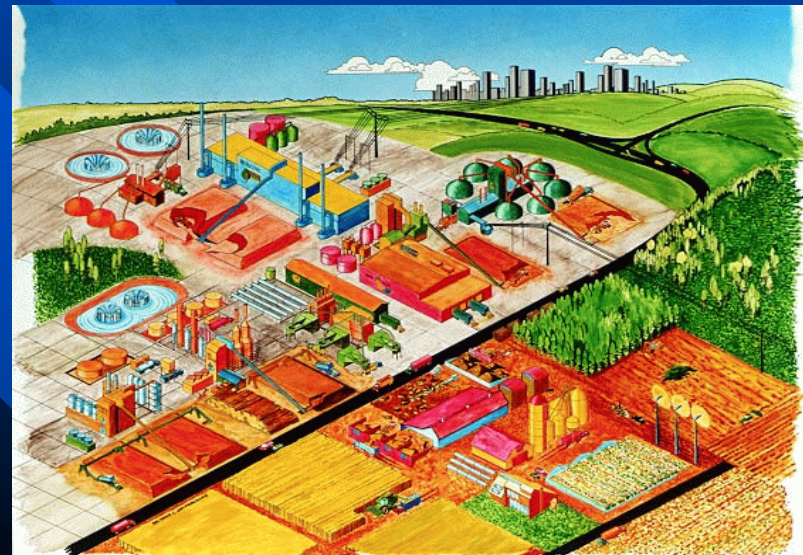
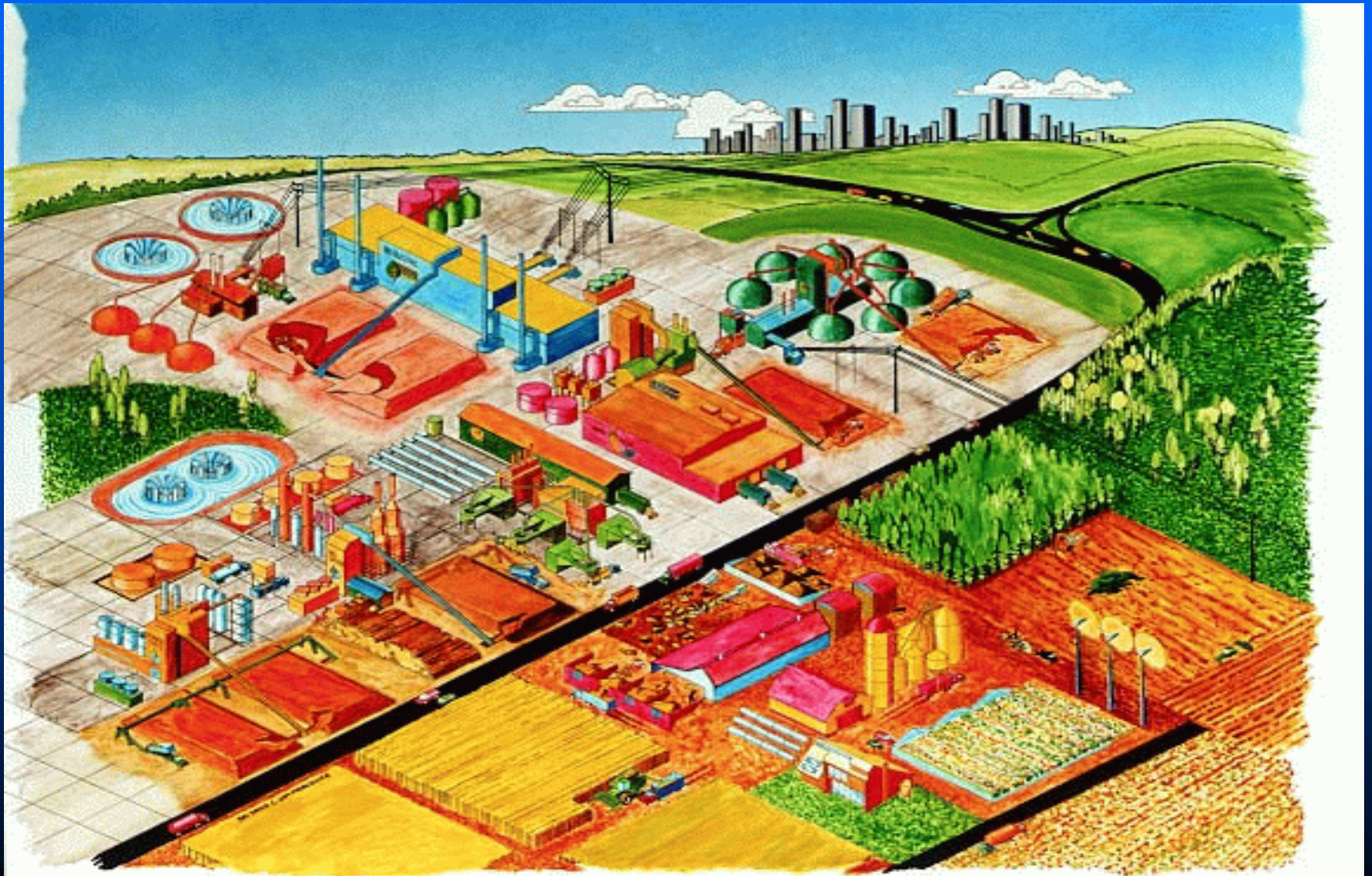


Dairy Renewable Energy: Grid Interties & Why's

Dr. F. Michael Byers Ph. D, Byers
Communications International Consultancy
Steve Miller, Wayne Blenkhorn,
Stonecrest Engineering
Shakespeare Ontario



Dairy Energy Centre



“Terror-Free”

&

“Carbon Neutral”

Foods & Fuels

On-Farm Energy Issues & Options

For Foods &
Fuels

Pawton Energy Centre

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Energy Generation & Integration

Dairy

Wind

Solar

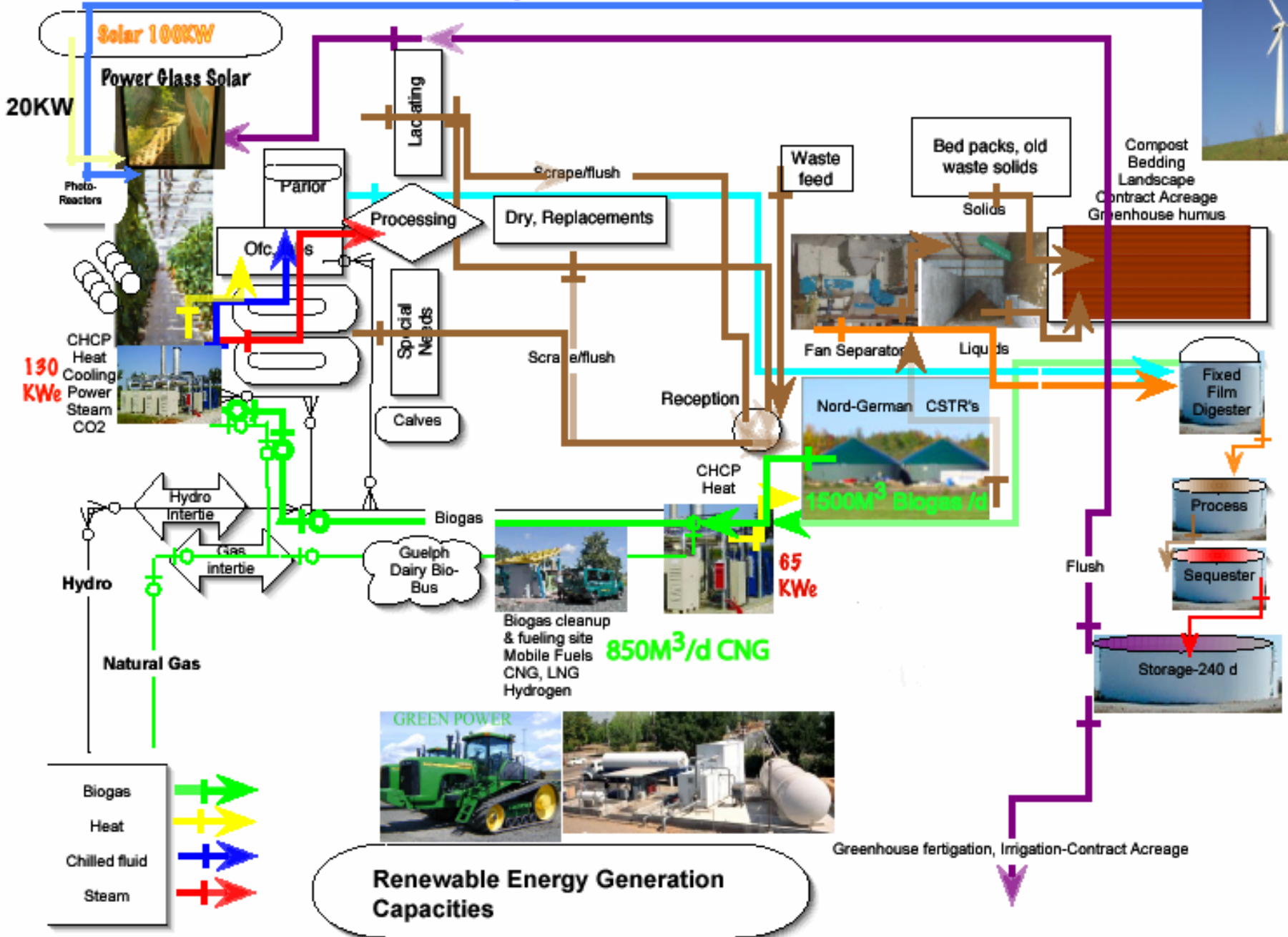
Hydro

Mains Gas

Fuels

Greenhouse Winter Night CHP-240 KW/h-Wind

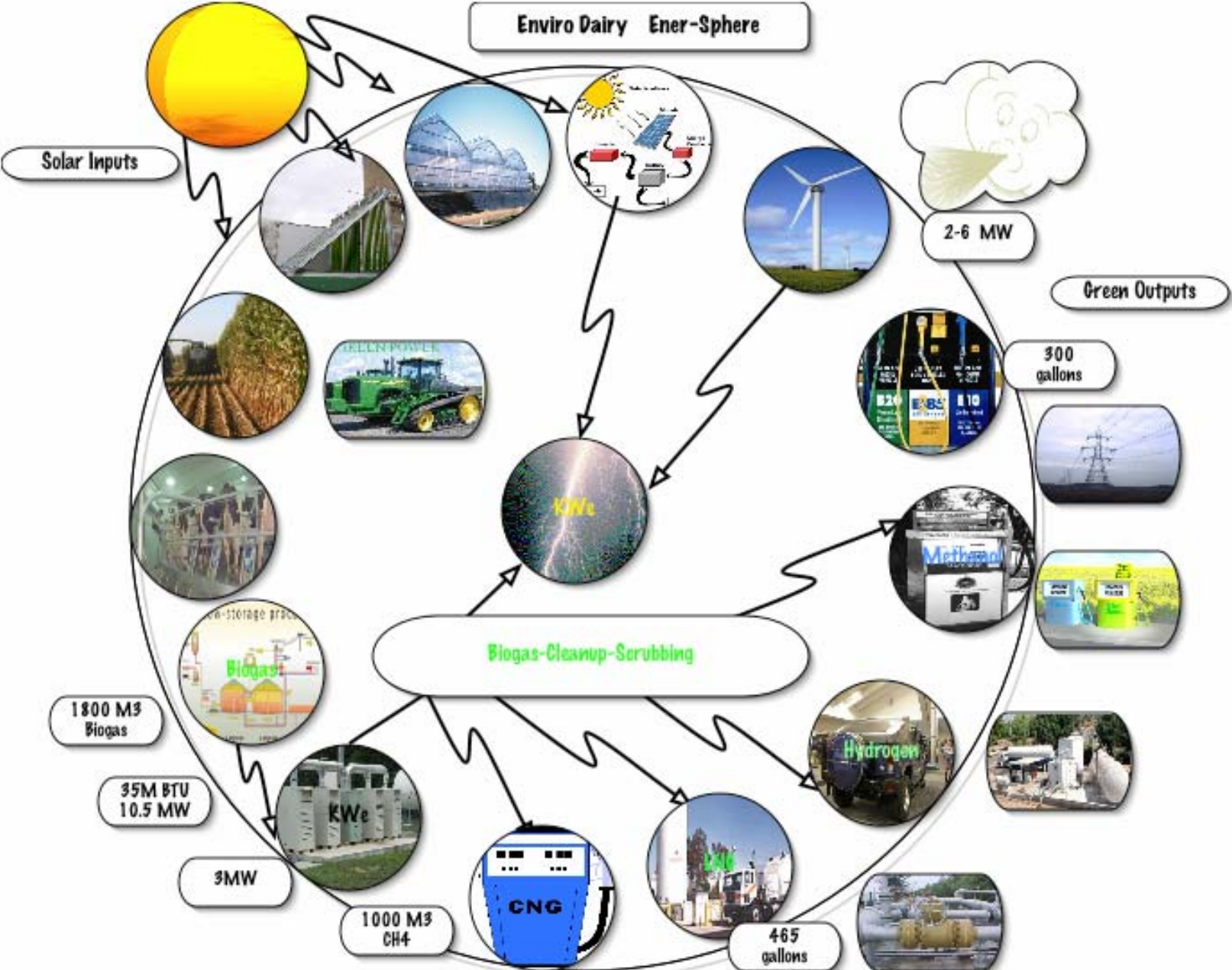
Fuhrlander 600KW



Renewable Energy Generation Capacities

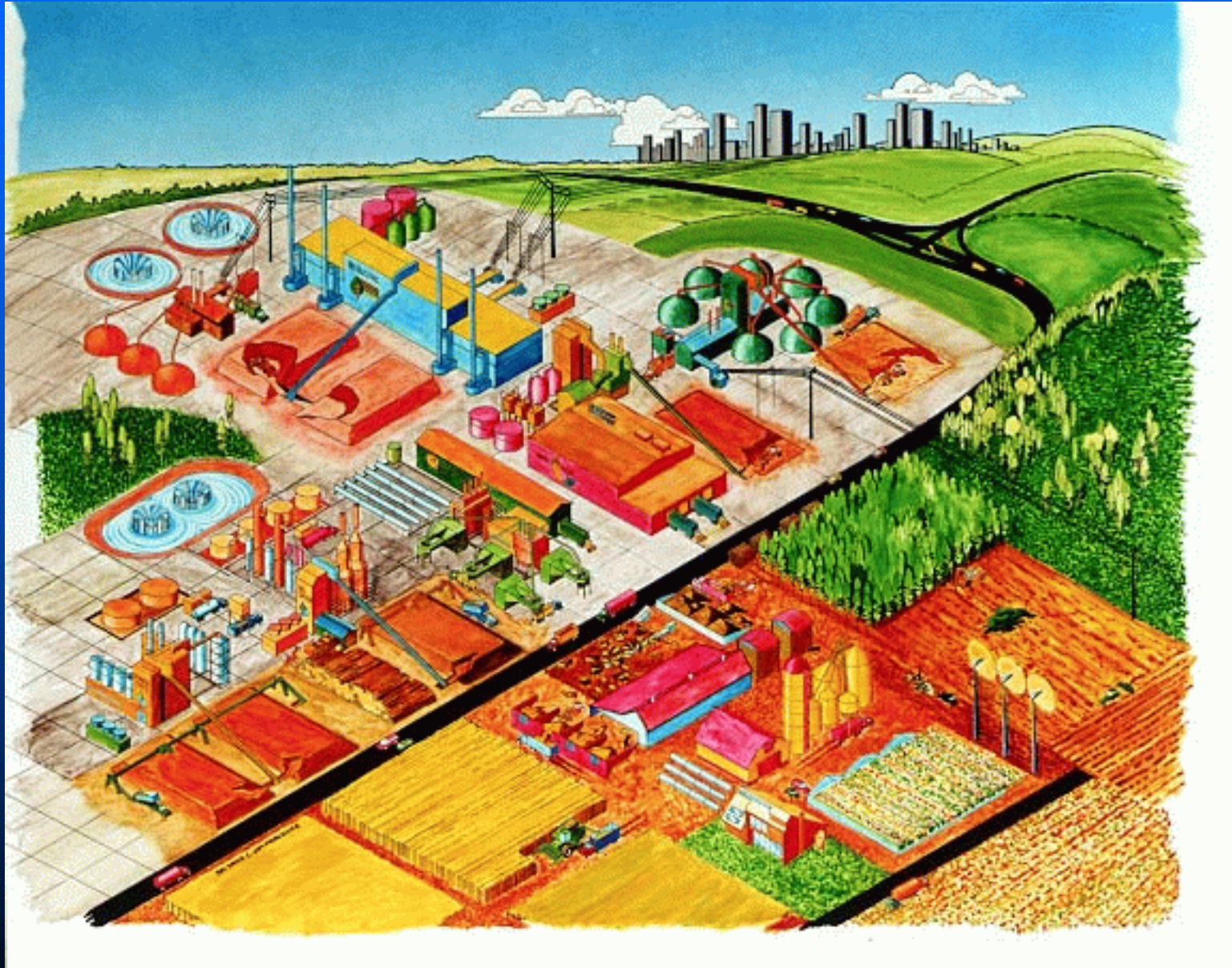
Greenhouse fertigation, Irrigation-Contract Acreage

Enviro Dairy Ener-Sphere



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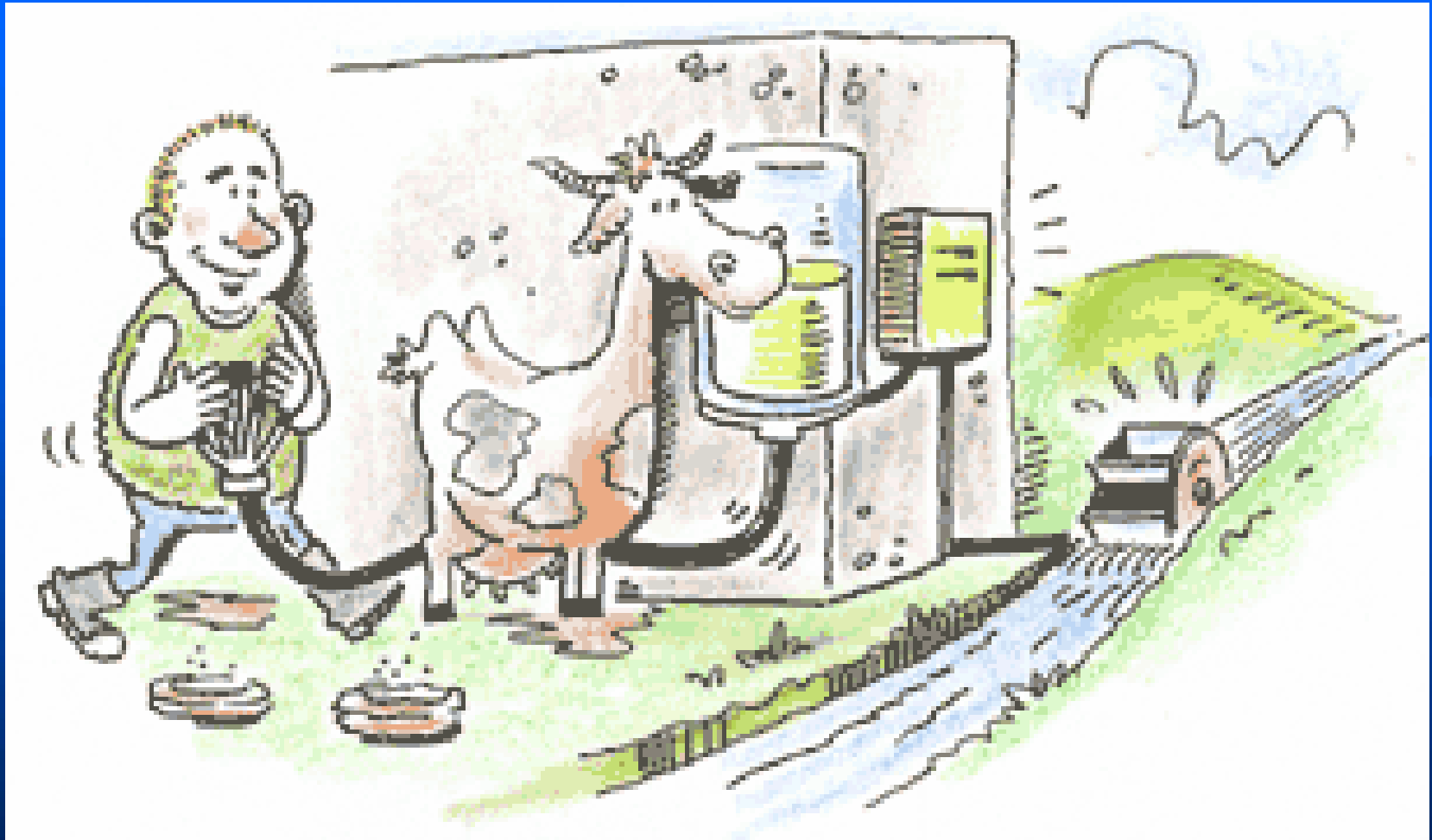
Agri-Ecology Systems

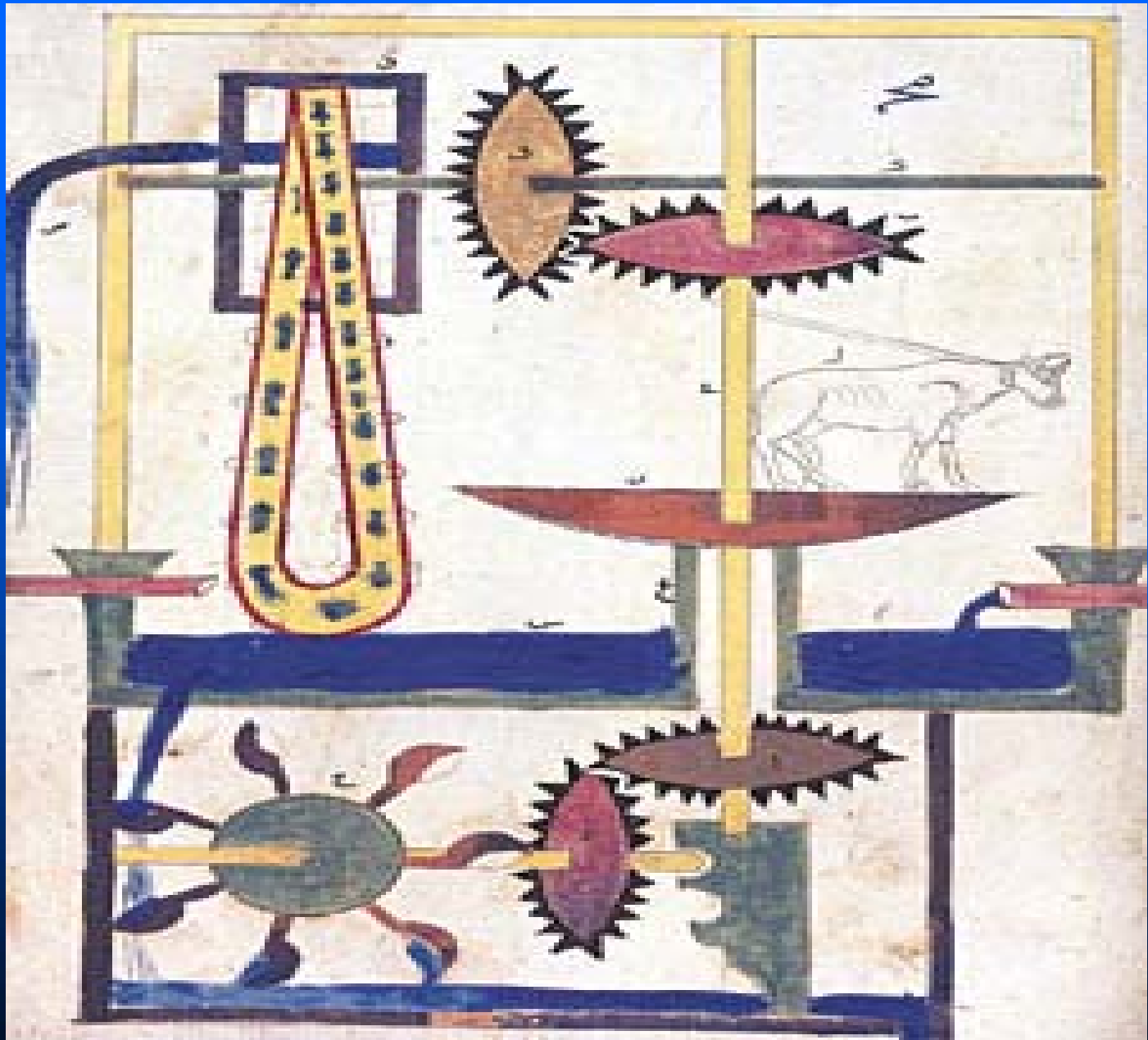


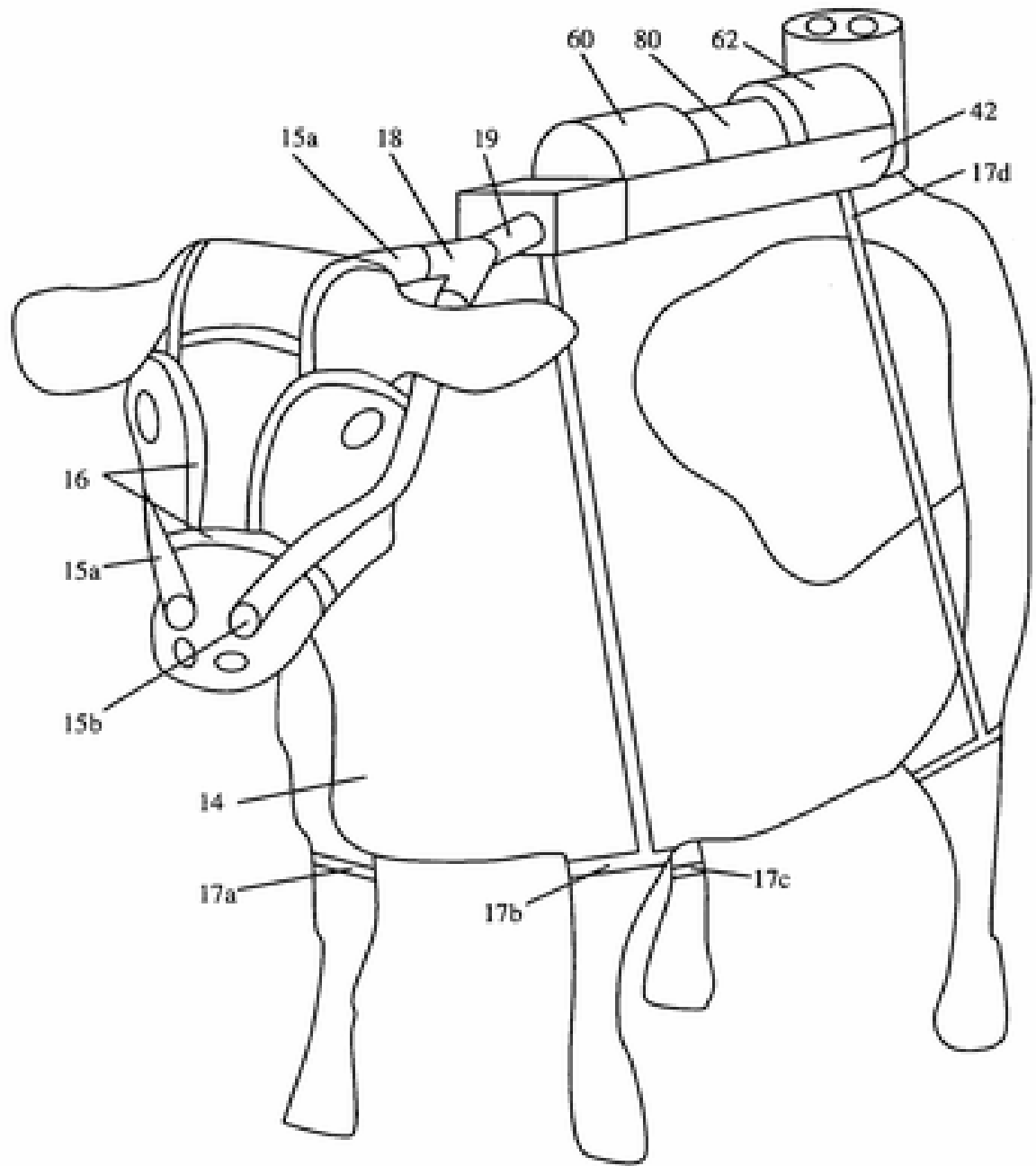
Hydro Inter-Ties

Issues and Options

Just What's
Cow-Hydro
Anyway???







Energy Marketing Scheme(ers)

Who guards the
Henhouse

Or

Follow the Money



scottgbrooks.com

Intertie Ground Truthing

- It's nigh impossible in most states to hook up a small generating unit to the electrical grid in a truly profitable manner, says Kurt Roos, director of the Environmental Protection Agency's (EPA) AgStar program, which fosters biogas energy production through a variety of methods.

Hydro-Inter Tie Issues-2

- Relatively high costs and a general unwillingness of electrical companies to cooperate with on-farm electrical generators are primary barriers.
- New York and California have used state initiatives and/or legislation to force electrical providers and sellers to work with biogas electrical producers. But most states haven't.
- “It takes away from (utility company) customers because if you have a dairyman who's spending \$50,000 a year on electricity and suddenly he's not — that's a concern,” says Allen Dusault of Sustainable Conservation, a California-based non-profit organization promoting ecological collaboration and problem solving.

Hydro-Intertie Issues

- » Electrical companies have some valid concerns about co-generators, such as the electrocution of workers in the event they shut down power to a section of line and a farm-based generator continues to feed energy into it. But these and other issues can be handled with technical standards, says EPA's Roos.
- » Many electrical companies charge enormous insurance fees, which are prohibitive to farm-scale biogas generators. Another barrier is “stand-by provisions,” which stipulate that if you quit buying electricity, you must pay the company a portion of the income you took from them.
- » A common tactic is to require farm generators to cover expensive studies on the effects of hooking into the grid, then deny the request. The only appeal is to the company that just refused the application. Other electrical companies simply refuse to buy from small biogas generators.

Energy Scenarios

■ Dairy Base Case

- What to produce
- Where to market
- How to prepare the products
- What form to market
- Target customers/clients

Energy Scenarios

■ Dairy Base Case

– State of the Art AD- New Millennium Dairies

» 4-22 Kwh hydro/cow/day

» 3X this in Equivalent 99% bio-methane

■ For fuels

■ For foods

■ For fertilizers

Hydro Interties

■ Dairy Base Case

- Uses Lots of power
- Regular customer
- Uses power throughout the day
- May be some whole skimming
 - » Ice builders etc.

Hydro Interties

- Dairy Case 1- Generate Hydro
 - Lost income for hydro utility
 - Potential power source
 - May do peak stripping
 - May do more whole skimming
 - » Ice builders etc.

Hydro Interties

- Dairy Case 1- Generate Hydro
 - Becomes hydro competitor
 - Hydro tries to discourage
 - Hydro stonewalls
 - Hydro reverts to “regulations”
 - » Environmental impact reports etc.

Hydro Interties

- Dairy Case 1- Hydro tries fees
 - Env & connect studies
 - Stranded costs
 - Standby charges
 - Net metering-single meter
 - Pay min. wholesale
 - Take green credits through contracts

Inter-Tie- An Experience

- Scenic View Dairy Experience: Scenic View Dairy was the first Michigan dairy to connect and sell power to the electric grid. The power purchase agreement negotiation and interconnection process for Scenic View Dairy elapsed over a 13-month time-frame, exceeding the ~2 month timing established by regulation and utility procedures. Total costs for primary and secondary side equipment, engineering and administrative/legal fees exceeded \$225,000. Equally significant, the process was delayed by the utility at several points resulting in additional loss of income and higher operating costs to our business. While waiting for the connection, the project was unable to save or make money by generating electricity during the highest period of usage over the summer.

Mains Gas

Issue and Options



Mains Gas Interties

- Dairy Case 1- Generate Pipeline Renewable Natural Gas
 - Gas co. buys at 99%+, sells at 95%
 - Can't be done, or Not done here
 - It' technically feasible-but
 - Threat to central sourcing

Mains Gas Interties

- Dairy Case 1- Generate Pipeline Renewable Natural Gas
 - Cleanup to “standards”
 - Solve pipeline sizing issues
 - Contracts???
 - Seasonality of Gas co. needs

Primary Fuels Generator

- Dairy Case 1- Fuels options
 - Renewable Natural Gas
 - Vehicle fuels
 - » CNG
 - » LNG
 - » Hydrogen
 - » Hythane
 - » Ammonia
 - Fertilizers
 - » Ammonia
 - Others

Integration

Sources

&

Sinks-Useages

Sphere of Focus
*Energy Research / Harvesting
& Facilities*





Generation

E/D 2050 Need
3MWh Heat/d

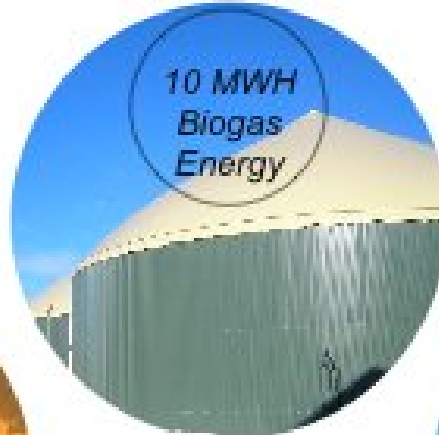


1-4 MWh
Solar KWe

Export

Net 40% biogas
(4MWh Energy)
to CNG, storage,
grid or mobile fuel

10 MWh
Biogas
Energy



E/D 2050 Need
2MWh
Electricity/d



2-4 MWh
Wind KWe

Biogas potential
3MWh Electricity
5MWh Heat
Through Microturbine

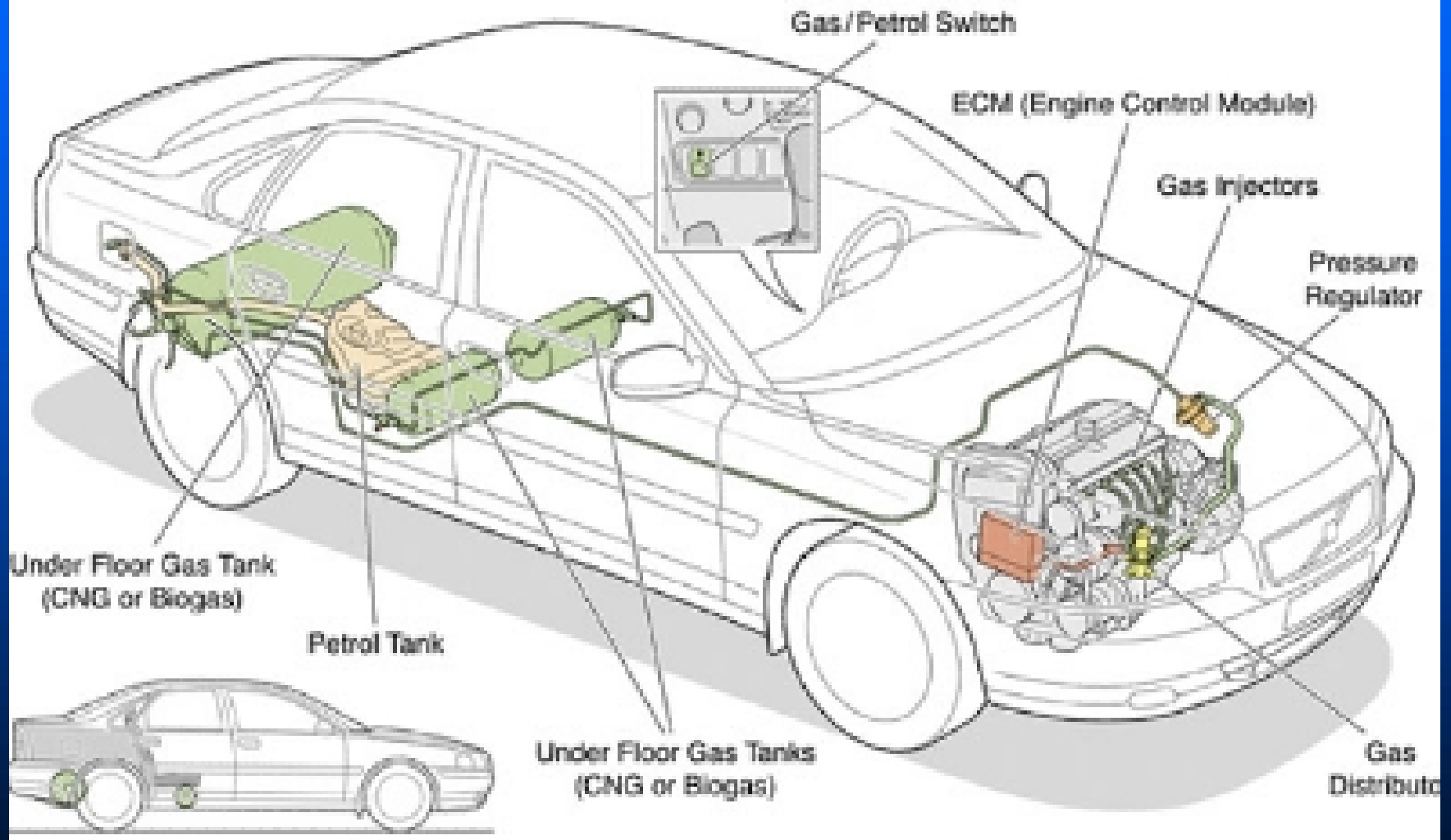
Export

Net 3MWh/d
Hydro to storage
(hydrogen) or Grid

Mobile Fuels

The image features a solid blue background. In the upper center, the words "Mobile Fuels" are written in a large, yellow, serif font with a black drop shadow. In the lower right quadrant, there is a decorative graphic consisting of four parallel, diagonal lines of a slightly darker blue color, extending from the bottom left towards the top right.

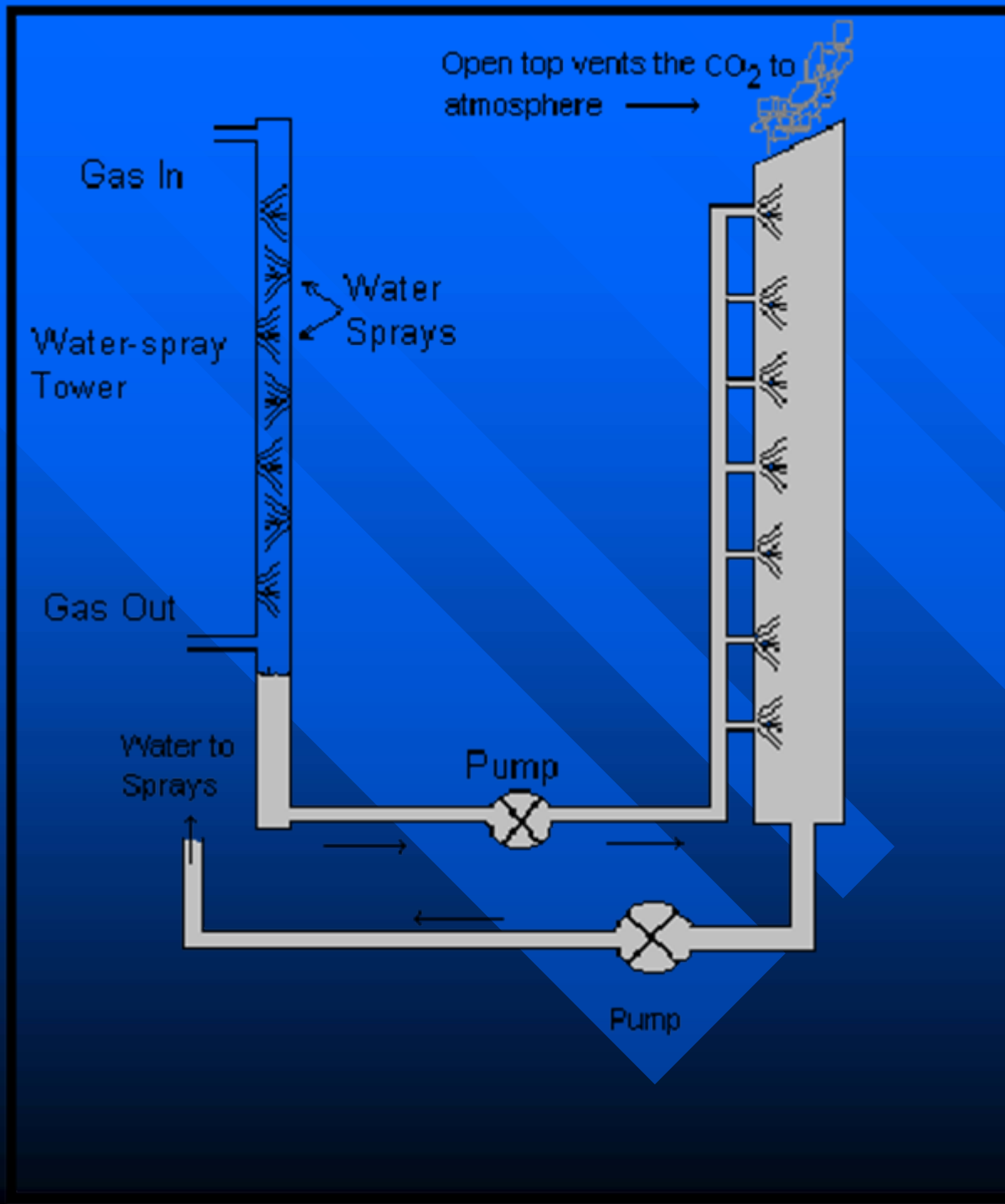
Bi-Fuel System (CNG, Biogas)

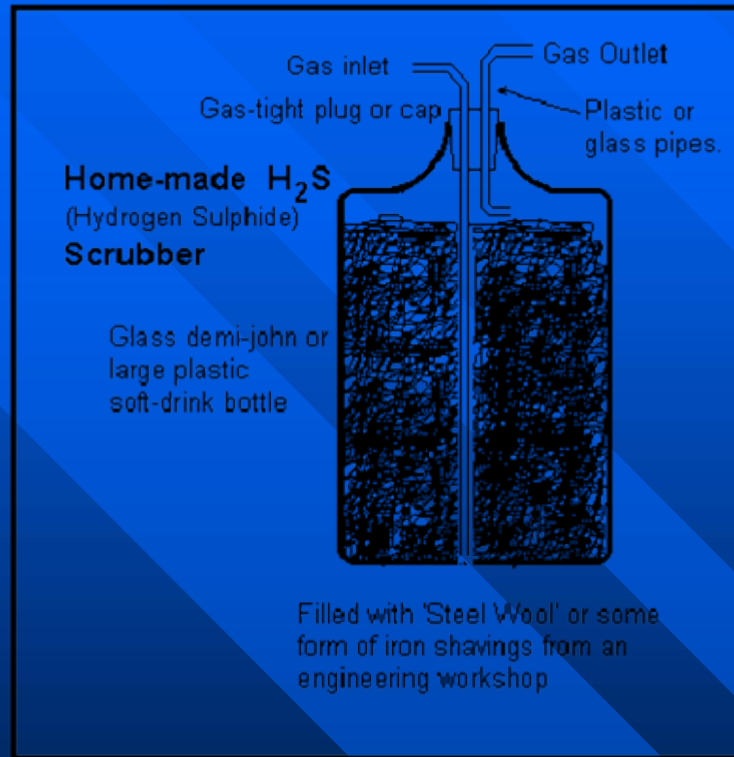


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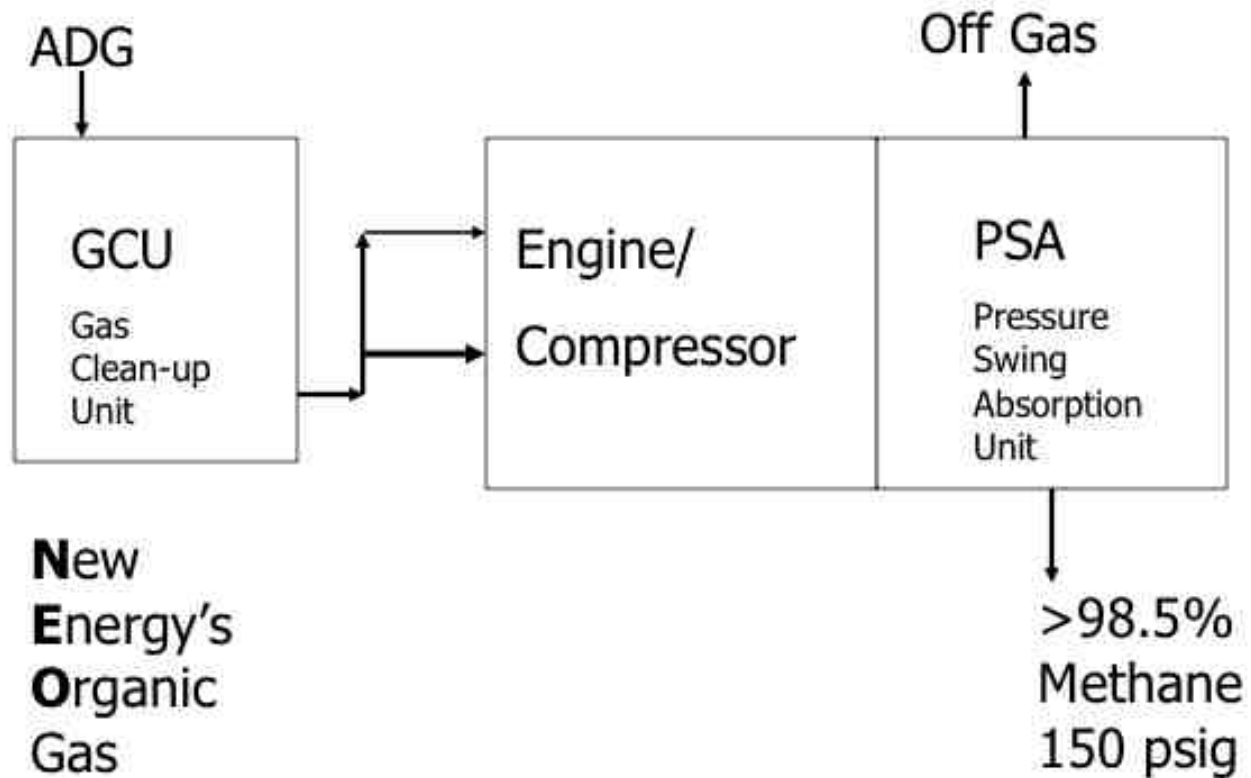


Interfaces

- 2.5 kW Electric at 120VAC / 60Hz (start-up and freeze protection if plant shuts down)
- 0.5 gph of water to be discharged back into the wastewater treatment facility (water condensed from the ADG gas flow at various points)
- Tie into ADG line – NESI's unit can handle 50,000 scfd of ADG
- Tie into natural gas feed line – NESI's unit will produce up to 1,200 scfh of pipeline quality natural gas



NEO-Gas™ Plant



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Pressure Swing Absorption Unit

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Mains Gas Generation & Marketing Systems

US Dairies

Current

Status

Cow Gas In The Pipeline-Texas

- Environmental Power Corporation, a key player in the renewable biofuels industry, says its subsidiary, Microgy Holdings, LLC, has achieved the initial delivery of pipeline quality renewable natural gas from the Huckabay Ridge facility in Stephenville, Texas. The facility is able to generate biogas from manure and other agricultural waste, condition the biogas to natural gas standards and distribute RNG(TM) via a commercial pipeline. RNG(TM) is Microgy's branded, renewable, pipeline-quality methane product.
- 30th March 2007

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Mains Gas Carbon Credits

- At full build out, Huckabay Ridge will be the largest RNG(TM) production facility in the world, with annual output of approximately 650,000 mmbtus of RNG(TM) per year - the equivalent of over 4.6 million gallons of heating oil. In addition to energy production, Huckabay Ridge is also expected to generate approximately 200,000 tons of carbon offset credits annually, based on existing Chicago Climate Exchange protocols.
- The carbon credits, have a value of approximately \$4.00 per metric ton

Mains-Gas Dairies-Michigan

- QuestAir, - to generate pipeline-grade methane for the local natural-gas distribution grid operated by Michigan Gas Utilities.
- Wilkinson declined to specify the contract's value but said QuestAir typically sells these types of products for \$100,000 to \$250,000 US.

B.C. technology key to practical cow-power plan

- Burnaby-based QuestAir Technologies said yesterday it's participating in a project to extract methane gas from 25 million gallons per year of cow manure generated at a Michigan dairy farm.

QuestAir Rotary Valve PSA System

- QuestAir's M-3200 purifies methane-containing gas streams such as landfill gas and anaerobic digester gas to high purity methane, suitable for supplementing existing natural gas supplies. The M-3200's optimized Pressure Swing Adsorption ("PSA") process system can upgrade up to 300,000 cubic feet of biogas per day.

ITR Biogas- Magic Valley ID

- RUPERT — Idaho's first and only natural gas "well" is expanding as a Rupert area farmer increases his dairy herd. The project has the attention of federal officials.
- Intrepid Technology and Resources Inc., is expanding its methane digester at Whitesides Dairy northeast of Rupert.
- The first company to produce pipeline-quality methane from cow manure, ITR, in partnership with Utah State University, is expanding its operation. Instead of utilizing about 30 percent of the dairy's waste, it will produce natural gas from 100 percent of the manure from 6,500 cows.
- All of the gas will be put into a pipeline and sold to Intermountain Gas Company, according to ITR Vice President Brad Frazee.
- The expansion will include an additional eight digester tanks and will produce enough gas to provide gas energy to 5,000 homes, Frazee said.
- "We think this could be a very viable addition to natural gas availability in America," said ITR President Jacob Dustin.
- "Each dairy in Idaho could become a source for alternative energy."

ITR Dairy Biogas Field

- Plan involves discrete projects that will ultimately bring 250,000 Magic Valley dairy cows under production to create the "Magic Valley Biogas Field" in the Magic Valley area of south-central Idaho.

Revise net metering to allow interconnected parties to freely “wheel” power

If _____ is not ready to provide an established rate for renewable energy as a means to encourage growth, we recommend to implementation of other ratemaking options for renewable energy systems greater than 30kW that include: - Systems with greater than 30kW to include at least 500kW, preferably 1000kW

- Optional "wheeling" approach, where renewable energy producers can use the grid for a fee to wheel their power to a customer with whom they have negotiated a purchase agreement without becoming an Alternative Energy Provider
 - Net-Metering against all meters paid by the same producer, or at least at the Billing Account or Site Level, which aggregates the entire energy usage of the entity owning or the site providing the renewable energy, rather than only a single meter on a multi-meter site
 - Net-Metering which provides payment for either excess power used or power generated, rather than the imbalanced approach of the renewable energy producer pays for an annual net usage, but receives no value for annual net production
 - Appropriate allocation of environmental credits (carbon, greenhouse gas, etc.), whereby the renewable energy producer retains the value of these credits unless appropriately compensated

Existing Biogas Facility

Expanded Fiber Removal Stand

Proprietary Gas
Conditioning
Equipment

Expanded Foundation for
8 Digester Tanks



“Terror-Free”

&

“Carbon Neutral”

Foods & Fuels

Dairy Renewable Energy: Grid Interties & Why's

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