EcoHub is protected by 26 U.S. and PCT international patents, covering over 550 claims with multiple additional patents at various stages of review (in office action)
- EcoHub's patents have successfully completed 60 office actions and represent the benchmark for “art” in the field
- Our patent portfolio covers every possible way/method to mechanically separate and recover materials from MSW utilizing technologies integrated into Advanced Material Recovery Facilities (50% or greater recyclable material recovery/diversion) and/or **High Diversion Organic Waste Processing Facilities** (75% or greater organics recovery/diversion) for MSW
- Our patent portfolio also covers every possible way/method to integrate and operate 2 or more manufacturing or conversion technologies on the backend of an Advanced Material Recovery Facility and/or High Diversion Organic Waste Processing Facility to manufacture recovered materials into products or to convert recovered materials into renewable energy or fuel
- EcoHub's comprehensive IP portfolio PROTECTS the WPWMA from patent infringement liability

Gitschel/EcoHub U.S. Issued Patents

US PATENT No.	DATE	DESCRIPTION
3 Series Patents - Process Patent Series - Wet and dry organics separated from inorganic materials to produce wet and dry organic fuel feedstocks and recover metals and glass from the inorganic materials		
US 8,393,558 B2	3/12/2013	MECHANIZED SEPARATION AND RECOVERY SYSTEM FOR SOLID WASTE
US 9,061,289 B2	6/23/2015	MECHANIZED SEPARATION AND RECOVERY SYSTEM FOR SOLID WASTE
7 Series Patents - Process Patent Series - Advanced sorting of every material in the MSW stream into up to 40 individual elemental streams - with Shredding or Screening up front		
US 8,398,006 B2	3/19/2013	MECHANIZED SEPARATION OF MIXED SOLID WASTE AND RECOVERY OF RECYCLABLE PRODUCTS
US 8,322,639 B2	12/4/2012	MECHANIZED SEPARATION OF MIXED SOLID WASTE AND RECOVERY OF RECYCLABLE PRODUCTS
US 8,684,288 B2	4/1/2014	MECHANIZED SEPARATION OF MIXED SOLID WASTE AND RECOVERY OF RECYCLABLE PRODUCTS
US 9,884,324	2/6/2018	ADVANCED SOLID WASTE SORTING SYSTEMS AND METHODS
US 9,649,666 B2	5/16/2017	MECHANIZED SEPARATION OF MIXED SOLID WASTE & RECOVERY OF RECYCLABLE PRODUCTS USING OPTICAL SORTER
8 Series Patents - Process Patent Series - Commercial Waste Sorting Systems		
US 9,713,812 B1	7/25/2017	METHODS AND SYSTEMS FOR SEPARATING AND RECOVERING RECYCLABLES USING A COMMINATION DEVICE
10 Series Patents - Machine and Process Patent - Shredder producing a 3 - stream output		
US 9,700,896 B1	7/11/2017	SYSTEMS AND METHODS FOR PROCESSING MIXED SOLID WASTE
2 Series Patents - Process Patent Series - Mixed waste sorting, with 2 or more backend manufacturing or conversion technologies		
US 8,632,024 B2	1/21/2014	SYSTEMS AND METHODS FOR PROCESSING MIXED SOLID WASTE
US 9,650,650 B2	5/16/2017	SYSTEMS AND METHODS FOR PROCESSING MIXED SOLID WASTE
US 10,688,544 B2	6/23/2020	SYSTEMS AND METHODS FOR PROCESSING MIXED SOLID WASTE

Gitschel/EcoHub PCT International Issued Patents

PCT - Country	Number of Issued & (Pending) Patents	Series and Patent Numbers
European Union – including Spain, Norway, UK, Germany, France	2 (1)	Series 2 and 7: Patent Numbers: 11871462.5 and 2750812 + Series 3 (pending): 11843499.2
Mexico	2	Series 2 and 7: Patent Numbers: 341670 and 355900
Canada	1 (2)	Series 2: Patent Number: 2,847,289 + Series 7 & Series 3 (pending): 2,818,920 & 2,818,937
Japan	2	Series 2 and 7: Patent Numbers: 6001550 and 6023070
China	3	Series 2, 3 and 7: Patent Numbers: CN 103476515 B, CN 103476516 B and CN 104023863 B
Hong Kong	1	Series 7: Patent Number: HK 1201491
Macau	1	Series 7: Patent Number: J/002774
India	1 (2)	Series 3: Patent Number: 311151 + Series 2 and 7 (pending): 4551/2013 & 2396/2014
Brazil	1 (1)	Series 3: Patent Number: BR112013012860-7 + Series 7 (pending): BR1120130128607



Proven Technology Utilization

“Where Has It Been Done Before?” - Backend Manufacturing & Conversion Technologies

- All resource feedstock that will be recovered by EcoHub from MSW is currently being made into new products or converted into energy or fuels with the exact same technologies that EcoHub will deploy. It's what happens to recyclables.
- The “new” idea from EcoHub is to site all of the manufacturing and conversion technologies on the same campus as the MRF, creating a “closed loop” system, rather than ship recovered resource feedstock off to 3rd party processors.
- **Paper-Boxboard Mills:** Over 500 mills operating for decades in the U.S. producing over 100,000,000 tons per year of products
- **Plastic Processing - Size Reduction-Washing-Flake Sorting-Pelletizing:** There are 1,000s of such plants operating for decades in the U.S. and abroad
- **Anaerobic Digestion of Yard Waste and Food Waste:** There are 100's of commercial anaerobic digester operations across the U.S. and the world that have been operating for decades

“Where Has It Been Done Before?” - Backend Manufacturing & Conversion Technologies

- **Pyrolysis to Renewable Energy and Fuels:** Pyrolysis has been used for turning wood into charcoal since ancient times. Pyrolysis technology has been used in the recycling industry for decades to convert biomass, wood, plastics, and rubber into syngas, oil, biochar, renewable fuels and renewable electricity. There are literally 1,000s of pyrolysis plants operating around the world.
- **Production of Furnace Ready Cullet from Recycled Glass Bottles:** This technology has been operating in the U.S. and the world for decades, since the dawn of recycling. The finished furnace ready cullet product is primarily used in the manufacturing of new glass bottles and fiberglass insulation.
- **Metal Recovery and Scrap Metal Markets:** Both have been established for many, many decades (more than 100 years). Metals were really the first recyclable commodity.

“Where Has It Been Done Before?” - Backend Manufacturing & Conversion Technologies

- **eWaste Recovery and Processing:** This form of recycling is relatively new, compared to the other technologies described, as it was established in the early 1990’s, with the advent of the “electronics revolution”. Over the past 25-years eWaste recycling and processing has become a highly established domestic and global industry.
- **Construction Materials Manufacturing/Rock Crushing:** This industry has been firmly established for decades. There are 1,000s of rock crushing operations all over the U.S. and abroad.



Questions and Answers



THANK YOU

October, 2020