THE POWER IN WASTEWATER TREATMENT

By

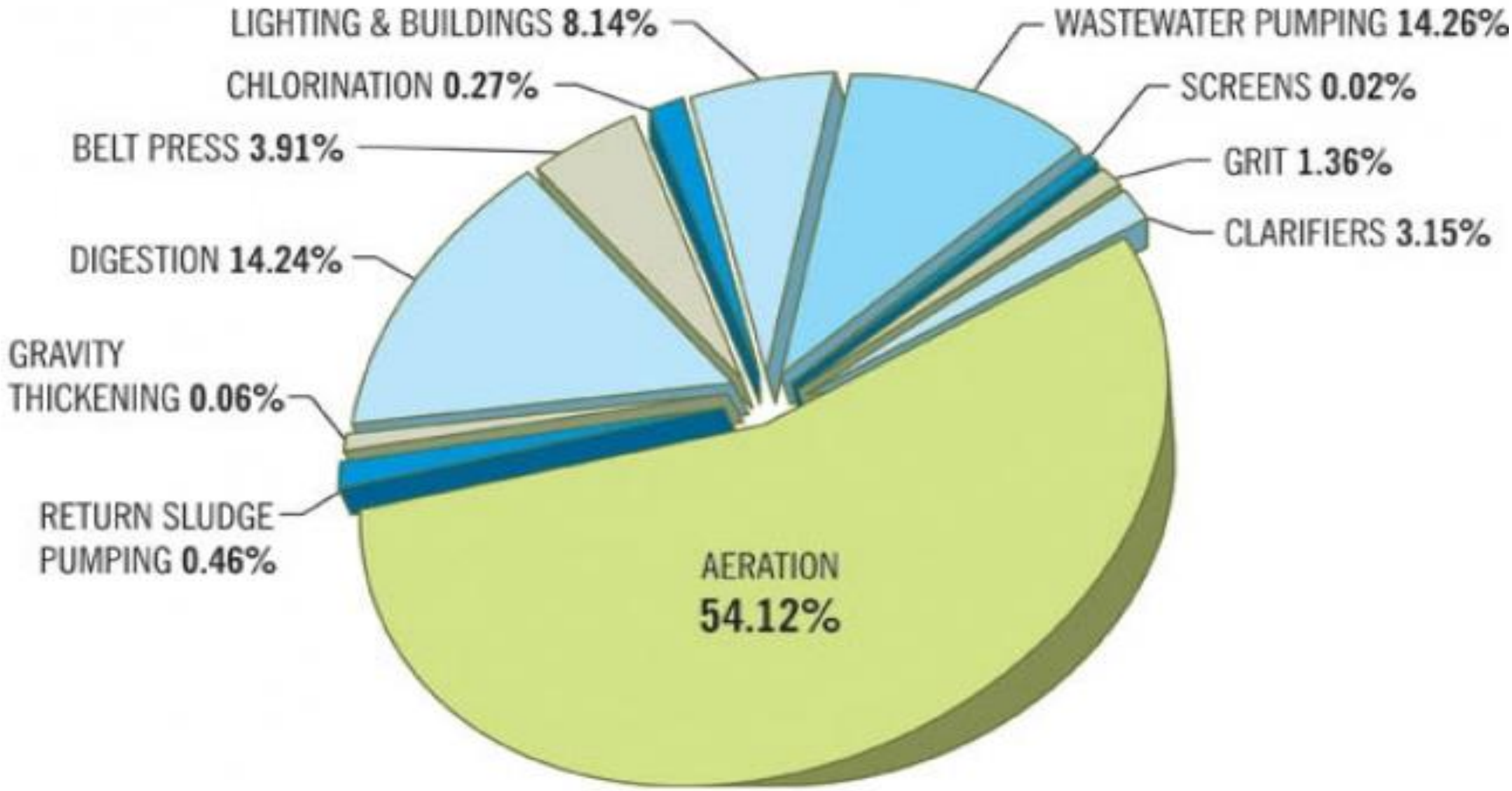
Mike Maringer

POWER COMES FROM

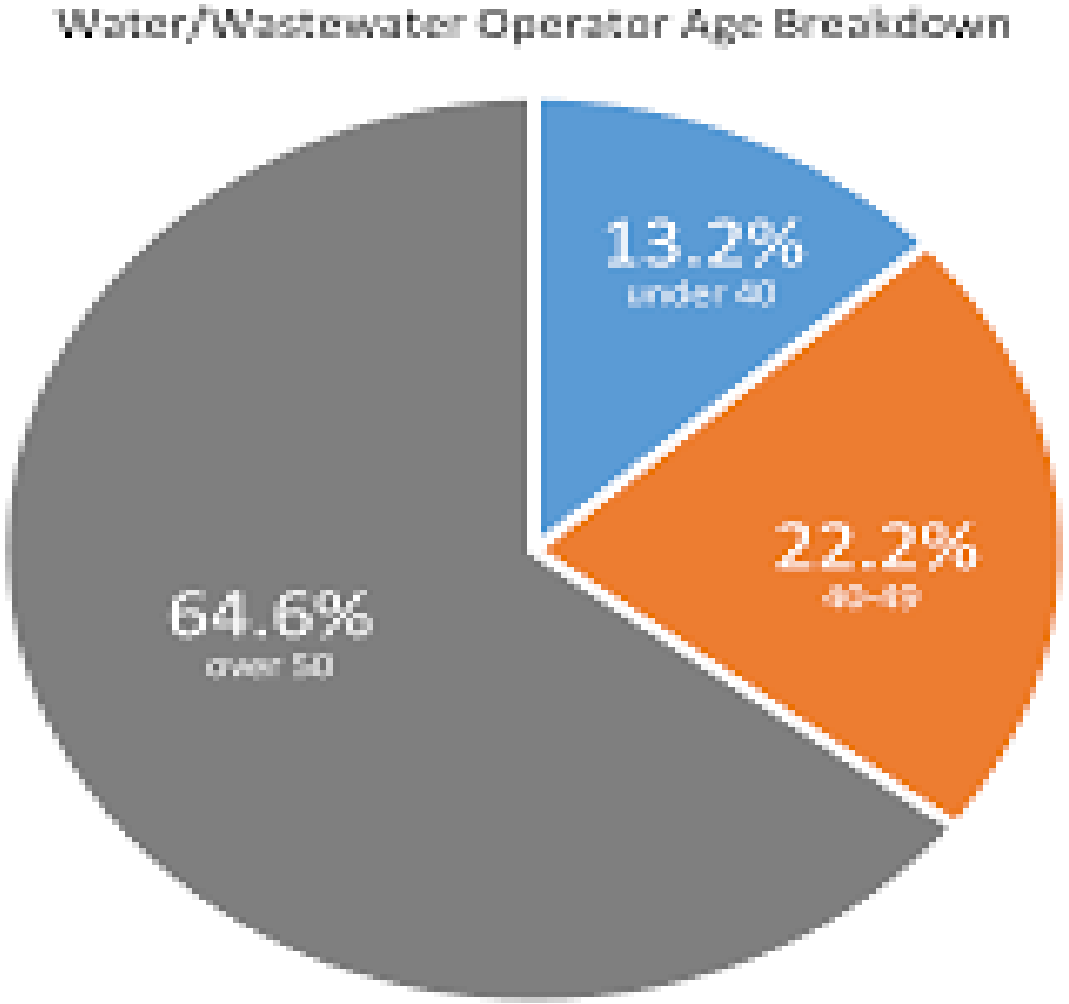
Products from Wastewater

Energy **Consumption** of **Wastewater Treatment Plants**.

Specific **power consumption** of state-of-the-art **wastewater treatment plants** should be between 20 and 45 kWh/(PE.) [PE = Population Equivalent or unit per capita loading]. ... The smaller a **plant**, the higher is its specific **power consumption**.


LIGHTING & BUILDINGS 8.14%
CHLORINATION 0.27%
BELT PRESS 3.91%
DIGESTION 14.24%
GRAVITY THICKENING 0.06%
RETURN SLUDGE PUMPING 0.46%
AERATION 54.12%
WASTEWATER PUMPING 14.26%
SCREENS 0.02%
GRIT 1.36%
CLARIFIERS 3.15%

What is your Manpower ?



Let’s

Find Out !

Calculating Your Manpower's Horsepower

1. **Weigh yourself.** Find out how much you weigh in kilograms (your weight in pounds (your weight in pounds multiplied by 0.454) and write it down.

2.

Find a stairway that is free from obstructions. You'll be running up these stairs with a stopwatch, so try to find a stairway that is not frequently used.

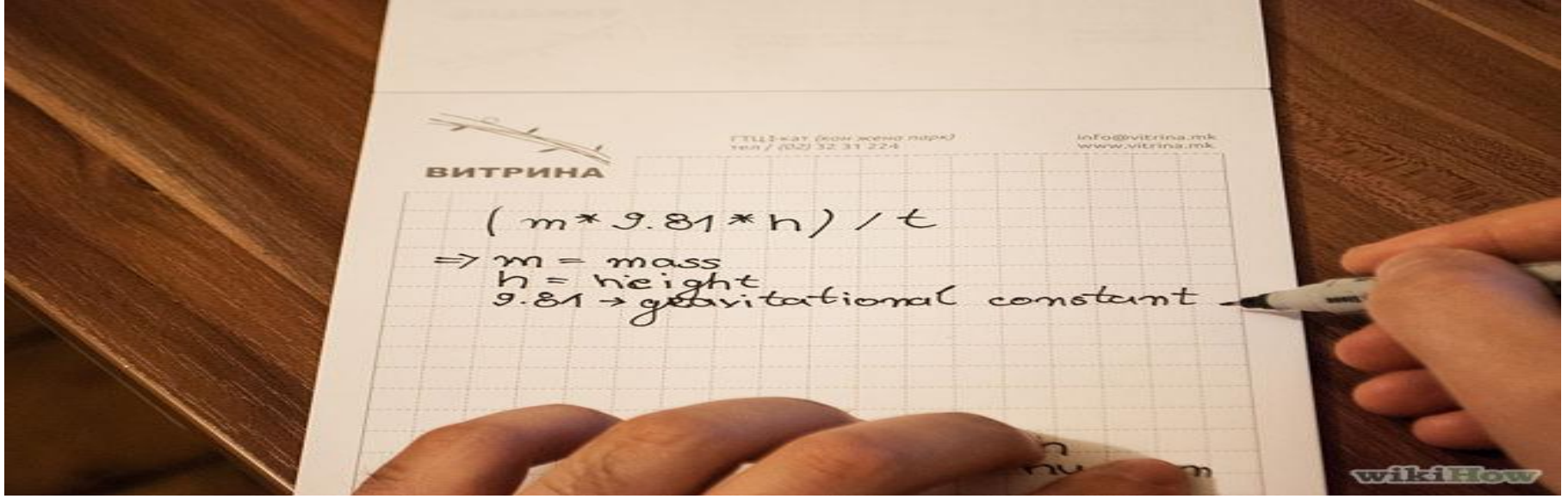
3. **Measure the total height of the stairs from the base to the top of the stairs (the height of one stair multiplied by the number of stairs).** If you measure in feet, multiply that number by .3048 to convert to meters. Write down the height in meters.

4.Keep a steady pace. Get a running start, and when your foot lands on the first step, start your stopwatch.

•When both feet are on the top step, stop your stopwatch. Write down the duration of your climb to the top.

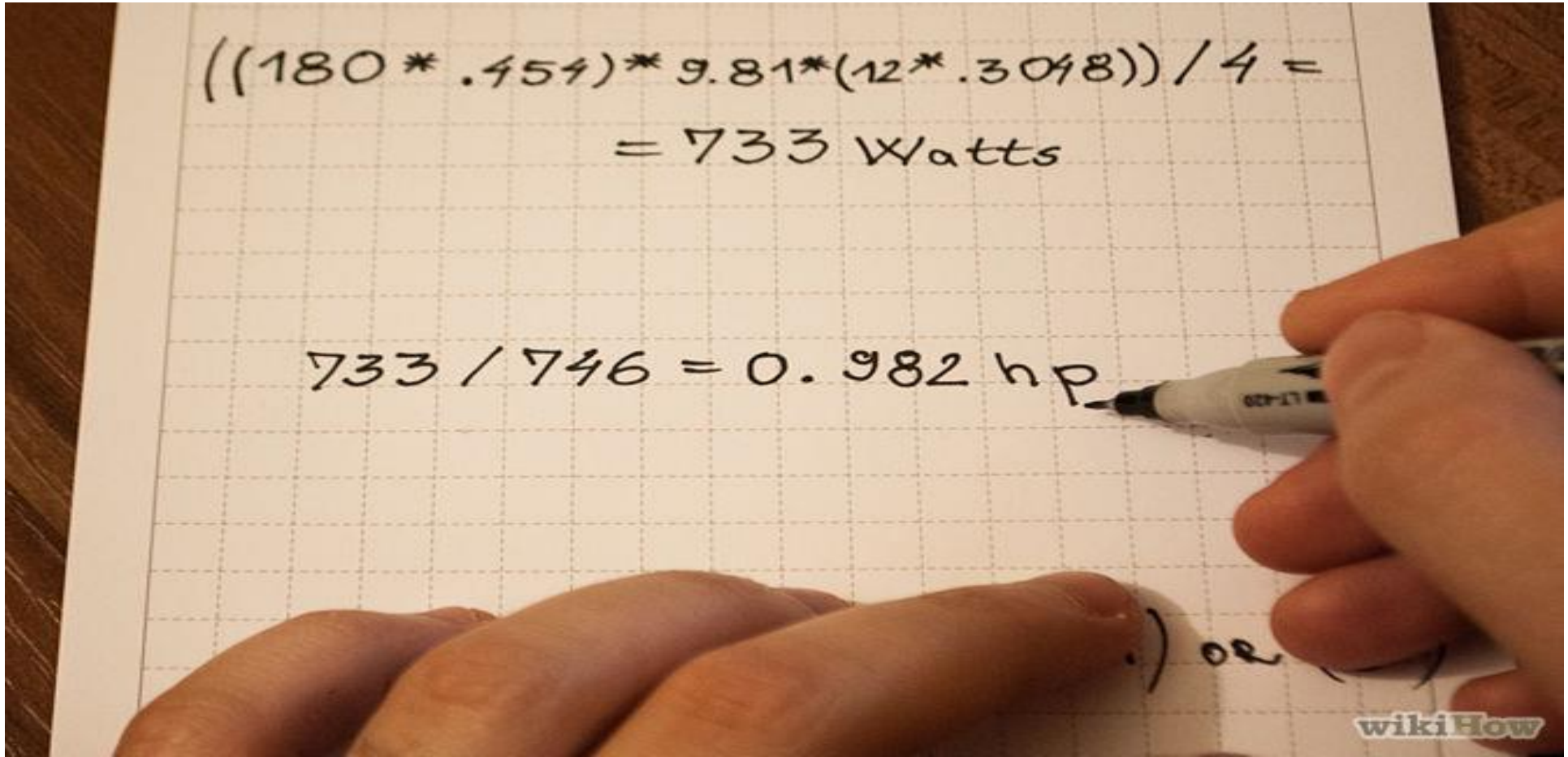
Your best **HONEST** guess

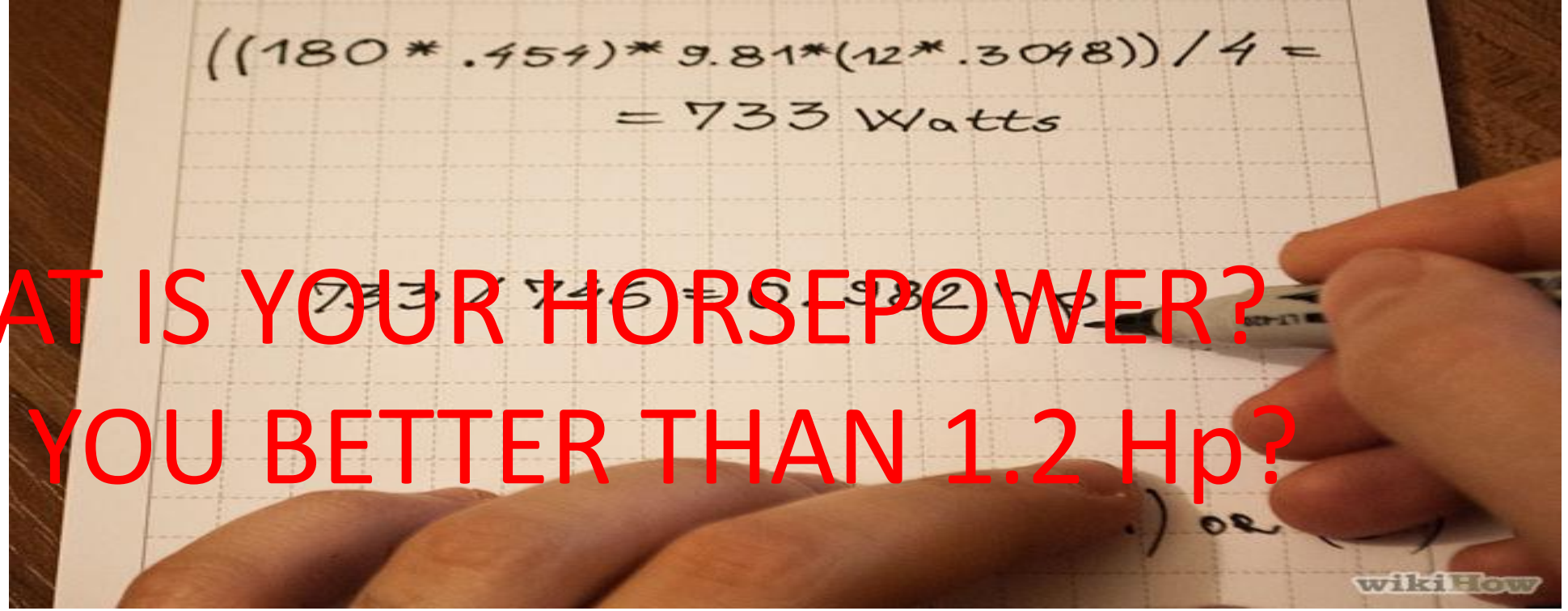
How fast can you run up these stairs?



5.**Calculate your Wattage.** Use the formula (m*9.81*h)/t, where m=mass (i.e., your weight in kilograms), h=height of staircase in meters, 9.81 is the gravitational constant that must be taken into account, and t=time in seconds of your climb. The resulting number you get is expressed in Watts.

Example: If you weigh 180 lbs, and you climb a 12-foot staircase in 4 seconds, that equals ((180 * .454) * 9.81 * (12 * .3048)) / 4 = 733 Watts





WHAT IS YOUR HORSEPOWER?
ARE YOU BETTER THAN 1.2 Hp?

6. Calculate your Horsepower. Divide the number of Watts by 746 to find out your horsepower rating.

- A healthy human can generate a short burst of about 1.2hp, and a sustained output of about .1hp.

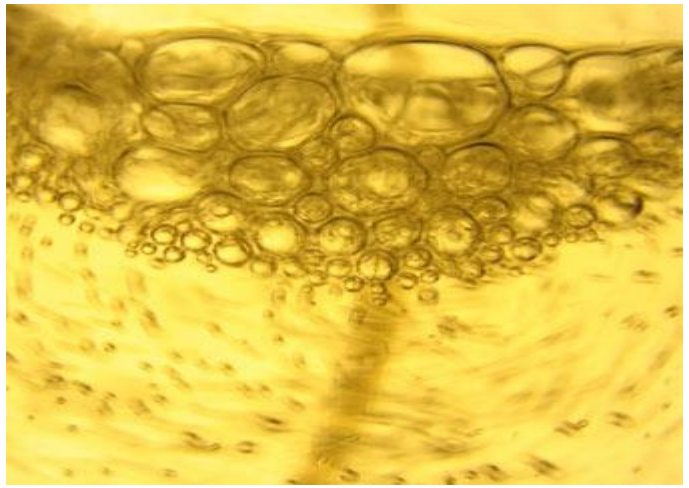
THAT MEANS 250 OPERATORS COULD REPLACE A 25 Hp MOTOR

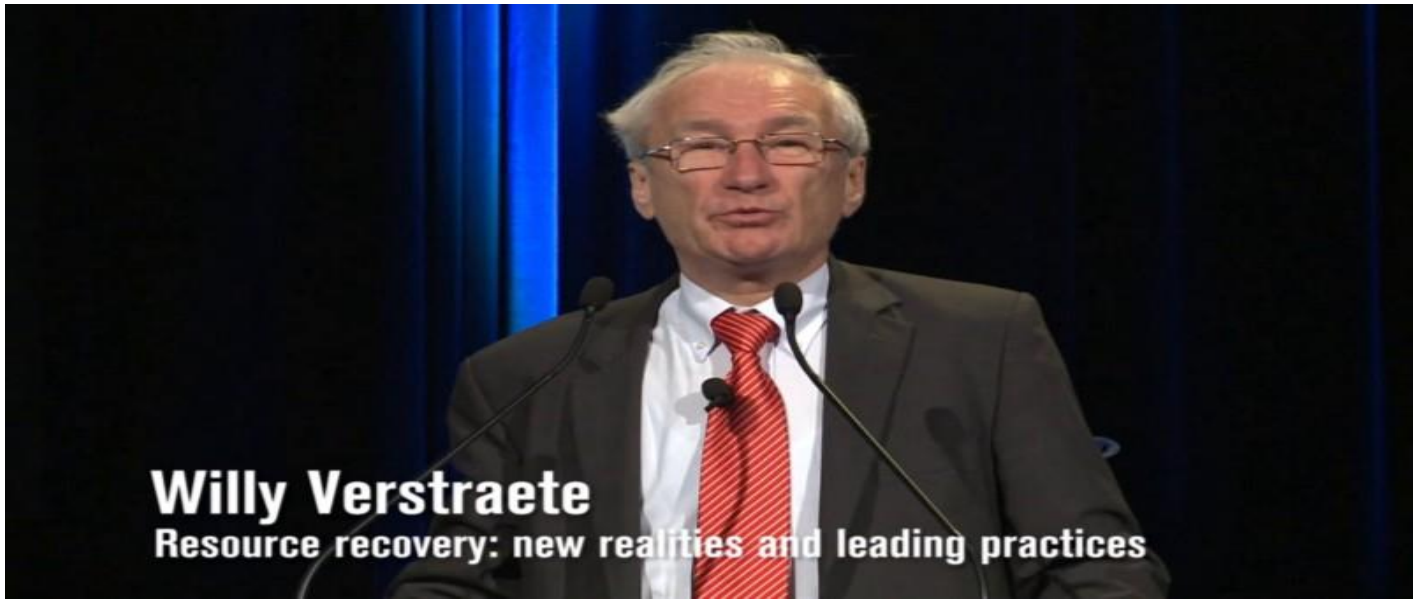
Our bodies are not **100%** efficient at converting food energy into mechanical output. But at **about 25% efficiency**, we're surprisingly good considering that most cars are **around 20%**, and that an Iowa cornfield is only about 1.5% efficient at converting incoming sunlight into chemical storage.

Where does the other 75% Go???

Americans use 5.7 billion gallons per day from toilet flushes.

Remember
They can't
FL_ _ H
Without US





According to calculations by the environmental biotechnologist Willy Verstraete, every 1000 gallons of waste water contains the equivalent of $1.88 worth of fertilizers, organic matter, energy-producing gases and more.

For Every 1,000 gallons of sludge
@ 3% solids and 68% volatility

There is $3.06 in biogas @ ($5.00/1,000Ft3)
and
$4.80 in electricity @ ($0.07/KWH)


1.1 billion
people lack access to clean water


2.6 billion people do not have access to
“improved” sanitation
Open defecation… = everyday business
for about 1,100,000,000 people


This is a 87 kWh
dump!!!

Content of Fecal Waste

Feces: 70-520 g/(p day) ~ 80% moisture

- Fats (5-25%)
- Carbohydrates (10-30 %)
- Nitrogenous materials (2-3%)
- Minerals (5-8%)
- Bacteria and bacterial debris (10-30%)

Where all pathogens and most of the energy is ~80 g_{dry} , 107 g COD, ~2 g N, **1.6 MJ per day**

Urine: 0.6 – 1.1 L/(p day)

- Organic salts (38%)
- Urea (36%)
- Organic compounds (13%)
- Ammonium salts (13%)

Is where most of the nitrogen is ~7 gN/(p day)

~440 W h/(p d)

- The average Residential House uses 30 kwh/DAY
  30 kwh/DAY/ .440 kw/crap = 68 craps per day to power your home

Treatment of Fecal Sludge in a Prototype Supercritical Water Oxidation Reactor

Marc A. DESHUSSES

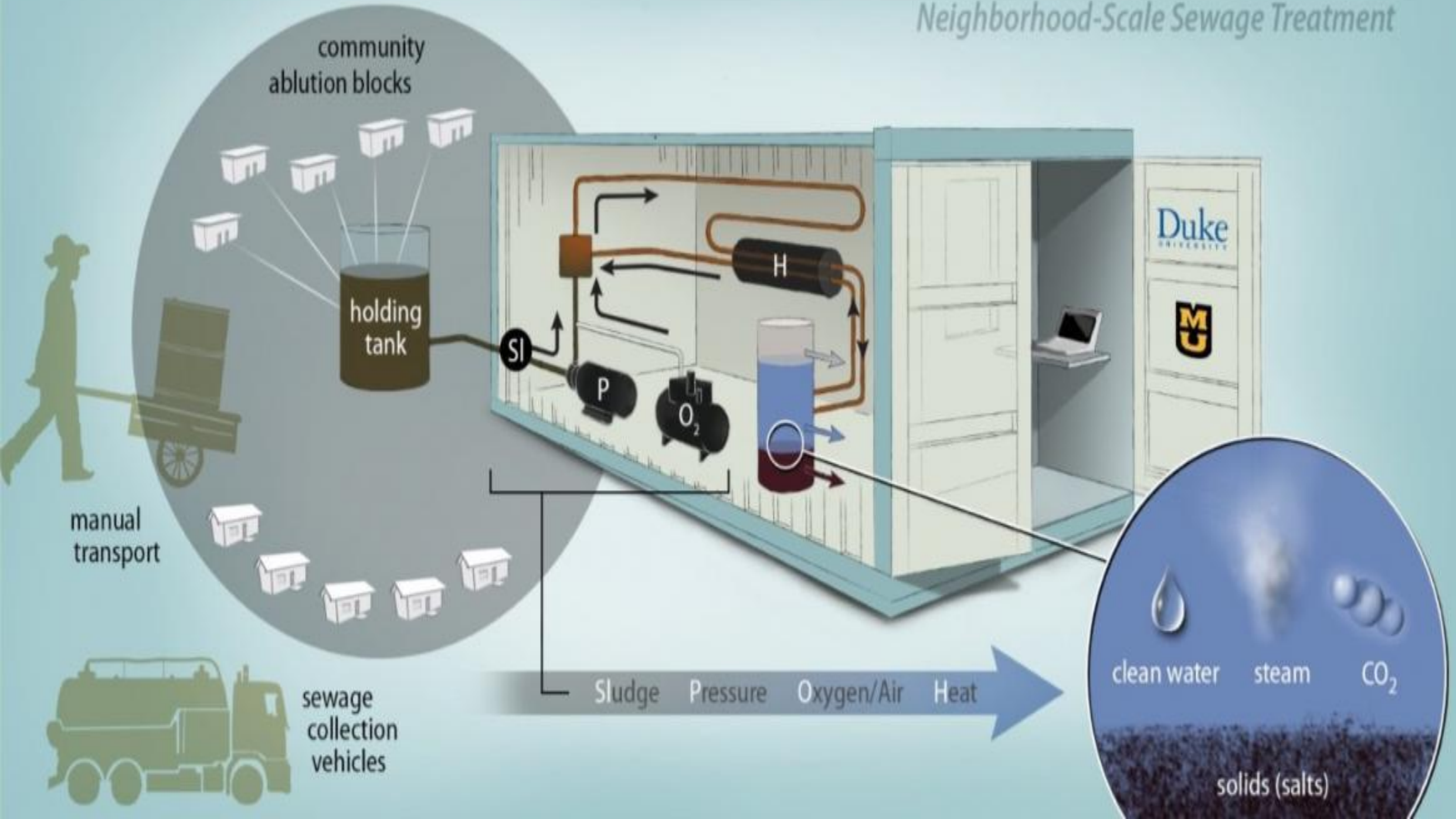
Department of Civil and Environmental Engineering
Duke University, Durham, North Carolina, USA

Project team: William Jacoby (Co-PI, University of Missouri): Kathy Jooss, Jose M. Abelleira-Pereira, Doug Hendry, Andy Miller, Kurabachew S. Duba, Allen Busick, Reza Espanani, Florencia Yedro, Sherif Elsayed

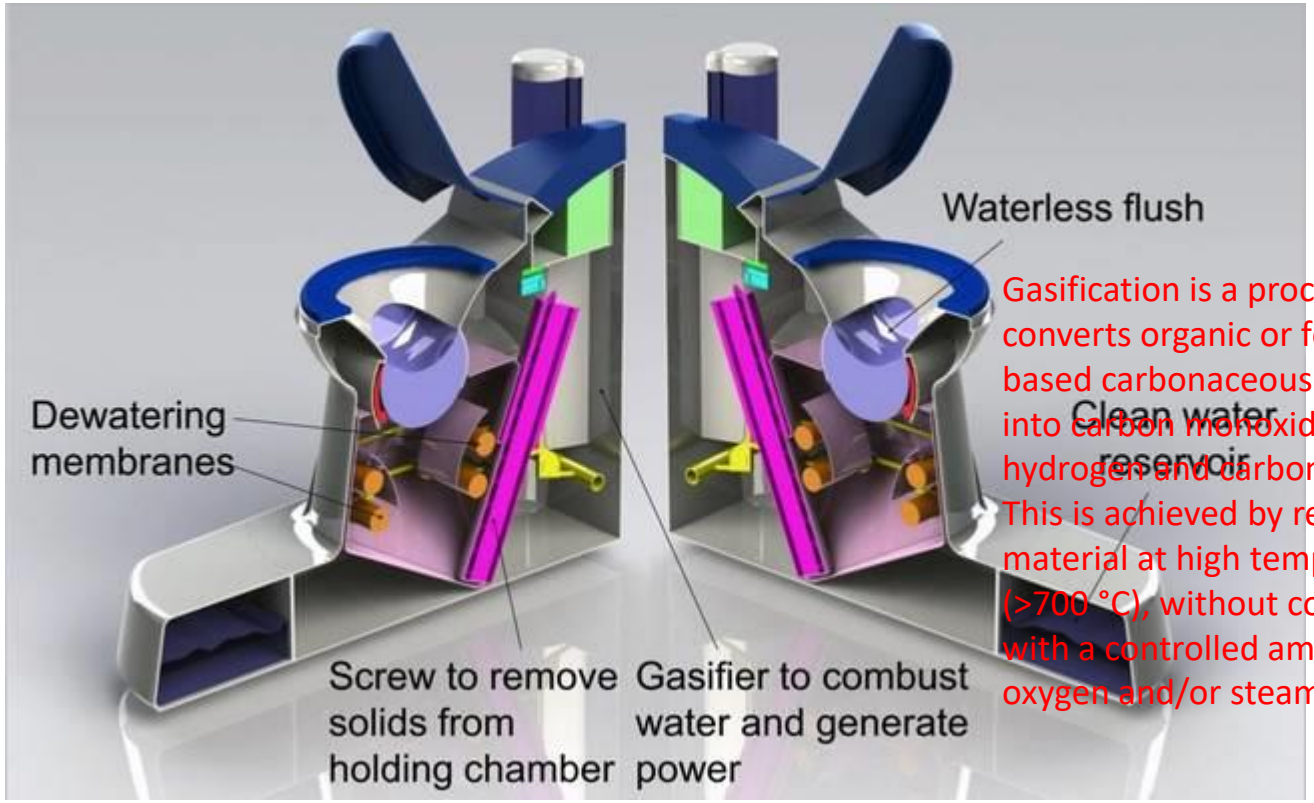
Funding: Bill & Melinda Gates Foundation

For those of you not familiar with supercritical water oxidation, the basic premise is that once water goes above 370 Deg C or (698 F) and 220 Bar of pressure(3,190 psi), it enters a fourth state, referred to as supercritical. If you introduce oxygen into supercritical water, you can completely oxidize organic material. This releases energy which can be used in a CHP plant and produces an inert ash-like material and water (supernatant) with a COD of less than 5mg/l.

Neighborhood-Scale Sewage Treatment



Cranfield University is developing the **Nano Membrane Toilet** which will be able to treat human waste on-site without external energy or water. The **Cranfield toilet** is designed for single-household use (equivalent to 10 people) and will accept urine and faeces as a mixture.



Gasification is a process that converts organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a controlled amount of oxygen and/or steam

Is this what they mean by Russian Hacking?

A group of businessmen from Washington show a big interest for The Russian Company “Cheloveckaja Energija” developer of a technology which is turning a human waste into energy! The whole idea is human waste to be collected, fats and oils to be extracted and to be used for a production of biodiesel. The side products can be used as a cheap and eco friendly fertilizer for the soil.

Most of the energy experts agree that: if this technology shows a positive result this can be a beginning of a new era for humanity.

Chevy CNG Vehicle

Average person emits 75cc CH_4/Fart
or 0.0025486 Ft3
<u>127Ft3 geg</u> = 49,831 Farts=1 gal. of gas
0.0025486
Google says we average 10 to 20 farts/D
49,831/15 = 3322 days or 9.1 years

Urine turned into hydrogen fuel

US researchers have developed an efficient way of producing hydrogen from urine - a feat that could not only fuel the cars of the future, but could also help clean up municipal wastewater.

Using hydrogen to power cars has become an increasingly attractive transportation fuel, as the only emission produced is water - but a major stumbling block is the lack of a cheap, renewable source of the fuel.

Gerardine Botte of Ohio University may now have found the answer, using an electrolytic approach to produce hydrogen from urine - the most abundant waste on Earth *- at a fraction of the cost of producing hydrogen from water.*

Urine consists of approximately 98% water, and 2% urea, which is made up of carbon, oxygen, nitrogen and hydrogen atoms. Gerardine Botte, a researcher at Ohio University, recently developed the *GreenBox*, a device that extracts the hydrogen from urea through a process called microbial electrolysis. Electrolysis uses a jolt of electricity to split the urea into hydrogen and oxygen atoms, and then captures the hydrogen to produce energy. The nitrogen can be used for artificial fertilizers.

MICROBIAL ELECTROLYSIS CELL

1. Plant waste fermentation produces acetic acid.

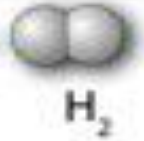
2. Bacteria consume acetic acid releasing electrons, protons, CO_2.

CO_2

Electrons

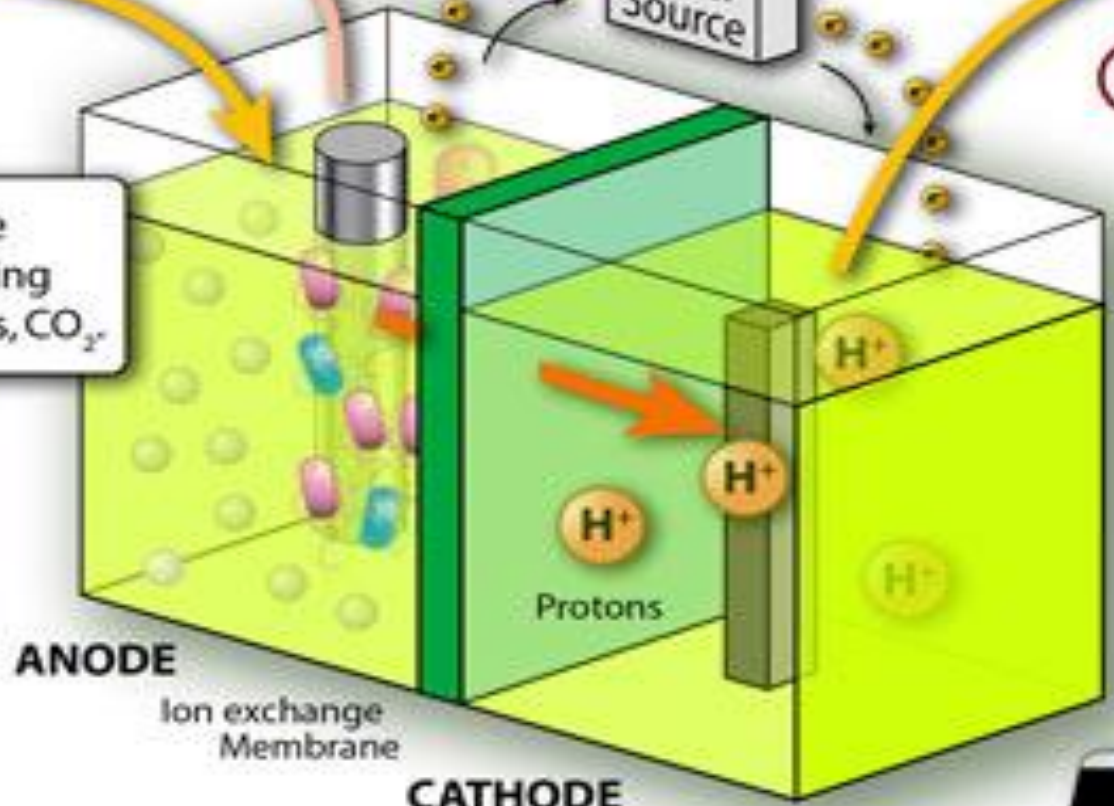
Power Source

3. >0.2 volts are added from an outside source.



H_2

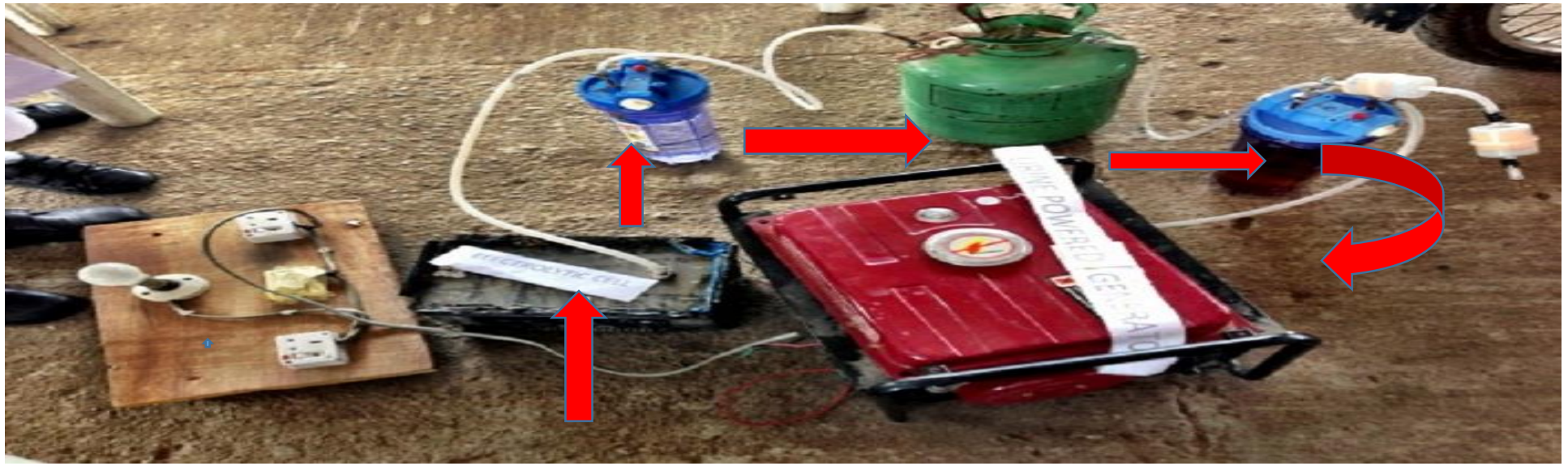
4. Electrons join with protons and form hydrogen gas.



5. Hydrogen is clean fuel that vehicles running on natural gas can use.

How many liters of urine are produced every day in the world? This seemingly gross question may very well hold the answer to fuel crisis that we all are facing. Approximately, 10.5 billion liters (2.77 billion gallons) of urine are produced every day which is (for comparison's sake) enough to fill above 4,000 Olympic sized swimming pools. This much amount goes to waste every day, but, now scientists are hoping that they can use this to generate power; power for homes, cities and vehicles.

Imagine powering your home with waste bi-products. You could essentially power your home with pee. Adult human being produces 1-2 liters of urine per day. 1 liter is enough to power a small generator for 6 hours. How do we know this? A 14 year old girl and her friends from Nigeria, Africa created a system that separates the hydrogen and oxygen in urine, purifies the hydrogen and uses it to power a generator.



The system works like this:

Urine is put into an electrolytic cell, which separates out the hydrogen.

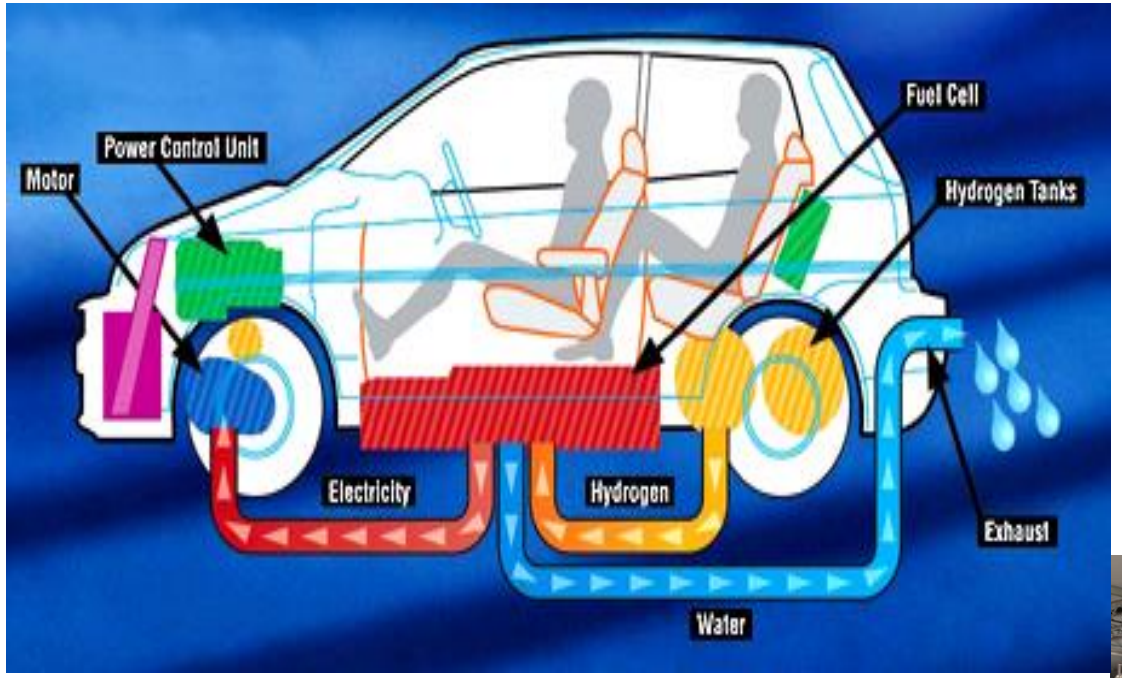
The hydrogen goes into a water filter for purification, which then gets pushed into the gas cylinder.

The gas cylinder pushes hydrogen into a cylinder of liquid borax, which is used to remove the moisture from the hydrogen gas.

This purified hydrogen gas is pushed into the generator.


PRACTICE YOUR AIM

Hydrogen Fuel Cell Vehicle



THINK OF THE POSSIBILITIES

They have OPEC

Organization of Petroleum Exporting Countries

WE Have:

OPISS

Ohioans

Peeing

In

Selective

Sewers

From Dr. Botte's Green Box to Mike's Vial

2.4 gallons H_2O = 1 Kg H_2

One kilogram of H_2 has approximately the same energy as one gallon of gasoline.

URINALYSIS

Urochrome is a pigment which gives your urine a yellow color.

OOPS

Urine consists of approximately 98% water, and 2% urea

It takes 128 ounces to make one (1) gallon

Or

2.4 gallons x 128 ounces = 307.2 ounces

It takes 6 vials to make 4 ounces

Or

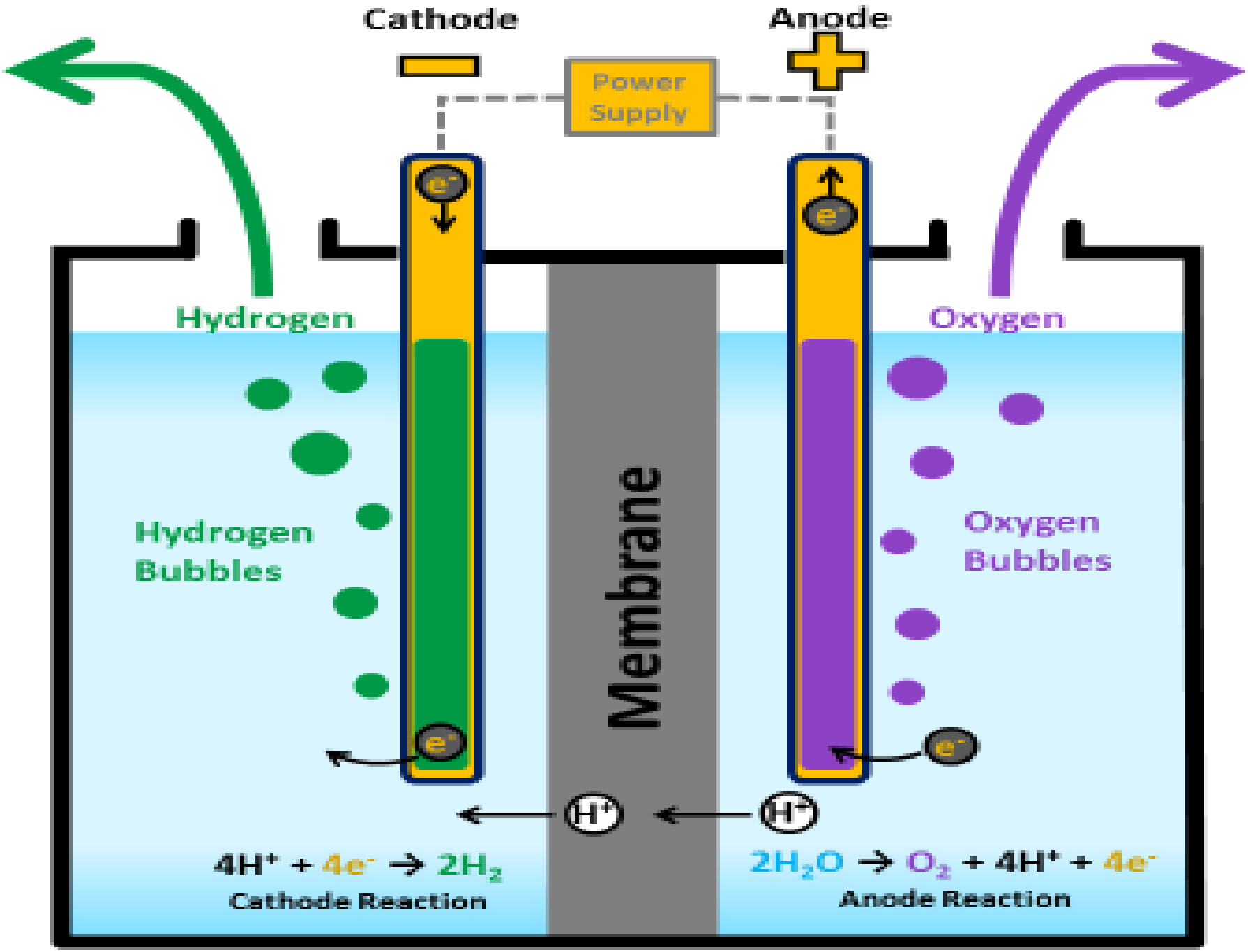
461 vials to make 2.4 gallons

2.4 gallons will produce 1 Kg H_2

1 Kg H_2 = 1 gallon gasoline

So

461 vials / How many here today?


Cathode
Anode
Power Supply
Hydrogen
Oxygen
Hydrogen Bubbles
Oxygen Bubbles
Membrane
e⁻
H⁺
4H⁺ + 4e⁻ → 2H₂
Cathode Reaction
2H₂O → O₂ + 4H⁺ + 4e⁻
Anode Reaction

You Wanted to Know

- 9 liters of urine produces 1 kg of hydrogen

- One kilogram of H_2 has approximately the same energy as one gallon of gasoline.

- Average Adult Human Being produces 1 to 2 liters of urine per day – So 9 liters/1.5 liters/Day = 6 Days to produce the equivalent of one (1) gallon of gasoline.

Remember the 10.5 billion liters/D that's 1,166,666,666 gals. gas

Cow Urine Can Sell for More Than Milk in India

India to launch cow urine as soft drink

Does your Pepsi lack pep? Is your Coke not the real thing? India's Hindu nationalist movement apparently has the answer: a new soft drink made from cow urine.

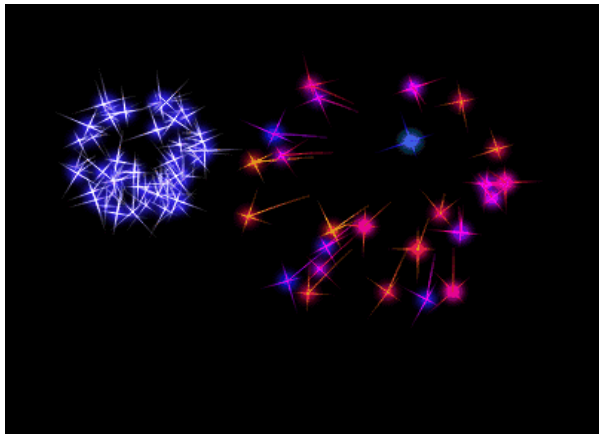
The bovine brew is in the final stages of development by the Cow Protection Department of the Rashtriya Swayamsevak Sangh (RSS), India's biggest and oldest Hindu nationalist group, according to the man who makes it.

Om Prakash, the head of the department, said the drink – called "gau jal", or "cow water" – in Sanskrit was undergoing laboratory tests and would be launched "very soon, maybe by the end of the year. It won't be like carbonated drinks and would be devoid of any toxins.

MOO Over Mountain Dew

Did You know that Urine is used to make Gunpowder?

- Gunpowder is made up of these ingredients:
- 75% Potassium Nitrate
- 15% Charcoal
- 10% Sulfur



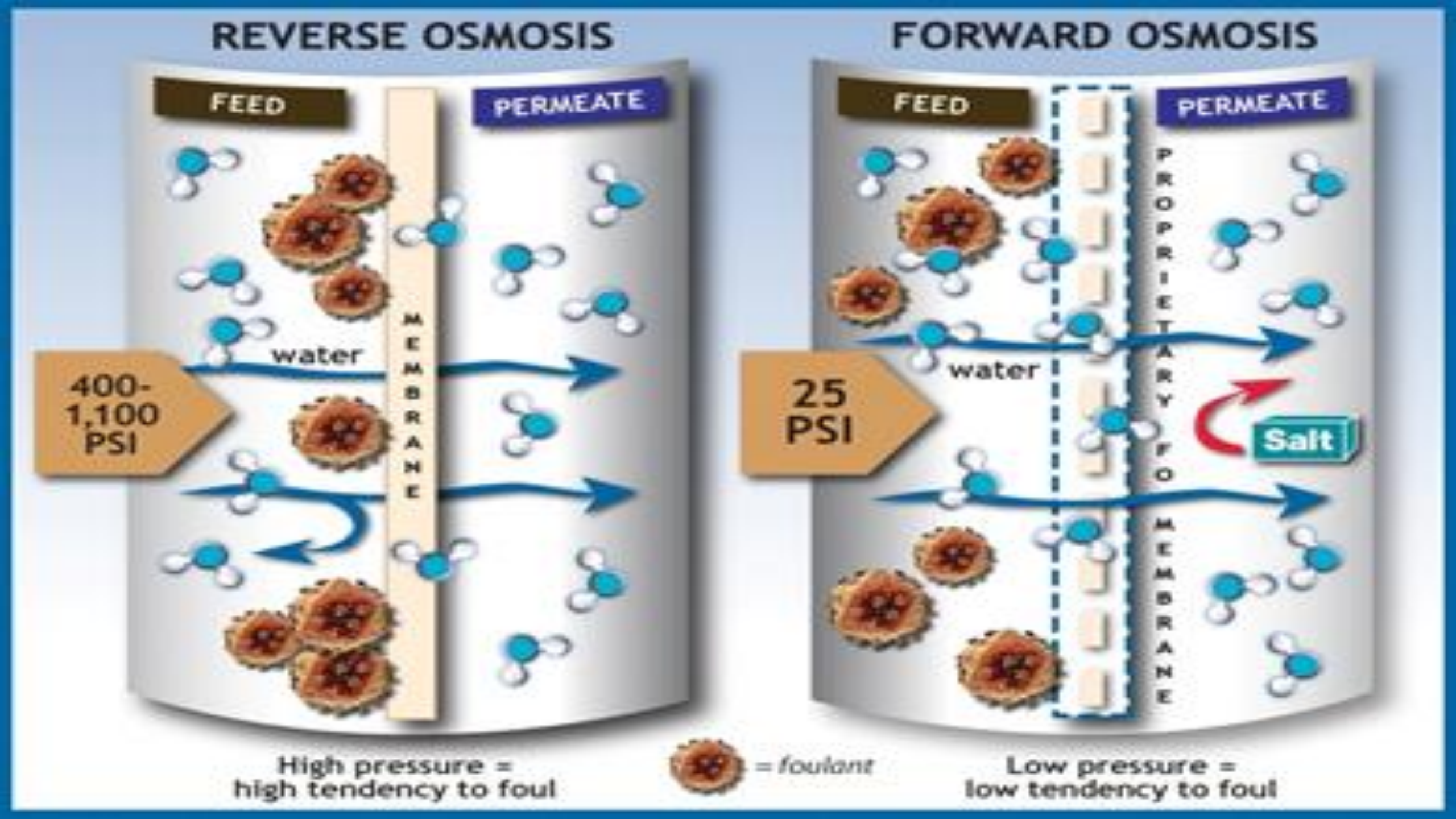
Guess where the KNO_3 comes from?

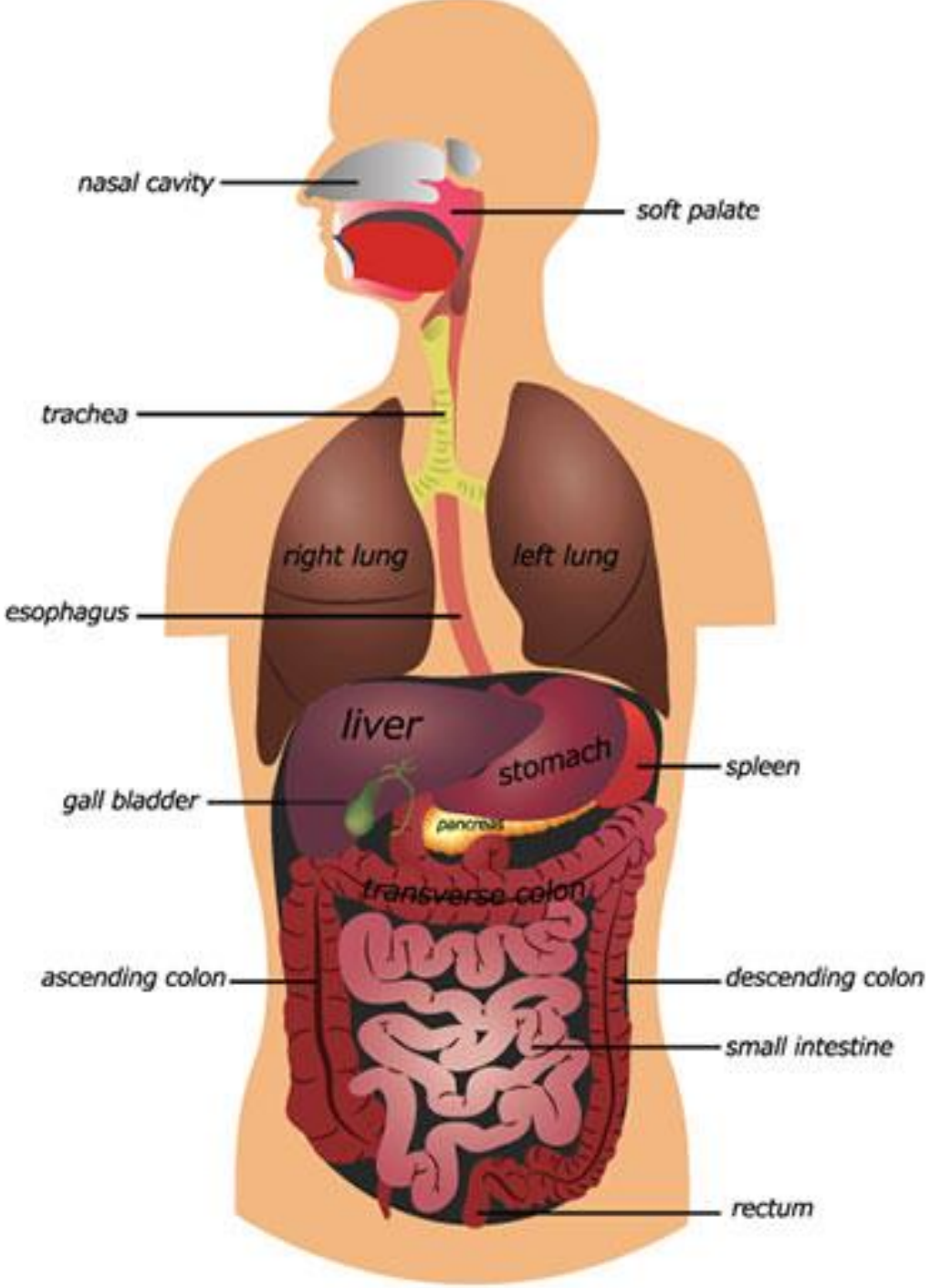
Traditionally, **gunpowder** used in **fireworks** was **made** of 75 percent potassium nitrate (also called saltpeter) mixed with 15 percent charcoal and 10 percent sulfur; modern **fireworks** sometimes use other mixtures (such as sulfurless powder with extra potassium nitrate)

How urine will get us to Mars

A new recycling system turns pee into drinking water and energy

DRINK UP Astronauts drink water made from recycled urine and other wastewater aboard the International Space Station. A new system would turn pee into drinking water and produce energy, a step toward long-term space travel


REVERSE OSMOSIS
FEED
PERMEATE
MEMBRANE
water
400-
1,100
PSI
High pressure =
high tendency to foul
= foulant
FORWARD OSMOSIS
FEED
PERMEATE
PROPRIETARY FO MEMBRANE
water
25
PSI
Salt
Low pressure =
low tendency to foul



Over your lifetime you'll eat about 60 tons of food. And all of that food will ultimately pass through your GI tract.

What you may not realize is that your GI tract is home to a lot more than what you ate for breakfast this morning.

Your GI tract is also home to a thriving population of approximately 100 trillion microbes like bacteria, fungi, and viruses

Hippocrates – "All Disease Begins In The Gut"

THE POWER of POOP

HAPPY MICROBES - HEALTHY BODY

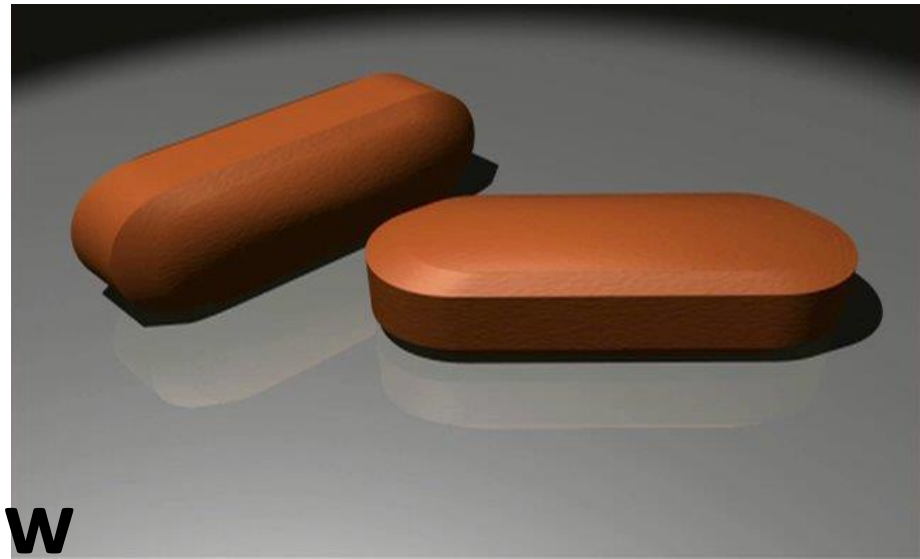
A new clinical trial -- which is not yet open to participants -- will study the effects of gut microbes from lean, metabolically healthy donors on the bodies of people with obesity and/or insulin sensitivity.

Now How Healthy does that person Look ?

To get the microbes from one person to the other, scientists will freeze the feces from donors and case the material into pills, to be taken orally by the subjects.

Massachusetts General Hospital

Recommended: not to chew



Wastewater Engineer makes beer from Milwaukee's Metropolitan Sewer District's final effluent, called:

ACTIVATED SLUDGE

That beer grabbed relatively high marks when presented to a tasting panel at Milwaukee's Lakefront Brewery. In the beer's defense, brewery President Russ Kilsch even said, "No pathogen known to man…can grow in beer." Sounds like people are certainly putting that theory to the test.

Brewery Makes Beer from ‘Toilet Water’

Stone Brewing of San Diego has made a beer using recycled wastewater.

Japanese Scientists Create Meat From Poop

They call it POOP STEAK – no kidding

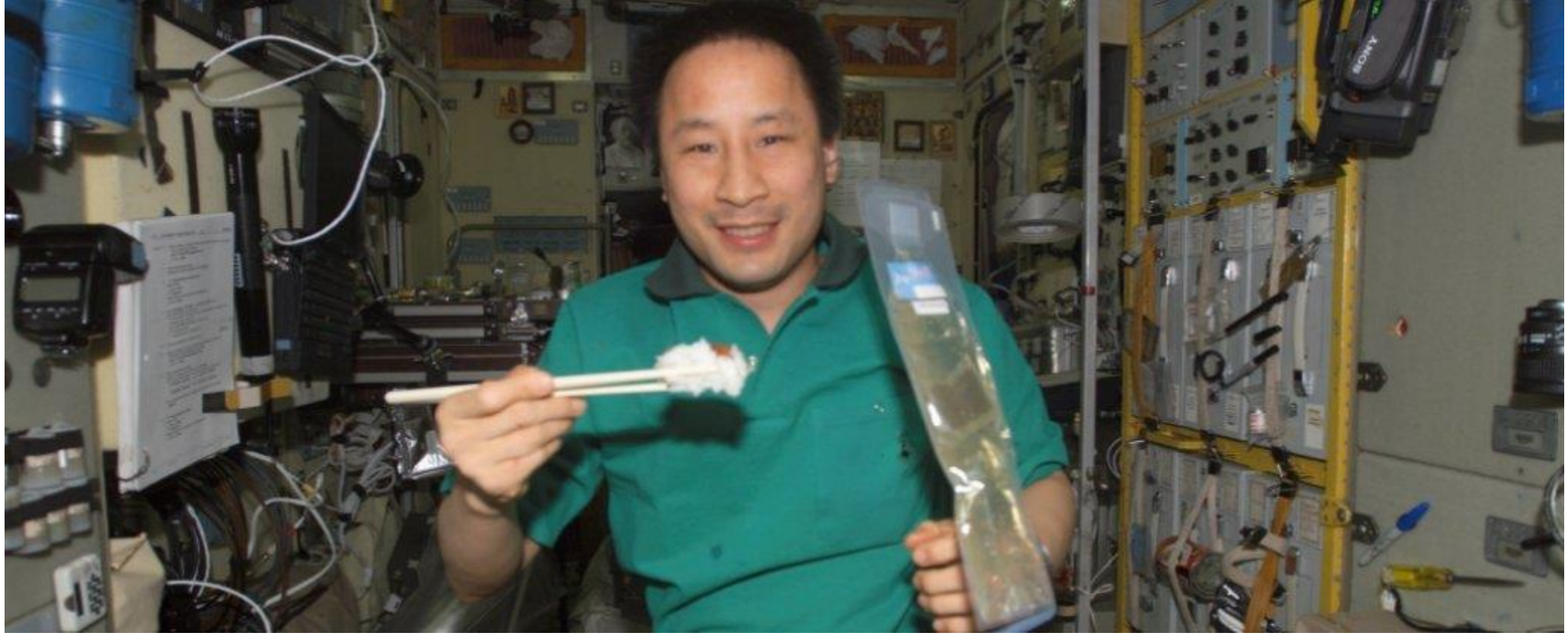
Mitsuyuki Ikeda, a researcher from the Okayama Laboratory, has developed steaks based on proteins from human excrement. Tokyo Sewage approached the scientist because of an overabundance of sewage mud(shit). They asked him to explore the possible uses of the sewage and Ikeda found that the mud contained a great deal of protein because of all the bacteria.

The researchers then extracted those proteins, combined them with a reaction enhancer and put it in an exploder which created the artificial steak. The "meat" is 63% proteins, 25% carbohydrates, 3% lipids and 9% minerals. The researchers color the poop meat red with food coloring and enhance the flavor with soy protein. Initial tests have people saying it even tastes like beef.

IF YOU LOSE TO OHIO STATE

IF YOU LOSE TO ALABAMA

POST GAME MEALS



The food that will sustain future generations as we colonize our way across space may be none other than our own sh*t, if a new NASA-funded project is successful. The US space agency has allocated researchers at ***Clemson University*** in South Carolina US$200,000 a year for up to three years to figure out how to recycle human faeces into synthetic food that could sustain astronauts during extended journeys or on a Martian colony. *Or Post Game Meals* That's my take

Can Artificial Meat Save The World?

The ability to efficiently create meat, or something sufficiently meat-like, will become progressively more important in coming years because humanity may be reaching a point when there's not enough animal protein to go around. The United Nations expects the global population to grow from the current 7.2 billion to 9.6 billion by 2050. Also, as countries such as China and India continue to develop, their populations are adopting more Western diets. Worldwide the amount of meat eaten per person nearly doubled from 1961 to 2007, and the UN projects it will double again by 2050.

Each year, Americans eat more than 200 pounds of meat per person.

- For example, a single pound of cooked beef, a family meal's worth of hamburgers, requires 298 square feet of land, 27 pounds of feed, and 211 gallons of water.
- As ghoulish as growing lab meat sounds, the concept has a long history, and not just in science fiction. *In 1931,* ***Winston Churchill wrote, "Fifty years hence, we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium."***

Beyond Meat Factory - 1985

in Columbia, Missouri, food scientists transform a mix of soy and pea proteins and amaranth into “chicken” strips.


EAT MORE
POOP STEAK
DRINK
GAU JAL

“R” World Is Changing

We use to say:

“This taste like Shit”

In The Future:

You’ll be paying them a compliment

Your mate farts

And you say:

Supper smells delicious!

Your mate says “I’m constipated”

And you say: Is there anything else to eat?

Comparison with vegetarianism

Subsets of Dietary Constraints

Diet name	Meat, poultry, fish	Eggs	Dairy products	Honey	Fruits	Vegetables
Ovo-lacto vegetarianism	No	Yes	Yes	Yes	Yes	Yes
Lacto vegetarianism	No	No	Yes	Yes	Yes	Yes
Ovo vegetarianism	No	Yes	No	Yes	Yes	Yes
Veganism	No	No	No	No[5][6][7]	Yes	Yes
Fruitarianism	No	No	No	No	Yes	No
Meatatarianism	Yes	Yes	Yes	Yes	Yes	Yes
Meatganism	Yes	No	No	No	No	No

A New Subset for Dietary Constraints

YOU Choose

A person who only eats poop steak

- Pooptarian
- Craptarian
- Fecaltarian
- Stooltarian

MANGO MATERIALS

From Methane to Bioplastic:

Challenges of Engineering and Fermentation at Scale

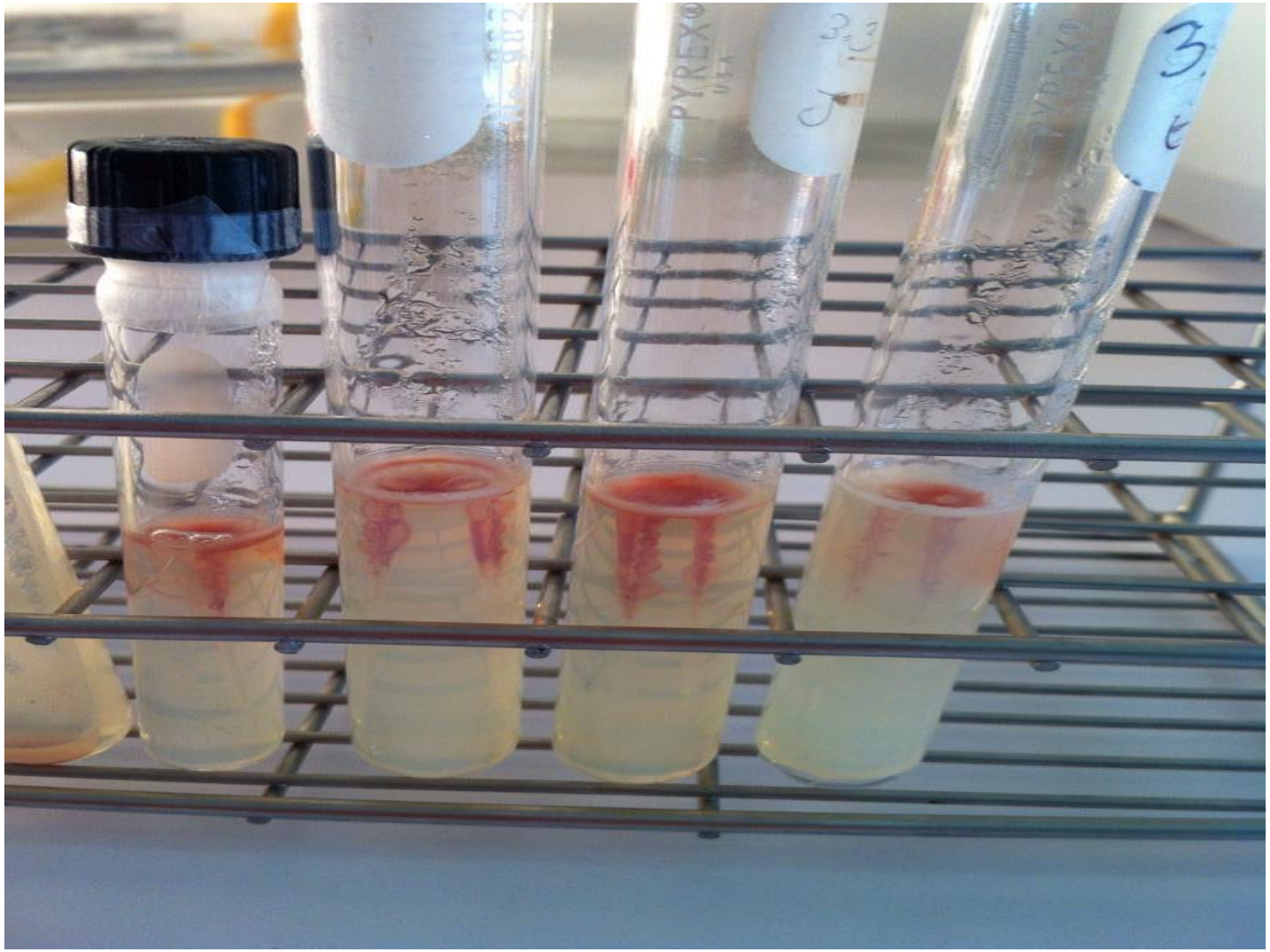
Allison Pieja, Ph.D., CTO Allison@MangoMaterials.com

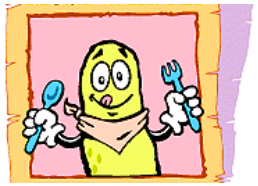
Anne Schauer-Gimenez, Ph.D., VP of Customer Engagement Anne@MangoMaterials.com

16 February 2017

MANGO MATERIALS

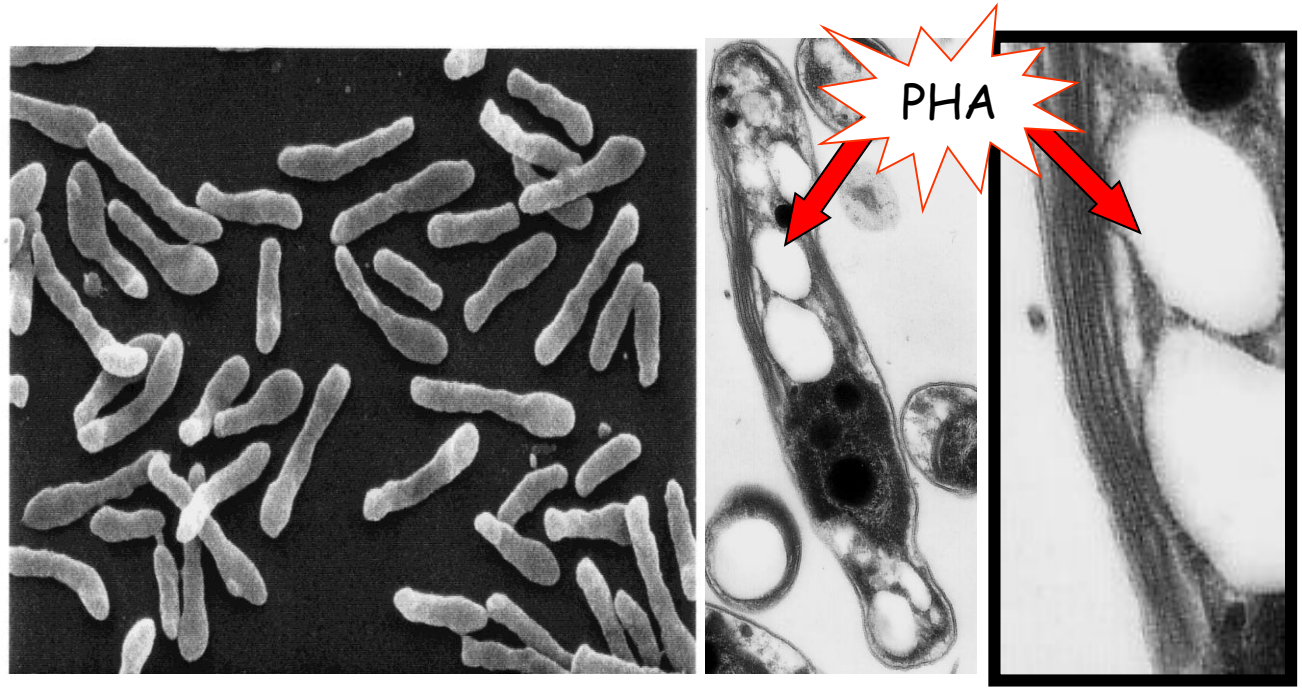
To turn waste into **ecofriendly**, **affordable** materials while creating a **positive** environmental impact.

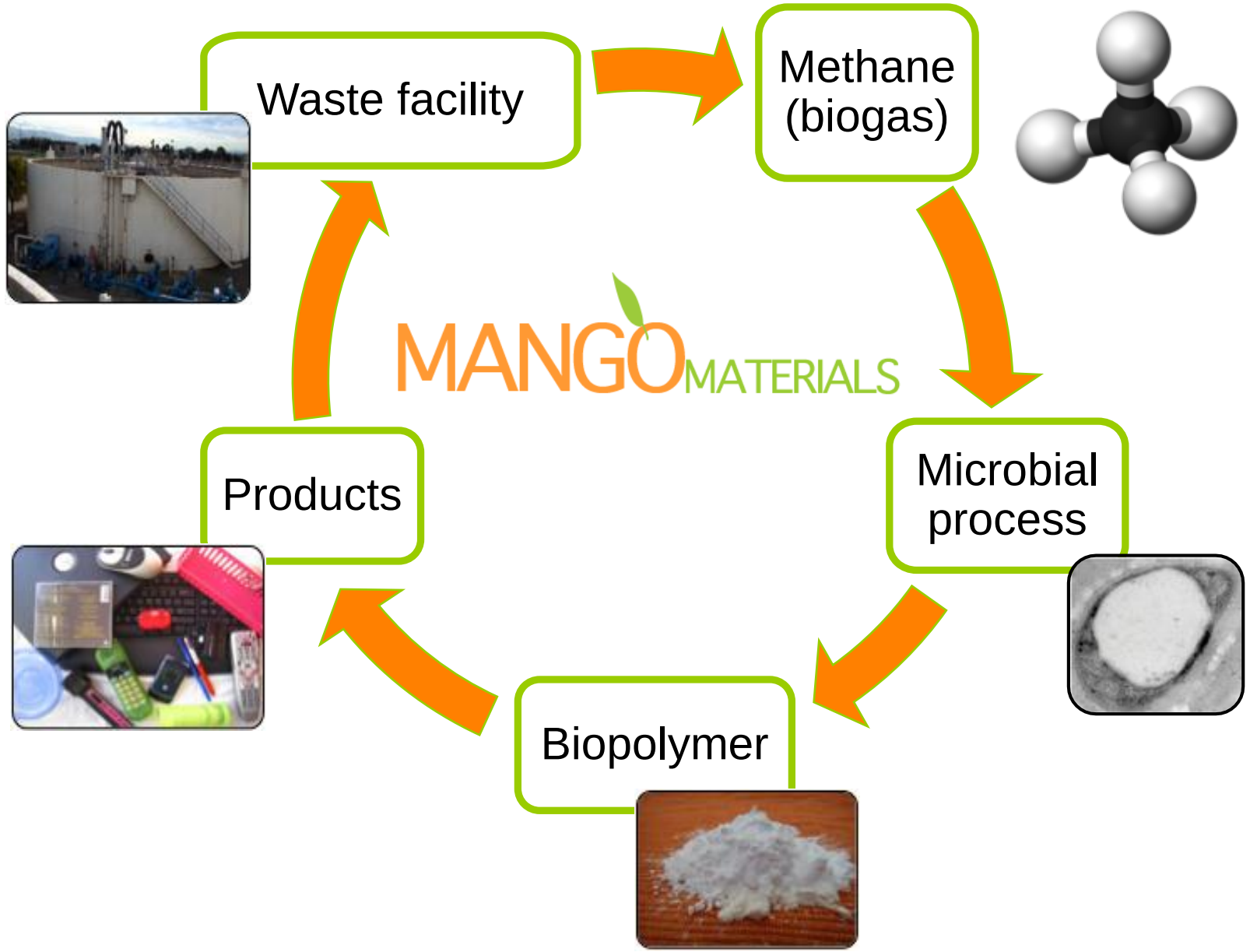

PYREX
USA



TN1: the right microbe to do the job

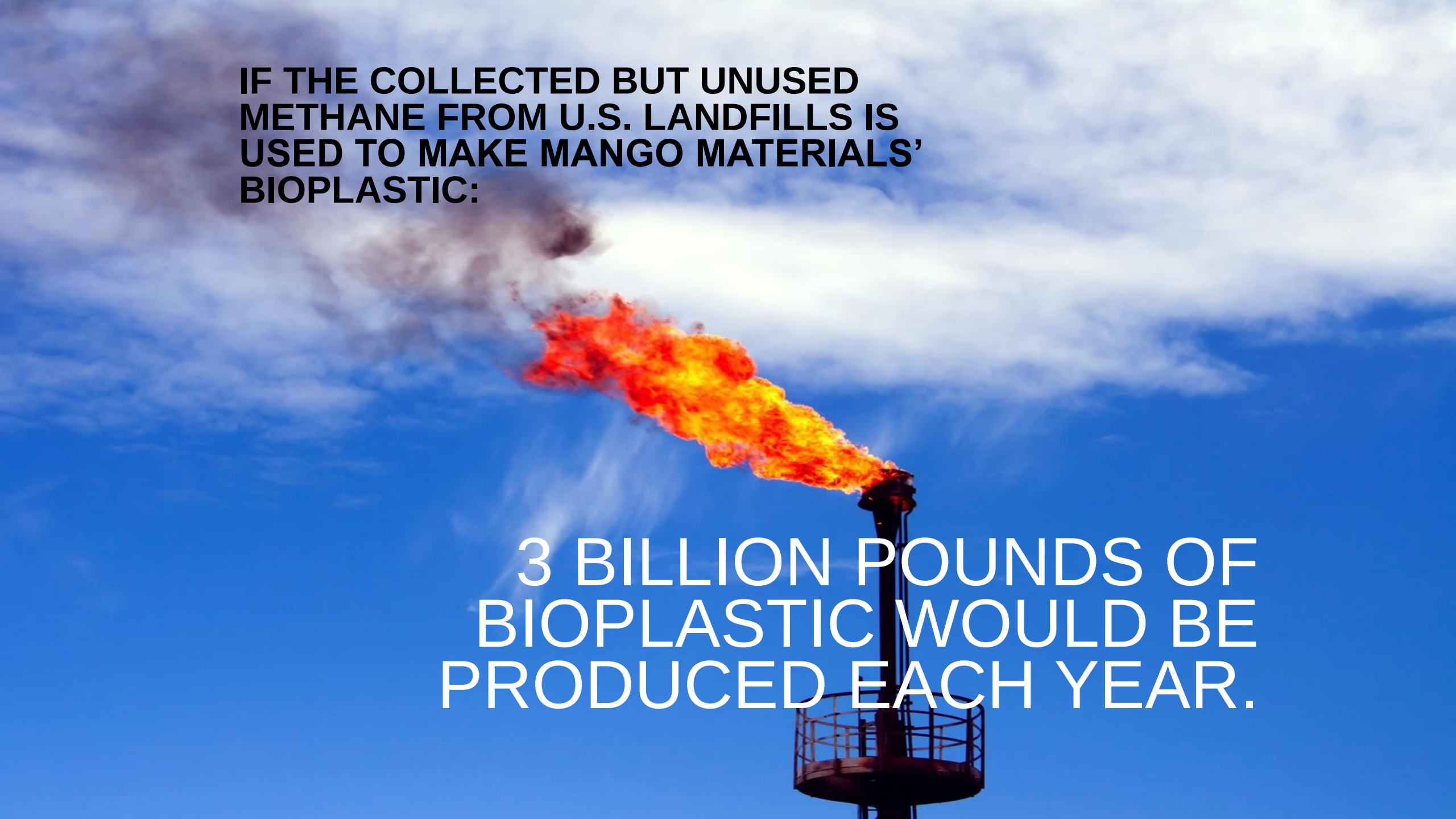
- Can use VFAs as food.
- Makes LOTS of hydrogen and PHA.
- Can grow aerobically and anaerobically.




Waste facility
Methane (biogas)
MANGOMATERIALS
Products
Microbial process
Biopolymer

IF THE METHANE FROM U.S. WATER RESOURCE RECOVERY FACILTIES IS USED TO MAKE MANGO MATERIALS' BIOPLASTIC:

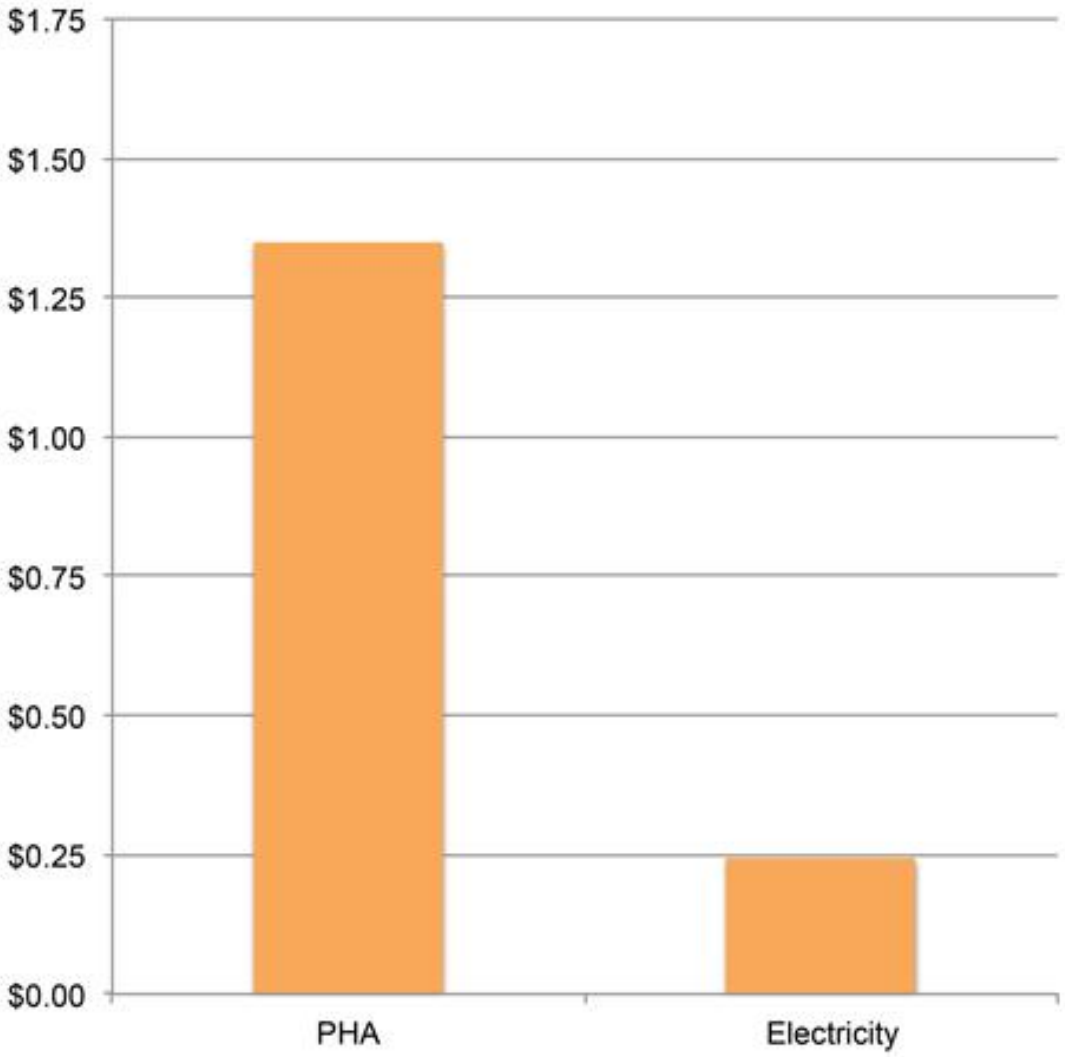
MORE THAN 250 MILLION POUNDS OF BIOPLASTIC WOULD BE PRODUCED EACH YEAR.



IF THE COLLECTED BUT UNUSED METHANE FROM U.S. LANDFILLS IS USED TO MAKE MANGO MATERIALS' BIOPLASTIC:

3 BILLION POUNDS OF BIOPLASTIC WOULD BE PRODUCED EACH YEAR.

Total Sales Per Pound of Methane



Integration at wastewater treatment facilities

Verify process on biogas (vs. pure methane)

Anaerobic
Digester

Pilot-scale operation

What’s next…

Demo-scale

The Mango Materials Team

Pauchon Foundation

Good news!


100% Degradation in 1 month


100% Degradation in 4 months


100% Degradation in 4 months


100% Degradation in 12 months

PHA bottle biodegradation over a period of 2 months.

CLOSED LOOP BIOPRODUCT ECONOMIES ARE NOW POSSIBLE

– LET’S BUILD ONE!

Decentralized Production

MANGO MATERIALS

www.facebook.com/MangoMaterials

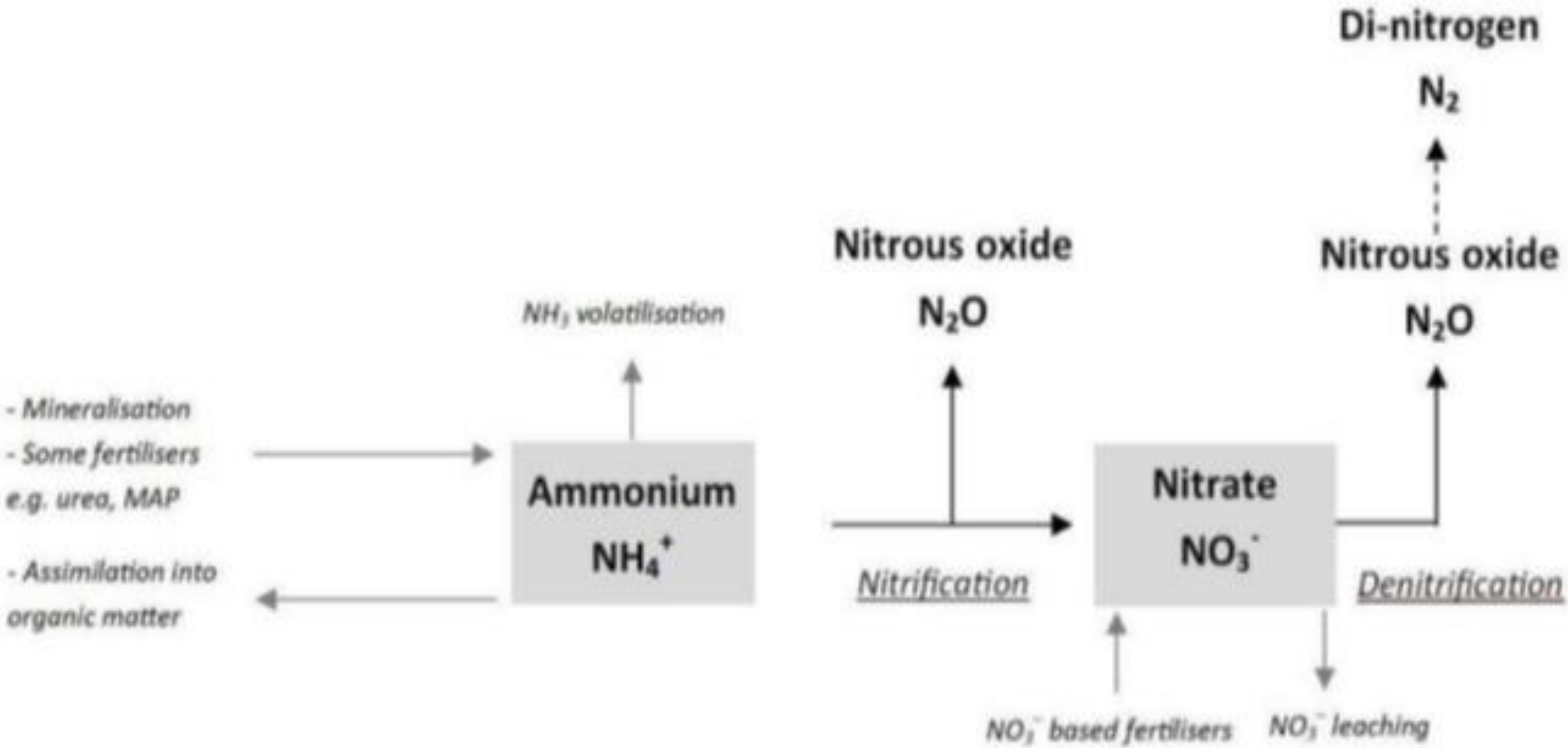
@MangoMaterials

Sign up for our newsletter –
www.mangomaterials.com

Stanford engineers use rocket science to make wastewater treatment sustainable

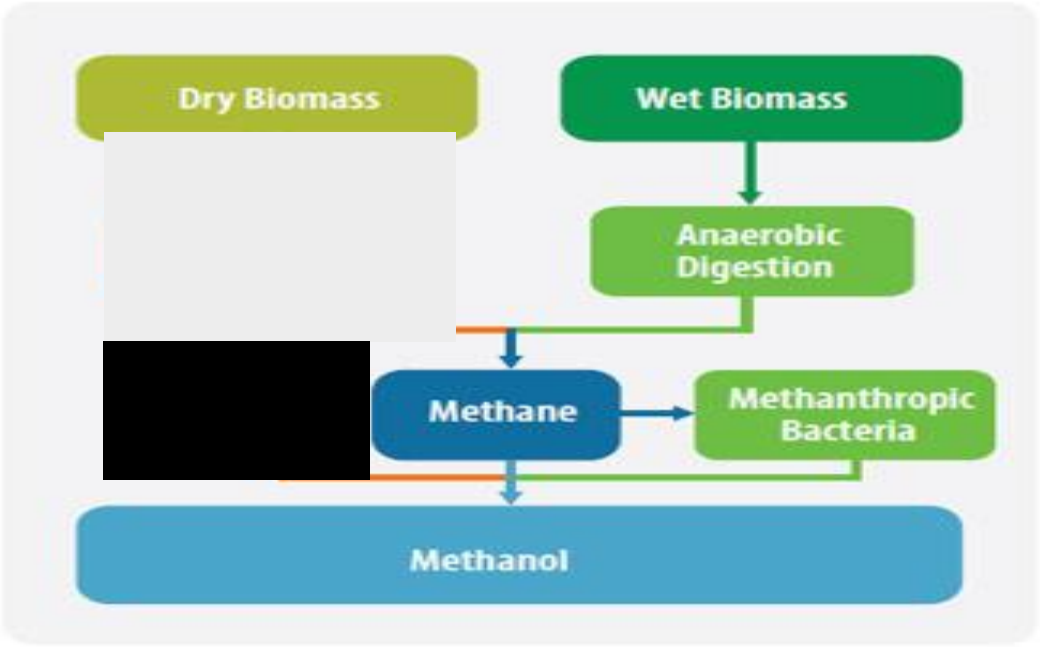
Researchers encourage bacteria that produce nitrous oxide and methane in sewage sludge. The gases can then be cleanly burned to produce energy to run the plant.

Nitrosomonas europaea appears to produce N_2O by more than one mechanism. Moderate amounts are released under full aeration, but the release increases sharply in response to oxygen limitation. Poth and Focht showed that *N. europaea* denitrified with NO_2^- as the electron acceptor and that the labelling pattern observed (with either $^{15}NH_4^+$ or $^{15}NO_2^-$) indicated that N_2O was primarily a product of NO_2^- reduction, rather than a by-product of NH_3 oxidation. The presence of nitrite reductase in*N. europaea* has been demonstrated in several investigations and it is probably involved in the production of N_2O by this organism under oxygen-limiting conditions


Di-nitrogen
N_2
Nitrous oxide
N_2O
Nitrous oxide
N_2O
NH_3 volatilisation
- Mineralisation
- Some fertilisers
e.g. urea, MAP
- Assimilation into
organic matter
Ammonium
NH_4^+
Nitrification
Nitrate
NO_3^-
Denitrification
NO_3^- based fertilisers
NO_3^- leaching

NITROUS STORAGE

- For racing purposes, nitrous oxide is usually contained in an aluminium cylinder; available in a variety of sizes ranging from 2.5 lbs to 20 lbs. While retained in the cylinder the nitrous is in a liquid form and held under high pressure. When it is released from the cylinder into the intake tract its physical state changes from a liquid to a gas. This transformation occurs as the nitrous is released from an area of extreme pressure (the aluminium cylinders are pressurized to approximately 1000 P.S.I.) into the vacuum of the intake manifold. This change in state is usually referred to as the nitrous 'boiling'.



Methanol, also known as methyl alcohol, is often abbreviated as MeOH.

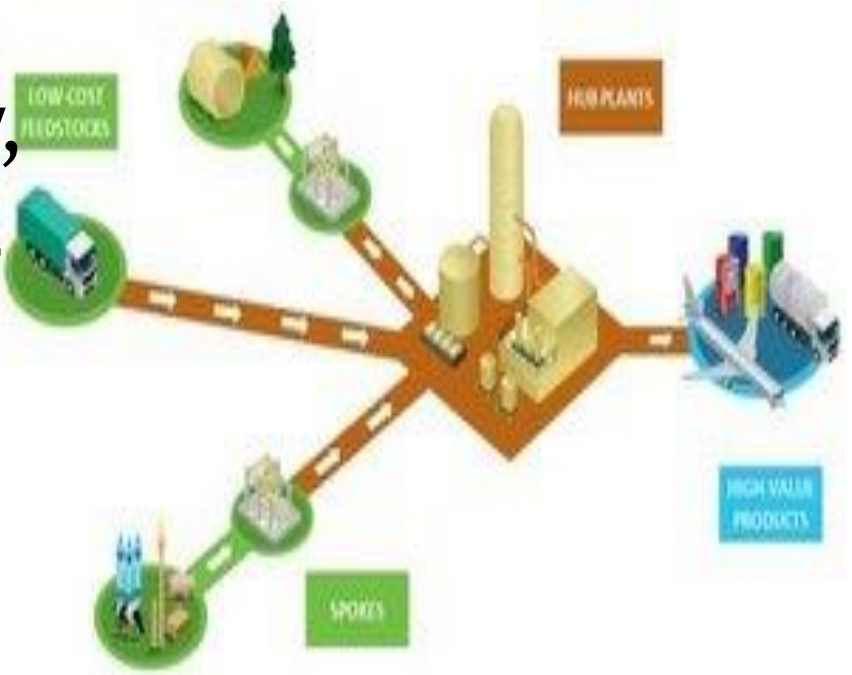
Biochemical pathways

One biochemical route is via methane formation by anaerobic digestion. This process is well developed due to the rise of biogas production from municipal waste or landfill sites.

The biogas has to be cleaned to obtain a gas with high methane content and MeOH is then produced from the methane as described above.

Recently a genuine biochemical route using methanothrophic bacteria has been investigated. For example, bacteria such as *Methylococcus capsulatus* will convert methane to MeOH if methane is the only available resource.

Maverick Synfuels, a leader in alternative fuels and chemicals production technology, and Plant Process Equipment Inc., a global energy engineering and fabrication company, have formed a partnership to manufacture and sell small-scale gas-to-liquids (GTL) methanol plants. These skid-mounted modular plants can be rapidly deployed and are capable of producing between 3,000 – 10,000 gallons per day of ultra-clean synthetic fuels and chemicals from natural gas or methane-rich “waste gas.”



If you produce 100,000 gallons of sludge/Day

100,000 gallons x 8.34 x 0.04 x 70%=

23,352 Lbs. Volatile solids

Destroy 55% by Anaerobic Digestion=

12,843 Lbs. Destroyed

12,843 Lbs. x 15 Ft^3 / Lb. Destroyed=

192,645 Ft^3

*NEED 186,000*Ft^3

To make 3,000 to 5,000 gallons of Methanol/Day

That's a 33.0 to 35.0 MGD activated sludge Plant.

•Here are just some types of materials that are made from methanol:
Plastics
•Synthetic fibers
•Paints
•Resins
•Magnetic film
•Safety glass laminate
•Adhesives
•Solvents
•Carpeting
•Insulation
•Refridgrants
•Windshield washer fluid
•Particle board
•Pigments and dye

ALGAL SCIENTIFIC

Why us, why now?

We address a growing environmental problem with game-changing technology and an experienced team

Management Team

Paul Horst (CEO). Jim Fahrner (CFO)

- Founded industrial computer company, 9x cash over cash exit in 3 years, later spun off as NASDAQ company
- Grew alternative energy subsidiary of DTE Energy to over $40M

Geoff Horst (CSO), Robert Levine (CTO)

- Developed Algal's patent-pending treatment process
- PhD candidates in biology and chemical engineering

Mike Maringer, James Bleyer (operations, engineering)

- Managed Campbell Soup's largest wastewater treatment plant (10 million gallons per day), highest certification
- Designed and built bio-fuel plants

Notable Advisors: Joh Kang, Walter Weber

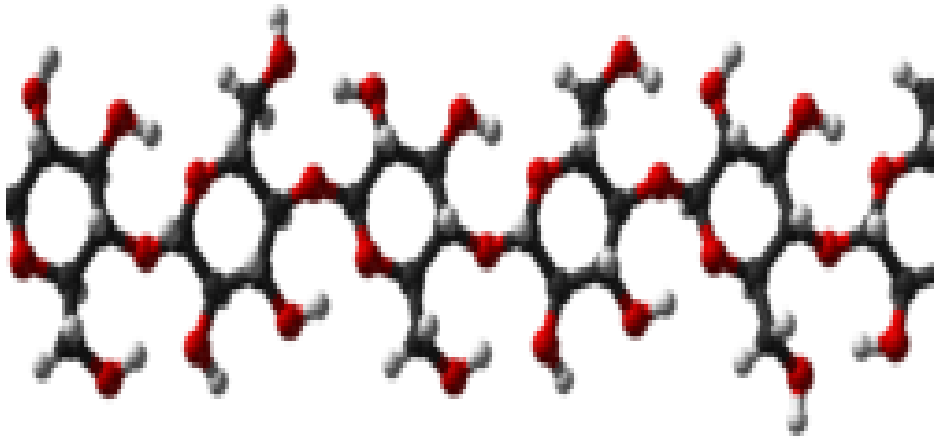
- PhD, VP & Director of water at Tetra Tech
- PhD, Professor Emeritus, U. Michigan

Engineering Partners

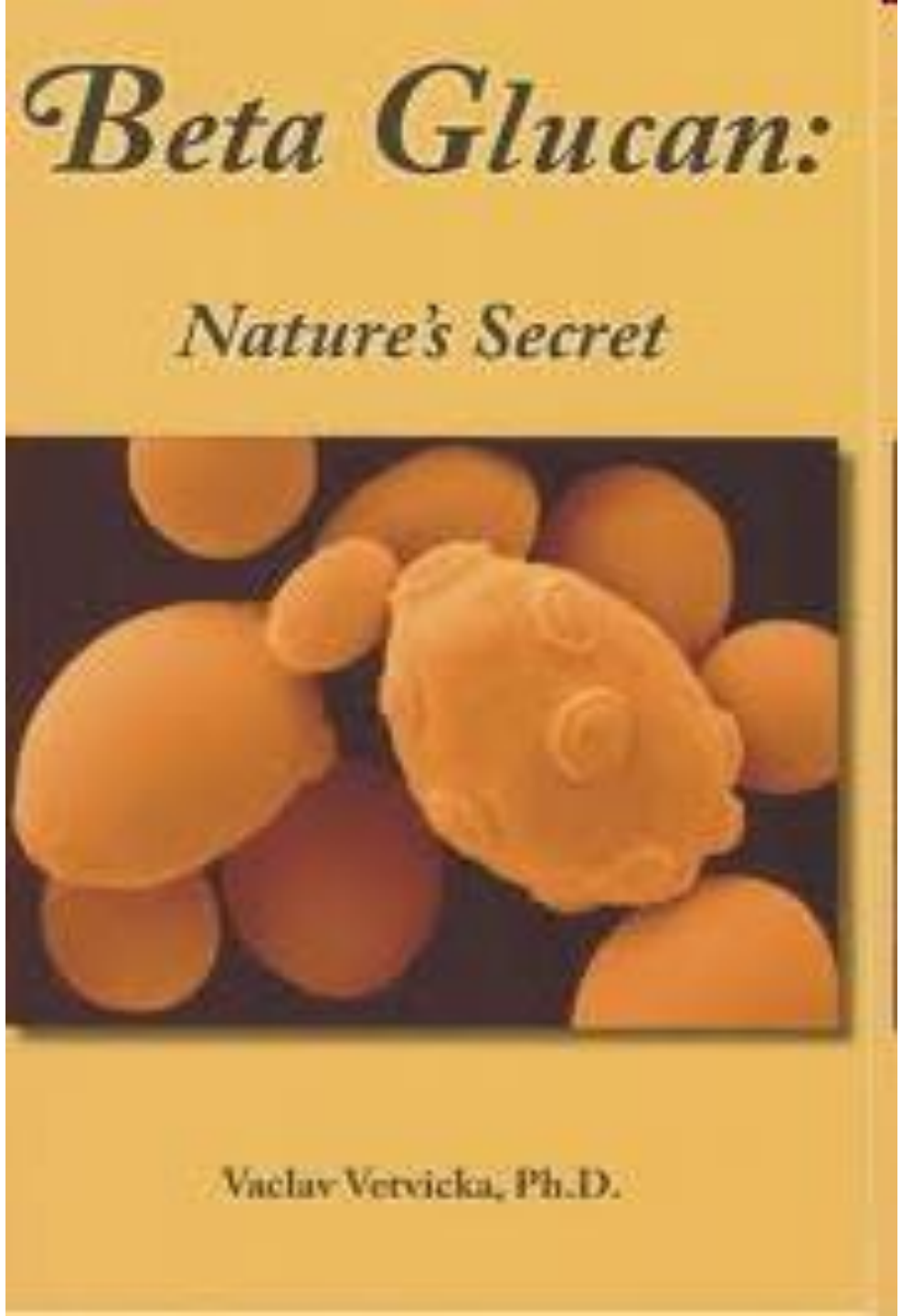
- Alan Environmental – John Baker


Took an idea (new way to treat wastewater), built and operated
the pilot units, sold the concept to Anheuser-Busch and now have
a full scale system treating nearly 2 million gallons per day

What is Beta Glucan?It is not a vitamin! Beta glucans belong to class of carbohydrates called polysaccharides. Beta Glucan is a fiber-type of sugar that come from the cell walls of yeasts, algae and other microorganisms.



3D structure of cellulose, a beta-glucan polysaccharide.



Beta-1,3-D glucan Clinical Applications

- Cancer
- Elavated Cholesterol
- Prevention of Infection
- Raditation Exposure
- Septic Shock
- Surgery
- Wound Healing

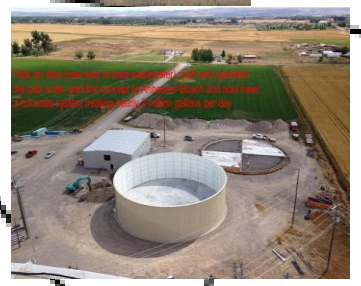
Stimulates the Immune System

ALGAL SCIENTIFIC

ALGAMUNE

High potency beta glucan for Animal Health

THE JOURNEY



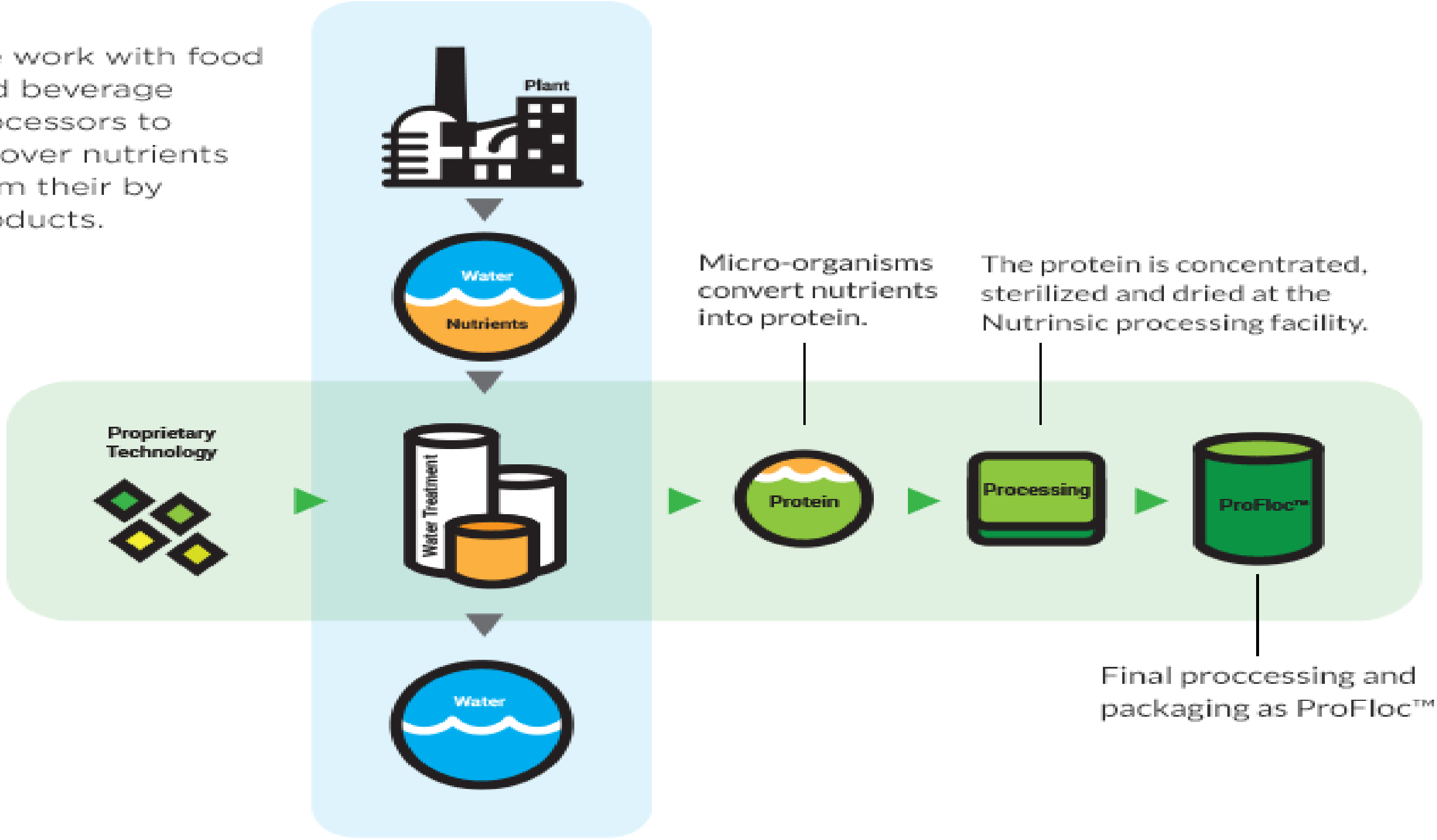
CIFT
Center for Innovative Food Technology

RUMPKE

A Little Closer to Home


MillerCoors™
Water Reclamation Center
NUTRINSIC
Trenton, Ohio

We work with food and beverage processors to recover nutrients from their by products.



Could we make meat out of this protein?

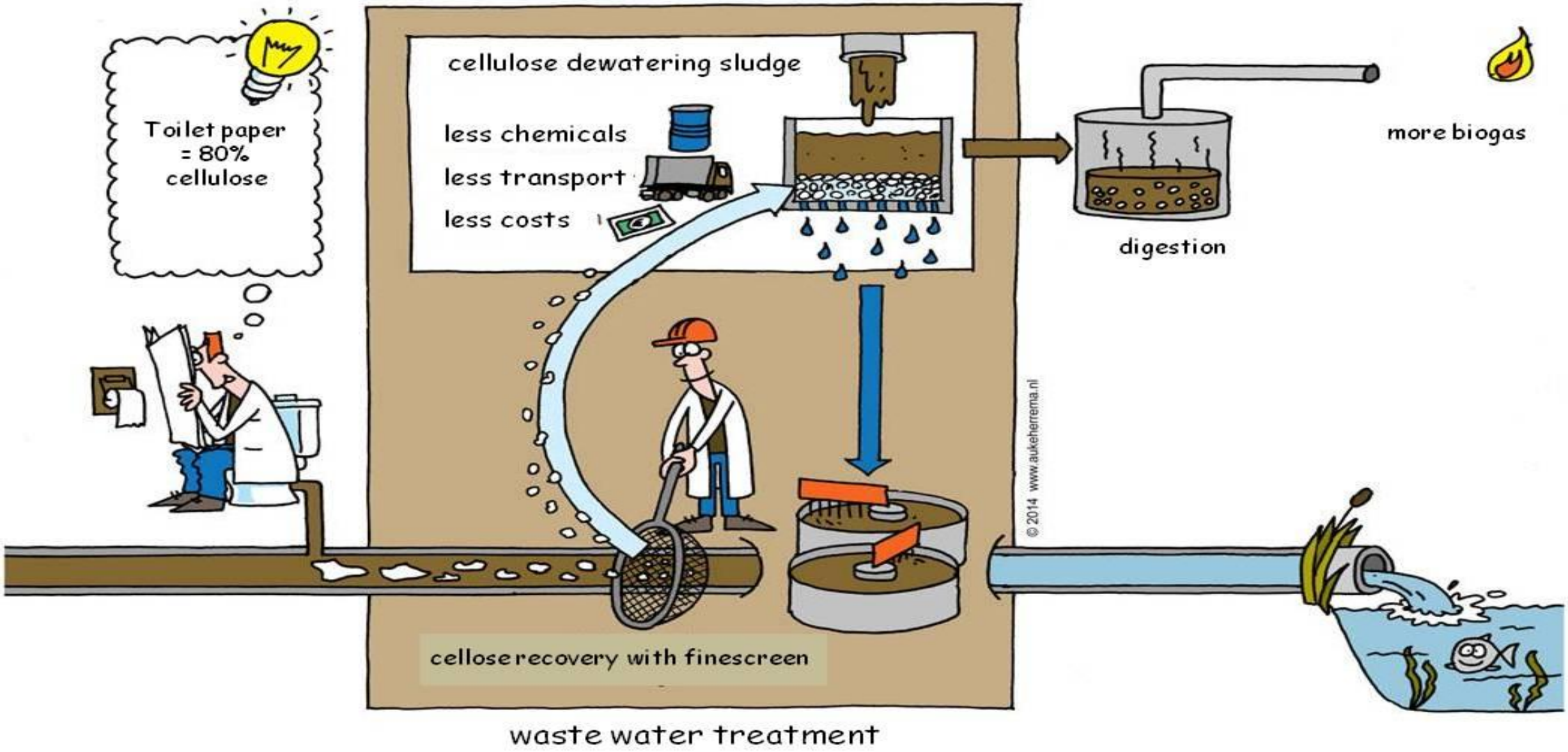
RECYLLOSE™

"An endless untapped and unlimited resource!"

Plastic	Insulation/ construction	Energy	Pulp and Paper

"One man's trash is another man' treasure"

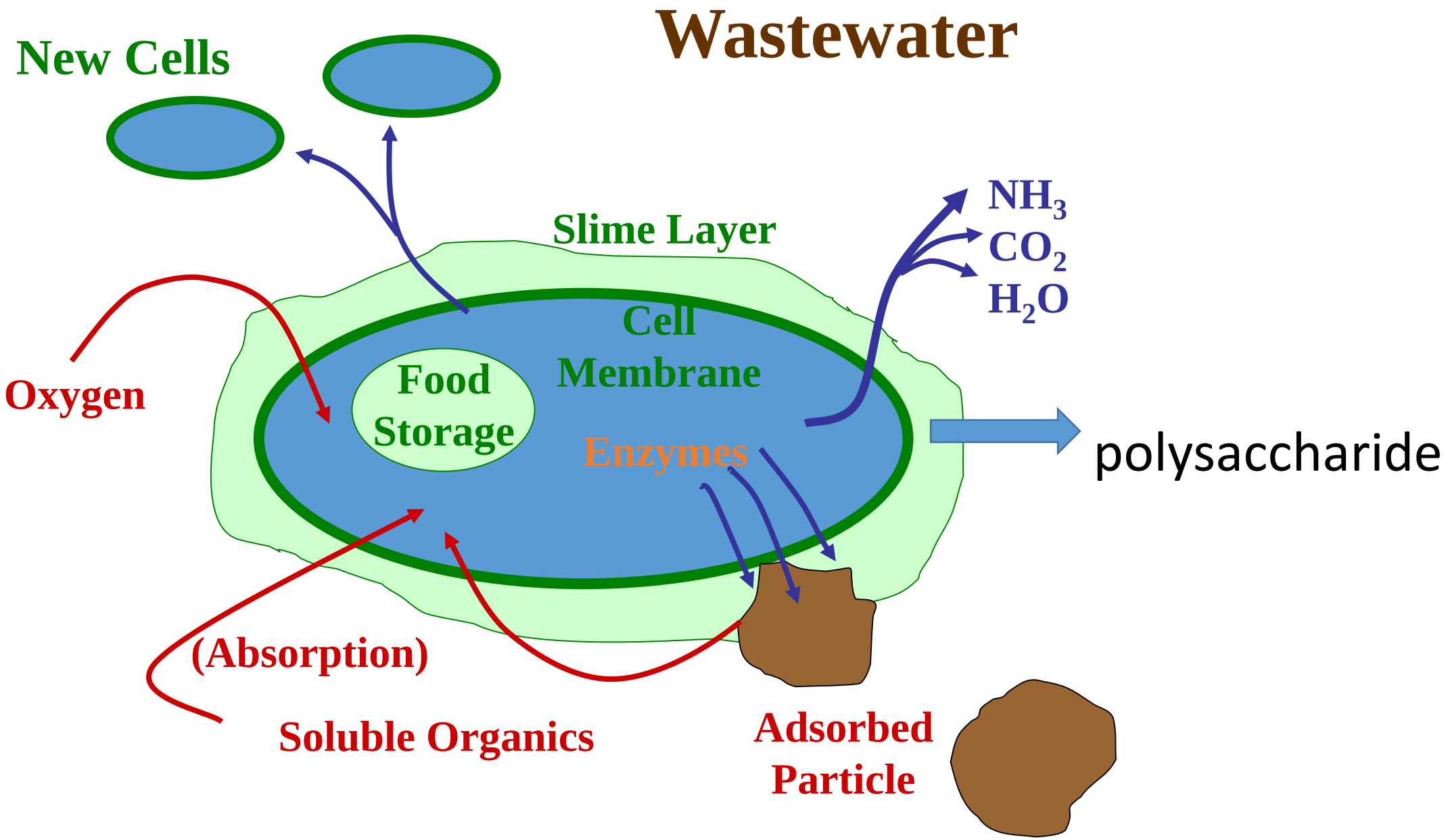
BioForm
Sewage Mining



waste water treatment

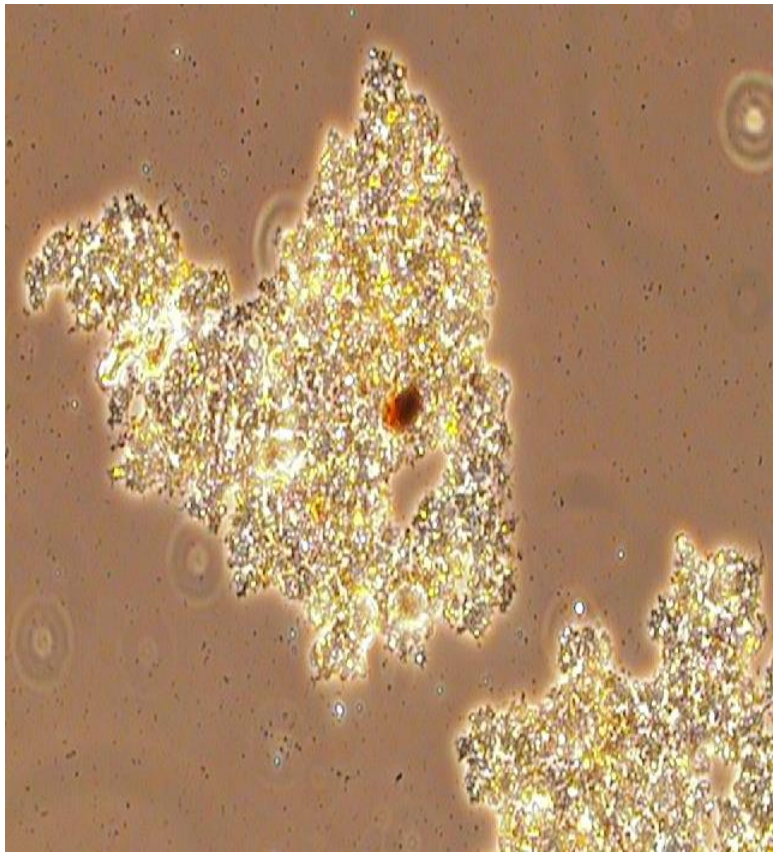
Bacterial cellulose is an organic compound with the formula $(C_6H_{10}O_5)$ produced by certain types of bacteria. While cellulose is a basic structural material of most plants, it is also produced by bacteria, principally of the genera *Acetobacter*, *Sarcinaventriculi* and *Agrobacterium*.

Bacterial, or microbial, cellulose has different properties from plant cellulose and is characterized by high purity, strength, moldability and increased water holding ability.[1] In natural habitats, the majority of bacteria synthesize extracellular polysaccharides, such as cellulose, which form protective envelopes around the cells


Wastewater
New Cells
Slime Layer
NH_3
CO_2
H_2O
Cell
Membrane
Food
Storage
Enzymes
Oxygen
polysaccharide
(Absorption)
Soluble Organics
Adsorbed
Particle

.

Biomass 400X



7200X

PLANT AT HEADWORKS

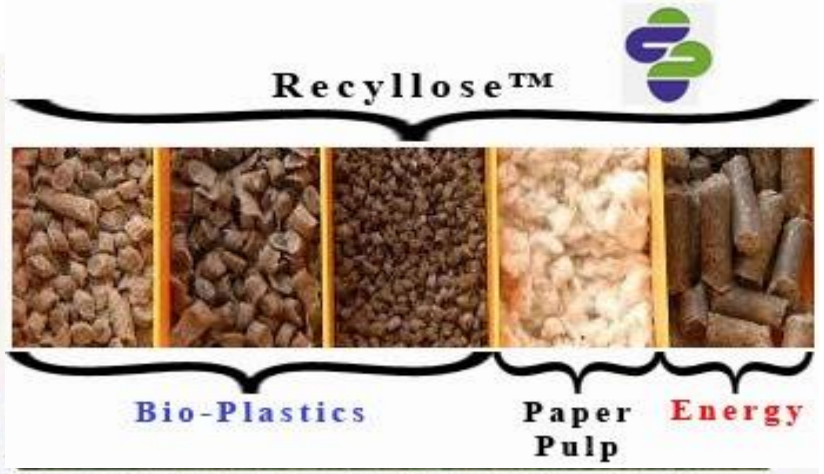
Applied CleanTech

SRS: Sewage Recycling System

We offer a unique and effective technology that pre-treats wastewater in its early stages, before sludge is formed. Our patented proven SRS sewage mining technology recycles sewage solids, thus creating a commodity that is high in demand. The SRS technology treats the sludge problem before it occurs by reducing sludge formation by up to 50% and significantly decreases sewage-related health hazards and treatment costs.

Recyllose™ : Revenue-Generating Resource

Based on proven proprietary wastewater-recycling technology, our sewage mining solution (SRS) automatically extracts cellulose out of raw wastewater and turns it into a valuable revenue-generating commodity: Recyllose™ (recycled cellulose). Recyllose™ has numerous applications in various industries, including construction, insulation, pulp & paper, and bio-plastics, can be used as an economical and environmentally-friendly fuel source, and more.



Changing the Way We Handle Wastewater

At Applied CleanTech, we developed a unique, innovative solution that automatically produces a usable, valuable and revenue-generating commodity from wastewater. Wastewater treatment plants (WWTPs) can now become manufacturers of RecylloseTM- a valuable recycled cellulose-based product from wastewater.

Our technology significantly reduces sludge formation by extracting cellulose out of raw wastewater. By doing so, we save costs and energy consumption to WWTPs throughout the entire process, as well as increase WWTp's capacity and reduce greenhouse gas (GHG) emissions & carbon footprint.

While Researching Renewable Energy - I Found This !

The crematorium currently holds around 2,100 services a year. This is enough, engineers estimate, to allow each turbine to generate 250 kilowatt-hours, enough electricity to power 1,500 televisions.

A *crematorium* in the city of Durham in the UK recently announced that it would use heat from its burners to produce electricity and bring down its energy costs. If the idea is realized, the company will install turbines in two of its burners and sell the excess energy to Great Britain's National Grid. In return, it will receive compensation from energy companies under the feed-in tariffs program. The third furnace will continue to warm the site's chapel and offices.

The amount of electricity that could be produced by the furnaces would depend on how much they are in use—or more to the point, *on the death toll.*

MICHIGAN FANS WANTED !

100,000/2100 x 250 KWH = 11,904 KWH ave. Home for one year – I didn't include visiting team fans!

Problem Solved - offer the Big House

WASTEWATER CARRY OUT

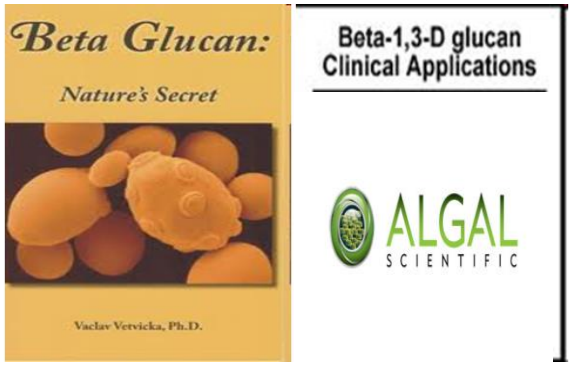
Aisle 1
BEVERAGES

Bottles or Cans

Aisle 2
MEATS

Operators Wanted

Aisle 3
Pharmaceuticals



POWER COMES FROM

Remember your “POWER comes from **Within”**

MIKE’S idea of a Bi – Fuel Vehicle

THANK - YOU