



**99th Annual Conference  
October 17-19, 2024**

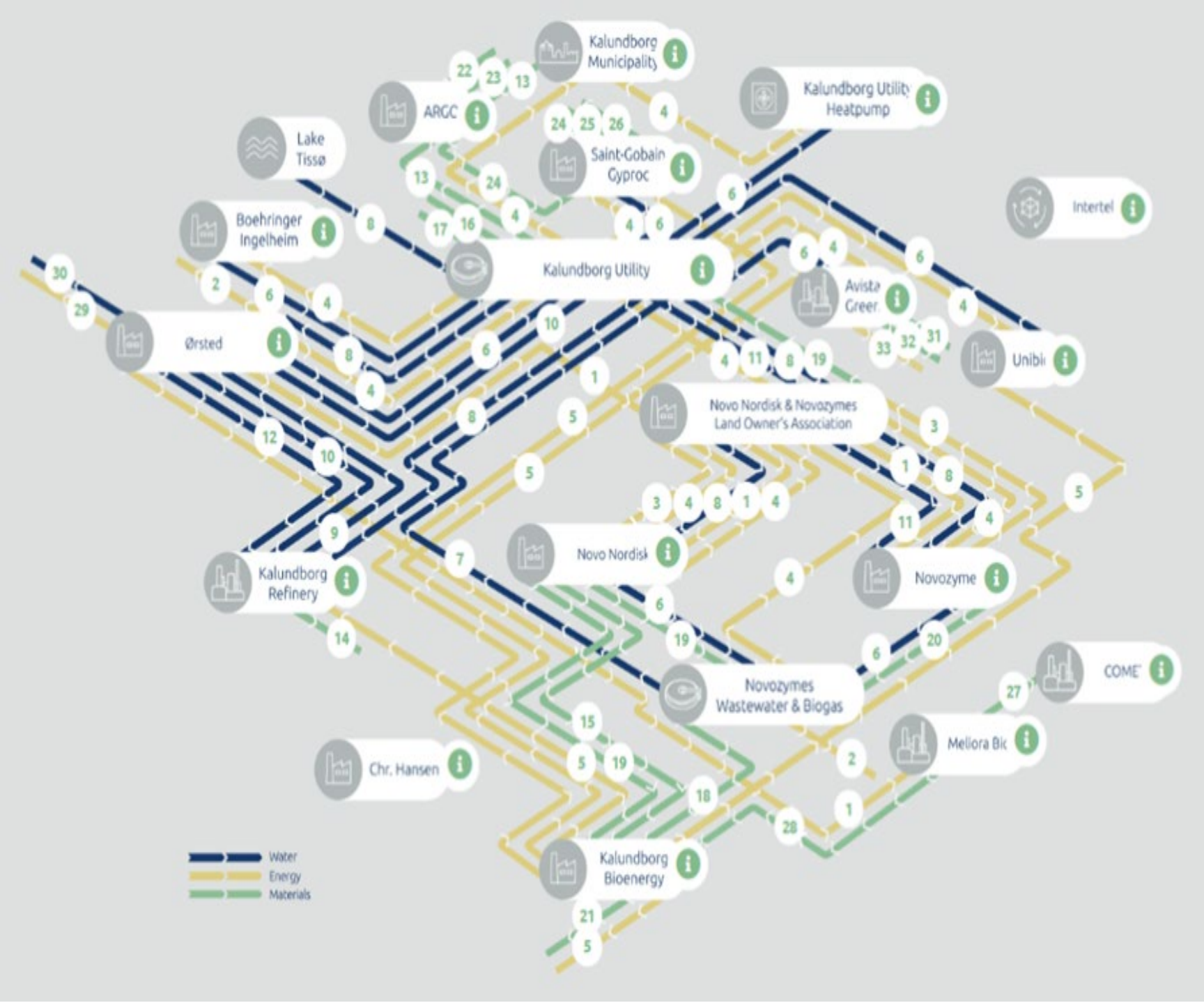
**"Denmark's Industrial Symbiosis  
Model for the U.S."**

**Rhys Roth, Executive Director  
Center for Sustainable Infrastructure**



# Kalundborg Symbiosis

- Thriving after 50 years of creating profits through a circular approach to production.
- Over 30 streams of surplus resources – Energy, Water, Materials -- exchanged between facilities.
- 17 companies, 5000 employees.
- Nearly 600,000 tons CO2 saved annually, and 62,000 tons of material recycled





REP. JENNY GRAHAM



SEN. SHARON BROWN \*



REP. CHRIS CORRY



REP. SKYLER RUDE



REP. BETH DOGLIO



SEN. JOE NGUYEN



SEN. SHARON SHEWMAKE



SEN. CHRISTINE ROLFES \*



SEN. GUY PALUMBO \*



REP. TERRY NEALEY \*



SEN. DREW MACEWEN



REP. GINA MOSBRUCKER



SEN. ANN RIVERS



REP. JACQUELIN MAYCUMBER



REP. DAVINA DUERR



SEN. REUVEN CARLYLE \*



SEN. BOB HASEGAWA



REP. VANDANA SLATTER



REP. NORMA SMITH \*



REP. LYNDA WILSON



SEN. SHELLY SHORT



REP. ALEX YBARRA



SEN. MONA DAS \*



SEN. DAVID FROCKT \*



REP. GAEL TARLETON \*



SEN. LISA WELLMAN



REP. SHARLETT MENA



SEN. MATT BOEHNKE



REP. MARY DYE



REP. STEPHANIE BARNARD



SEN. NIKKI TORRES



REP. KEVIN WATERS



REP. MIKE CHAPMAN



SEN. JUNE ROBINSON



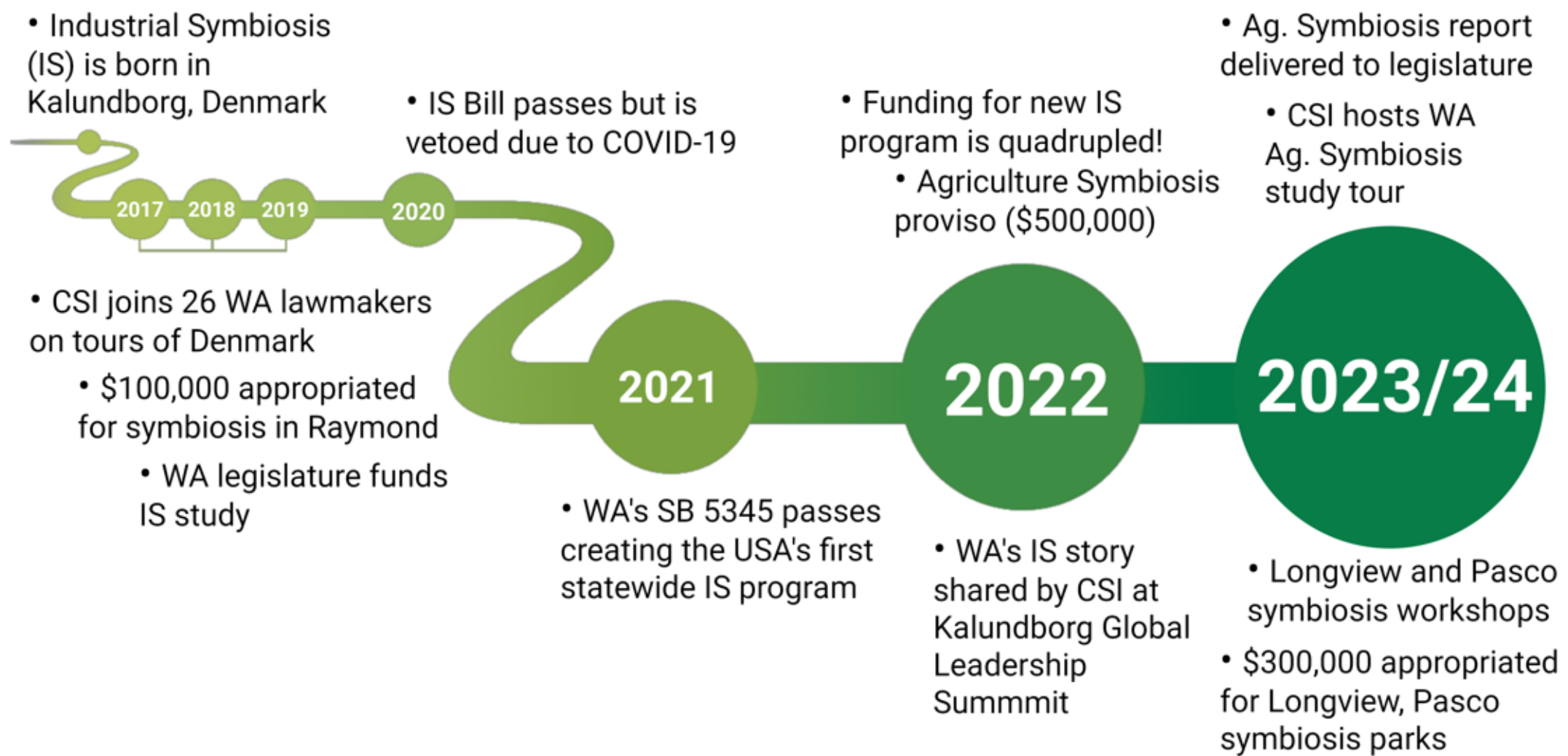
SEN. LIZ LOVELETT



REP. JULIO CORTES

\* = Retired

## Washington's 'Denmark Symbiosis Coalition' of State Legislators



2017

2018

2019

2020

2021

2022

2023/24

# GreenLab Skive, Denmark

- A green and circular industrial park, powered by 100% green energy – 84 MW wind and solar energy
- GreenLab has attracted \$450 million in public and private investment (mostly private)
- Provides six major industrial facilities with carbon-free power, heat, steam, water, instrumental air, and nitrogen



# Billund Biorefinery; Billund, DK

- Public 'wastewater' utility that invests in harnessing local water-organics-energy flows to develop synergies that generate value
- Treats organic wastes from local industry, agriculture, and the municipality
- Produces energy -- both heat for the local district system and electricity
- Produces valuable co-products from waste streams, including clean fertilizers



- **Energy:** Produces 1.7x the energy it consumes
- **Solid Waste:** 98% recovered for beneficial uses
- **Cleaned Water:** 3.8 million m<sup>3</sup>/yr
- **Nutrients:** Produces 4,000 tons/yr of organic fertilizer

# Portland-to-Denmark Clean Industry Delegation: June 2022



- John Wasiutynski, City of Portland
- Shea Flaherty Betin, Prosper Portland
- Joshua Basofin, Climate Solutions
- Benton Strong, Vigor
- Candace Avalos, Verde
- Donnie Oliveira, City of Portland
- Steve Sundquist, CSI
- Alando Simpson, COR
- Quincy Brown, We All Rise
- Corky Collier, Columbia Corridor Asc.
- Don Hunter, Evraz
- Jillian Schoene, City of Portland
- Janet Hammer, City of Portland
- Evan Ramsey, Bonneville Env. Fdn.
- Susheela Jayapal, Multnomah Cty.
- Duncan Hwang, Oregon Metro
- Kellye Dundon, NW Natural
- S. Caflisch, BlueGreen Alliance
- Nina Carlson, NW Natural
- Jeremy Keltner, Novo Nordisk
- Shaylah Jones, Novo Nordisk
- Lisa Smith, WSMA
- Steve Reese, Evraz
- Carmen Rubio, City of Portland

# OR-to-Denmark Industrial Symbiosis Study Tour Delegation

## June 2024



**Lucetta Elmer**  
State Rep. R-24  
McMinnville & Yamhill



**Mark Gamba**  
State Rep. D-41  
Milwaukie & Oak Grove



**Ken Helm**  
State Rep. D-27  
Beaverton & Cedar Hills



**Bobby Levy**  
State Rep. R-58  
Echo & La Grande



**Margaret Magruder**  
County Commissioner  
D – Columbia County



**Kelley Minty**  
County Commissioner  
R - Klamath County



**Courtney Neron**  
State Rep. D-26  
Wilsonville & King City



**James Williams**  
County Commissioner  
R – Lake County



**Corky Collier**  
Columbia Corridor



**Chris Cummings**  
Business Oregon



**Denny Elmer**  
Craftmark Inc.



**Jeff Hampton**  
Business Oregon



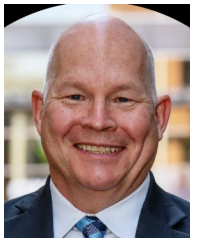
**Laurie Hutchinson**  
Obsidian Renewables



**Ben Jacobsen**  
Jacobsen Salt Co.



**Bill Kent**  
COR



**Jim McCauley**  
League of Oregon Cities



**Matt McGrath**  
Port of Astoria



**Lisa Mittelsdorf**  
Port of Morrow



**Chris Nemlowill**  
Fort George Brewery



**Melanie Olson**  
Business Oregon



**Garson Pliska**  
Public Coast Brewing



**Debbie Radie**  
Boardman Foods



**Debbie Silva**  
Oregon Steel



**Amy Wentworth**  
Pacific Seafood





# Wastewater Symbiosis Study Tour Delegation September 2024



**Terry Alber**  
Idaho DEQ



**Kyle Arrington**  
City of Spokane



**Karen Bill**  
Clean Water Services



**John Bowman**  
Lakehaven Water & Sewer



**Frank Dick**  
City of Vancouver



**Jeff Donovan**  
City of Spokane



**Erik Grimstad**  
City of McMinnville



**Jocelyn Jones**  
WA Dept. of Health



**Dawn Lesley**  
Jacobs



**Adam Martian**  
City of Moscow



**Gary Mathis**  
City of Sheridan



**Vincent McGowan**  
WA Ecology



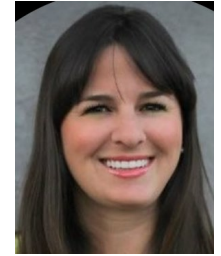
**Layne McWilliams**  
PNCWA



**Ken Miller**  
Lakehaven Water & Sewer



**Matt Noesen**  
Jacobs



**Laura Nolan**  
HDR



**Peter Olsen**  
Keller Associates



**Peter Schauer**  
Clean Water Services



**Emily Scofield**  
N. Santiam Sewer Authority



**Jessica Shaw**  
City of Wenatchee



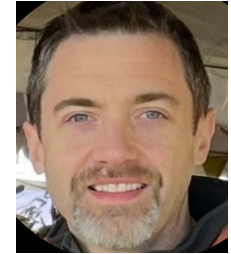
**Rebecca Singer**  
King County



**Edward Tabor**  
Business Oregon



**Hannah Thomascall**  
Spokane County



**Jon Unger**  
Business Oregon



**Jennifer Wigal**  
Oregon DEQ



**Steve Worley**  
City of Vancouver



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**Thank You!**

**More info: [www.centerforsustainableinfrastructure.org](http://www.centerforsustainableinfrastructure.org)**

**Follow CSI on LinkedIn**

**Rhys Roth, Executive Director  
Center for Sustainable Infrastructure**



# Denmark Tour - Partners



# County Commissioners



**Commissioner Magruder**  
Clatsop County



**Commissioner Williams**  
Lake County



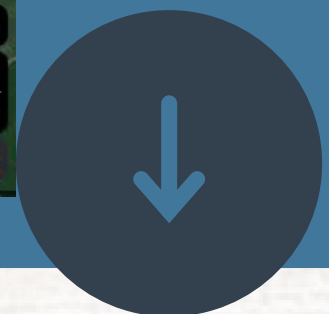
**Commissioner Minty**  
Klamath County



# CITY OF PASCO

**Process Water Reuse Facility  
(PWRF)**

# P W R F Facility Site



# P W R F Site



How can we  
Create  
Industrial  
Symbiosis  
from  
Agricultural  
Waste?



# Gas Upgrade System



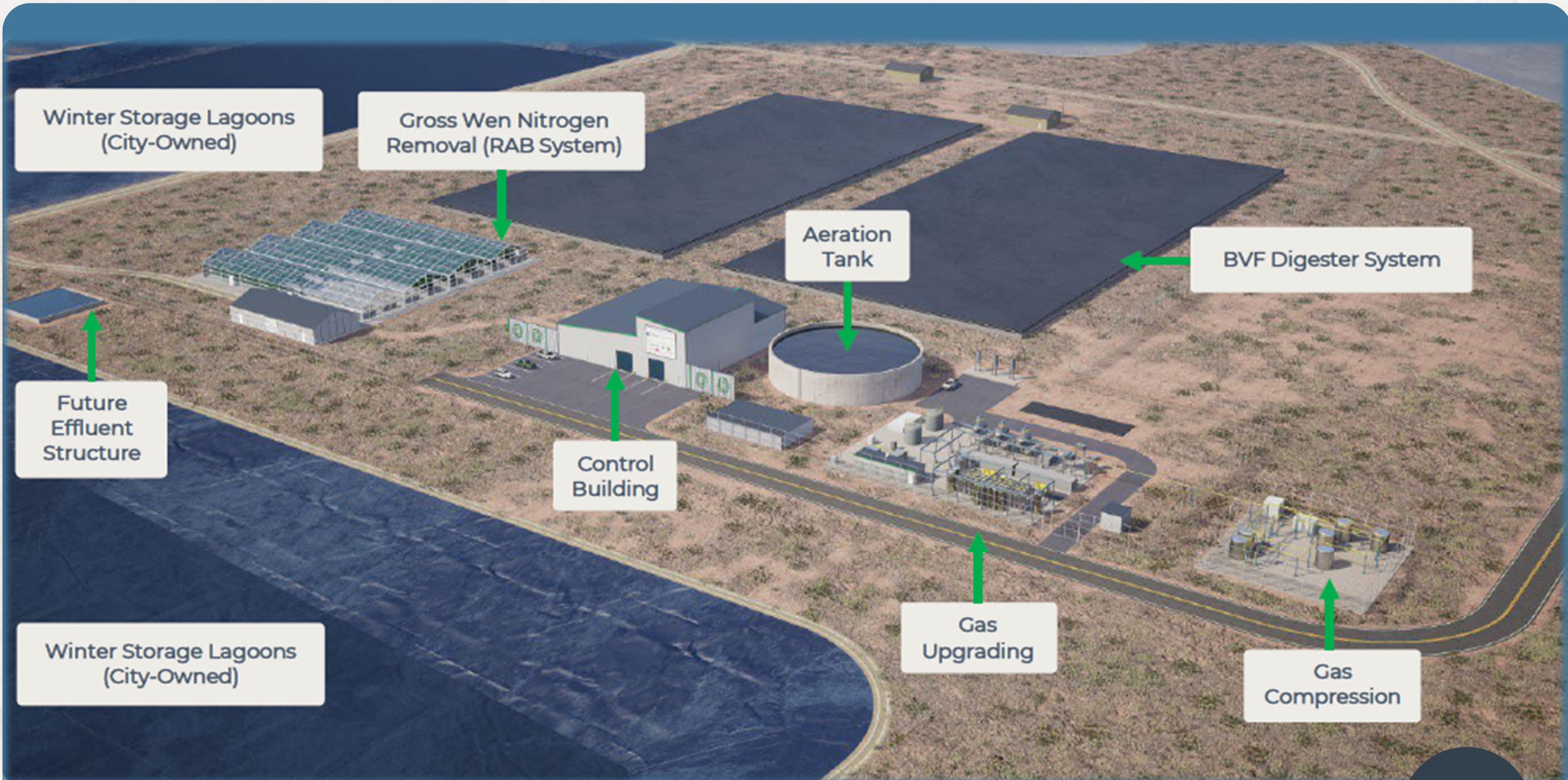
## RNG Production

Methane from Anaerobic Digesters  
Renewable Natural Gas Revenue  
Produces enough RNG to heat  
4,500 homes

**BURNHAM:**  
helping Pasco  
create Bioenergy  
from Agricultural  
Wastewater







Winter Storage Lagoons  
(City-Owned)

Gross Wen Nitrogen  
Removal (RAB System)

Aeration  
Tank

BVF Digester System

Future  
Effluent  
Structure

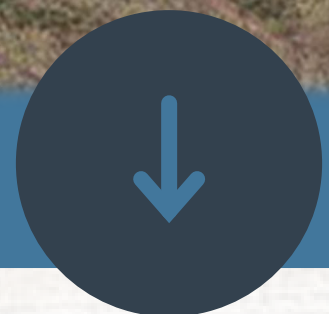
Control  
Building

Winter Storage Lagoons  
(City-Owned)

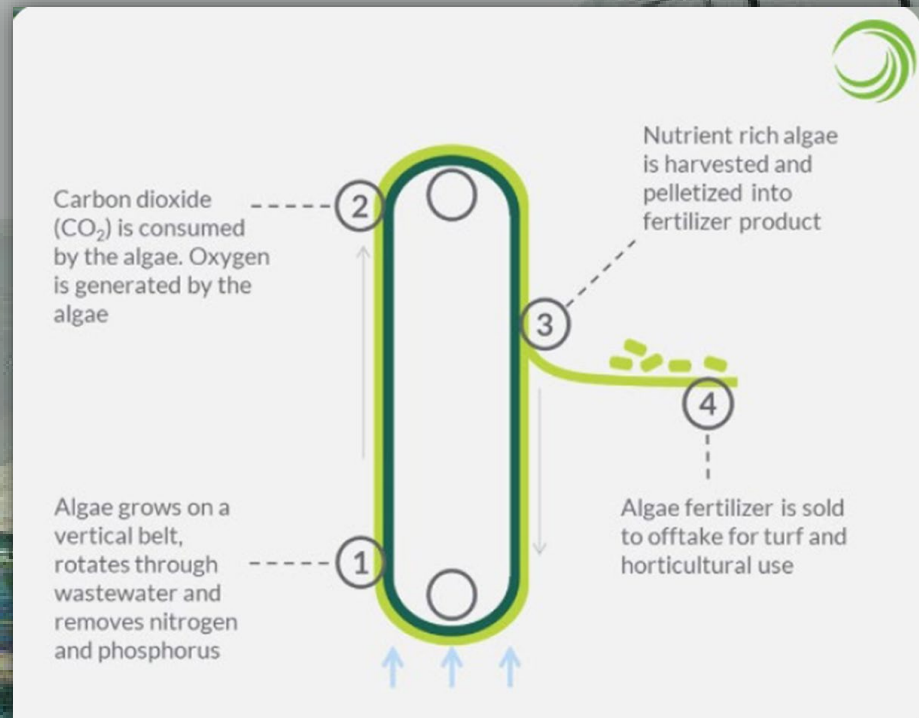
Gas  
Upgrading

Gas  
Compression

# Solution



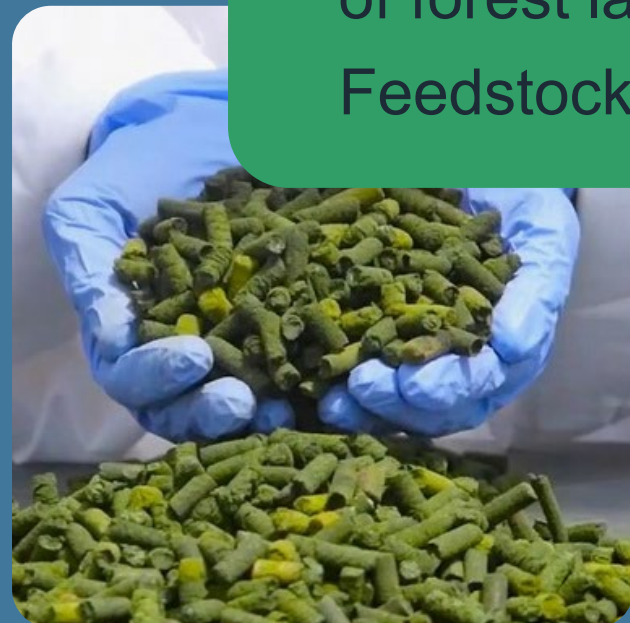
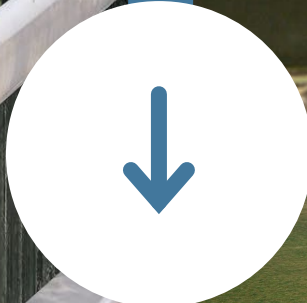
# RAB Nitrogen Removal



- Gross Wen's RAB System is world's #1 algae treatment system with 30+ (commercial & pilot) installations globally
- Reduces operating costs, energy usage and carbon footprint vs traditional nitrogen removal
- Pasco's PWRF will be GWT's largest installation to date

RAB Installation in Pasco, WA

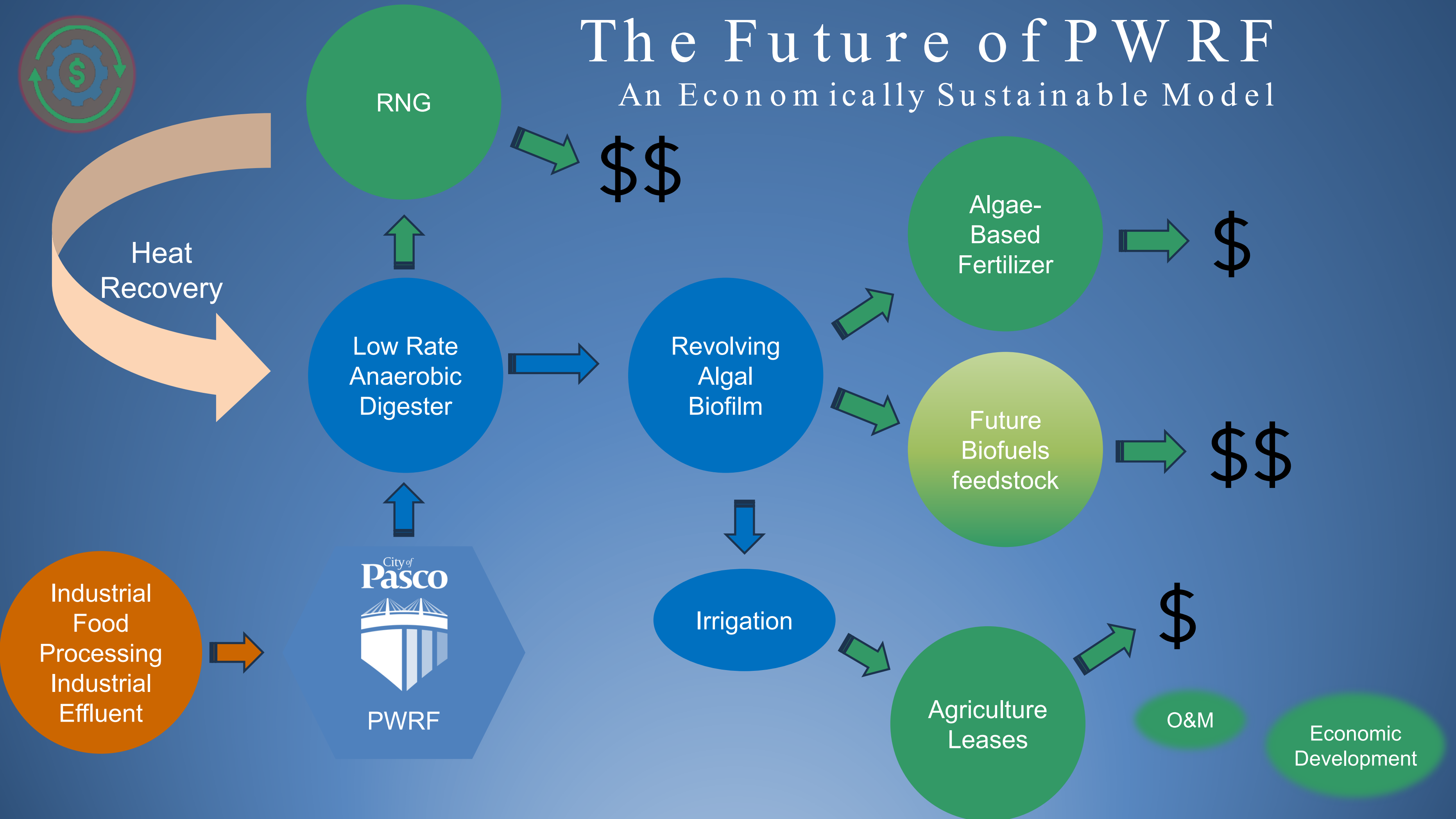
# Algae Nitrogen Removal



**Algae System**  
Reduces Nitrogen  
Cleans Wastewater  
Carbon Capture = 8,000 acres  
of forest land  
Feedstock for future Biofuels

# The Future of PWRF

An Economically Sustainable Model



# Pasco's P W R F Improvements



Governor Jay Inslee visits the Project on May 19, 2023

“The Project is **“taking something that was a problem and turning it into a solution... this treatment of agricultural industrial wastewater can lead the world in how we handle water and turn water from a wasted product into a useful product.** We know we need more clean energy, and this is producing clean energy with clean methane.”

-Washington State Governor Jay Inslee





# Site Progress