Gridley's Dept of Energy Biomass Project

'The Gridley Project'

March 19, 2009 Peer Review

Washington, DC

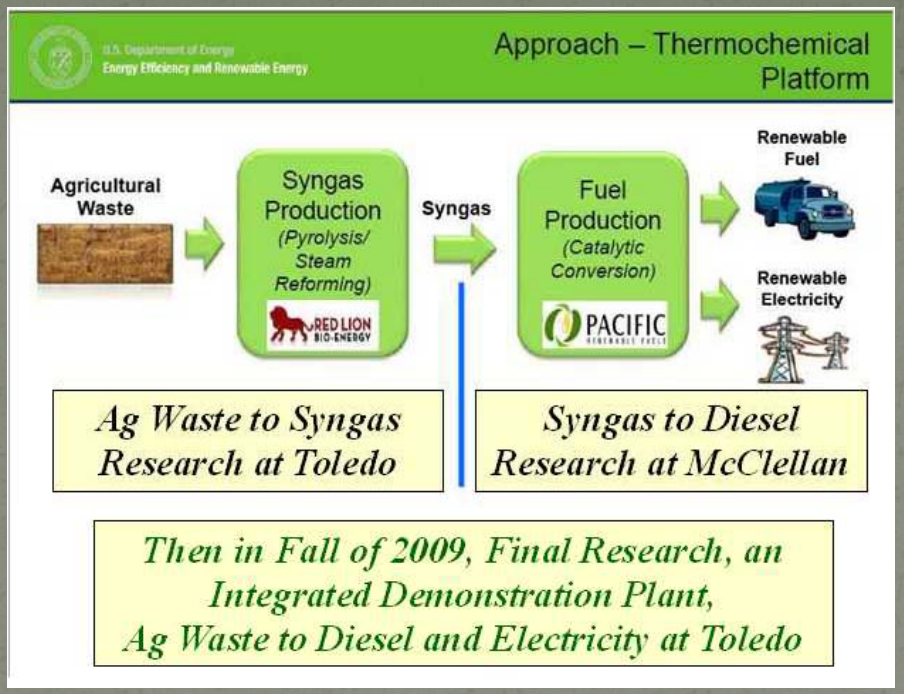
- When the 'Gridley Project's research stage ends this fall or winter, only if the new technologies and the economics of the projects continue to be successful, a commercial plant will be built in Gridley. This is not a sure thing!
- The current estimation is that that plant would produce 9 MW of electricity. So Gridley will just need to use outside power only to cover our 12 MW summer peeks. The cost for plant electricity is estimated at only 7.2¢/kwh cost.
- In addition to the electricity, each year the plant will produce about 5 million gallons of zero-sulfur diesel at about $2.00/gal wholesale.
- The biomass fuel for this plant would be from 12 truckloads per day of rice straw and other agricultural waste.

Common Local Questions and Concerns:

1. Don't do an Ethanol plant! Good corn is burned up in ethanol plants.
2. Gridley and others have tried to generate fuel from rice straw and failed!
3. What is the net cost to the City of Gridley?
4. What has been the cost to the City of Gridley for previous projects?
5. What Pollution will come from the Commercial Plant?
6. How can little Gridley do what giant corporations have been trying to do?
7. Gridley doesn't have the expertise to evaluate these projects.
8. What guarantee do we have that the project will go all the way to become a commercial plant producing electricity and fuel and creating jobs?
9. What are the remaining hurdles before a plant is ready to build?

The town is justly concerned about these issues. Hopefully, we can find the answers to these valid concerns in this report.

'Gridley Project' Research - two <u>new</u> technologies for one plant:



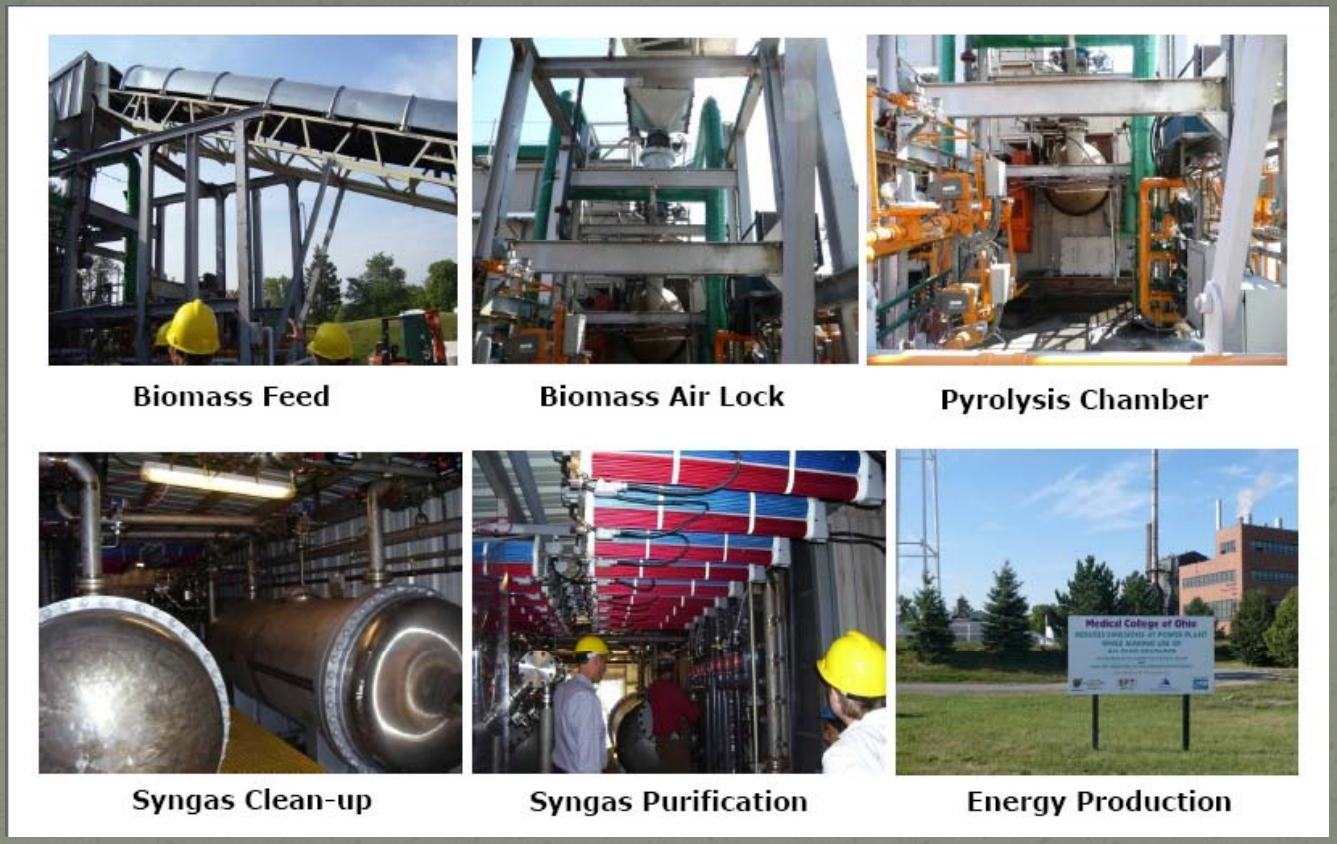
•The new **<u>Ag Waste into Syngas</u>** Production technology is now being tested at Toledo, Ohio by Red Lion Bio-Energy. Syngas, like natural gas, is very rich in carbon and hydrogen.

•The new **<u>Syngas into Diesel technology</u>** is now being tested at Sacramento's McClellan Industrial Park by Pacific Renewable Fuels. Diesel and Electricity are produced from Syngas.

•By this fall, engineers hope to **<u>integrate the two research projects</u>** at Toledo. The integrated test plant will continuously convert Ag Waste → Renewable Diesel ***and*** Electricity!

•Then, if all goes well, **<u>a Commercial Plant!</u>** Ag Waste is planned for rice straw but it could be green lawn clippings, pruned branches, paper, cardboard, etc.

New Technology #1, Ag Waste into Syngas at Toledo by Red Lion



This demonstration size plant in Toledo is producing Syngas at 1/3 the cost of natural gas using agricultural wastes (including rice straw) as a fuel stock!

Owens Corning is in the process of ordering a plant six times the size of this one both to 'go green' and to lower their operating costs for their Toledo, Ohio, glass factory.

New Technology #2, Syngas into Diesel at McClellan by Pacific Renewable Fuels

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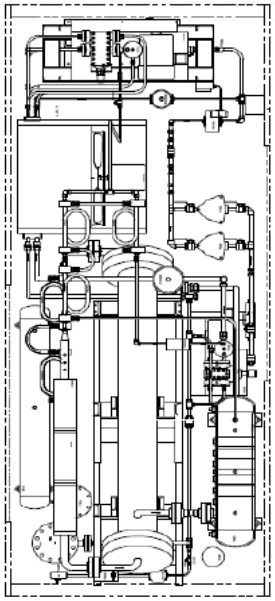
Accomplishments – PRF Syngas to Fuels Process Development Unit (PDU)

- PDU construction and check-out in final stage
- Adaptive control system built and testing underway
- Full end-to-end integration test with RLB TCC system scheduled for Q3, 2009
- PRF Terra diesel reference fuel synthesized for diesel engine tests



Top View – Process Development Unit

Process Development Unit (skid mounted)

PRF Diesel Fuel

This Skid Mounted unit is in a 20 Foot Shipping Container. The DOD wants portable units. By this summer, Gridley will be able to see this unit feed in bottled syngas and output sulfur free diesel that can power farm equipment and trucks – with no refinery required!

Benefits if this Biomass Plant is Built in Gridley

Benefits if this Biomass Plant is Built in Gridley

•**Low cost electricity.** City will have 9 MW of 7.2¢/kwh electricity from the plant with no PG&E transmission fees. Gridley will almost be self-sufficient with this power. Or, sell it w/ 12.5¢/kwh est. value of renewable electricity - the plant could net Gridley $1m each year. Present power cost/kwh: WAPA 4.92¢, Geo 9.14¢, MPP 7.94¢, NCPA Pool 7.73¢.

•**Low cost, sulfur-free diesel.** In addition to the electricity, the Gridley plant will produce 5 million gallons of zero sulfur diesel. This is not a 'biodiesel' like those that foul engines but it is a high quality, clean, diesel fuel. Dynamometer tests will start soon to further test this diesel.

•**New electrical substation.** The city's 12 MW present substation on Fairview Drive is nearly maxed out by the summer peek loads. So if Gridley grows either with more homes, with a large new industries, or with a solar farm, Gridley will need a new, larger, substation to avoid black outs. This project includes a $3 million, 25 MW, substation that will handle a Gridley of twice the present peak load. This substation will be paid for entirely by the owners of the plant – at zero cost to the City of Gridley and its electrical customers.

•**New Industry, New Jobs.**

1) The power plant will bring 50 new, full time, high paying jobs to Gridley.
2) The power plant will be used as a training site for future, similar plants. These trainees will stay in Gridley motels and eat at Gridley restaurants while being trained.
3) The cheap steam generated by the power plant should attract additional industries.
4) Future expansion to this plant could use residential green waste as a low cost fuel and to help out local landfills – and to create more new jobs.

Benefits if this Biomass Plant is Built in Gridley (cont.)

- **Help Existing Gridley Jobs.**
  1) This will help area farmers by giving them an extra source of income as they sell their agricultural wastes to this plant.
  2) The plant's steam will lower Rio Pluma's operating costs.
  3) Some of Rio Pluma's waste can be used for feedstock in the power plant, making the plant more efficient and also easing the load on Gridley's sewer plant.
  4) Area Farmers are in danger of having to replace all their older diesel engines because of sulfur emissions. The 5 million gallons of diesel out of this plant is sulfur free and would have a wholesale price of about $2.00/gallon.

- **Help Relieve the Country and the World from Petroleum Oil Dependence.** The US spends $500 billion annually on foreign oil, importing 70% of our oil, benefiting many enemies of the United States and making us more dependent upon foreign debt to China and to other countries. This technology will be used worldwide.

- **Avoid future penalties** to the State of California because Gridley needs more renewable energy to meet the state's RPS (Renewable Energy Portfolio) goals. Other NCPA cities are interested in buying part of this plant to help meet their own upcoming renewable energy requirements from the State.

- **'Green Community'** worldwide recognition – grants, educational, etc. opportunities. Even if we don't build a commercial plant, be proud Gridley helped this crucial research.

Common Local Questions and Concerns: *NOW ANSWERS*

Common Local Questions and Concerns:
NOW ANSWERS (1 of 4)

1) **Don't do an Ethanol plant! Good corn is burned up in ethanol plants.** – This plant uses agricultural wastes instead of corn to make its fuels. And the fuel will probably be diesel, not ethanol.

2) **Gridley and others have tried to generate fuel from rice straw and failed!** – This a different, newer, process than the previous BCI process. BCI used a bacteria in the F-T that was very expensive and fragile and unreliable. Red Lion uses a thermo chemical process. Hitler used early F-T process and fuels throughoutWW2. Appendix A-6 compares Red Lion's to other F-T units now being tested in DOE experiments.

3) **What is the net cost to the City of Gridley?** – Zero. In the current 'Gridley Project', all City costs are reimbursed by the DOE and DOD. This is the most important point of this presentation – and the least understood.

4) **What has been the cost to the City of Gridley for previous projects?** Zero. The costs of all the previous projects have been reimbursed by DOE and by the State.

5) **What Pollution will come from the Commercial Plant?** The main residue from the process is a small quantity of carbon ash that is valuable for manufacturing of carbon filters, cosmetics, and for other uses. The inventors are working to clean up even smaller quantities of other chemicals. The only gas given off is steam and CO_2. Environmental review will be done as part of a commercial plant design.

Common Local Questions and Concerns: *NOW ANSWERS (2 of 4)*

6) How can little Gridley do what giant corporations have been trying to do?

In the tradition of America, these two new technologies came 'out of the garages' of the inventors in Sacramento and Toledo and were funded initially by their own personal savings. These inventors have continued to invest their personal funds, now with DOE and other agencies matching their continuing investments. Garage inventors can do what giant corporations cannot. And DOE, DOD, and Gridley can help them do what they cannot do by themselves.

The DOE suggested the inventors work with the City of Gridley because:

a) During Gridley's previous project with BCI, Gridley had worked hard with local rice growers to develop and test rice straw as a feedstock.

b) Local rice growers had helped by forming a Growers Rice Straw Coop to develop a large, reliable quantity of rice straw to fuel BCI's F-T plant.

c) Gridley, with its municipal power system, can use and greatly value the electricity generated. The 9 MW of electricity will totally power Gridley for most of the year but for a large power company, this project would just be a hobby - not worth years of their effort .

Common Local Questions and Concerns:
NOW ANSWERS (3 of 4)

7) Gridley doesn't have the expertise to evaluate these projects. The DOE and the DOD do. They have had their experts evaluate the projects and have decided to fund the projects and even the City of Gridley's expenses to help overview the projects. At any of DOE's Peer Reviews, the panel of experts could recommend that DOE immediately discontinue funding the project. Instead these experts have recommended continuing funding and support. The DOE even referred this project to the DOD for further support and evaluation. See the list of 'Project Collaborators' for other experts who have been reviewing and approving of these technologies. Fuel supply is a top issue for the Department of Defense. All branches of the military (Army, Air Force, Navy, Marines, etc.) have recently been tasked to find alternatives. Overseas military fuel costs $300/gallon, delivered.

8) What guarantee do we have the project will go all the way to become a commercial plant producing electricity and fuel and creating jobs? **None.** But the project has had zero cost to the city for the pure research of these technologies. The developers say all the revolutionary new technologies have been proven in laboratories. It's a matter of connecting the two new technologies, and then designing and building a full size plant.

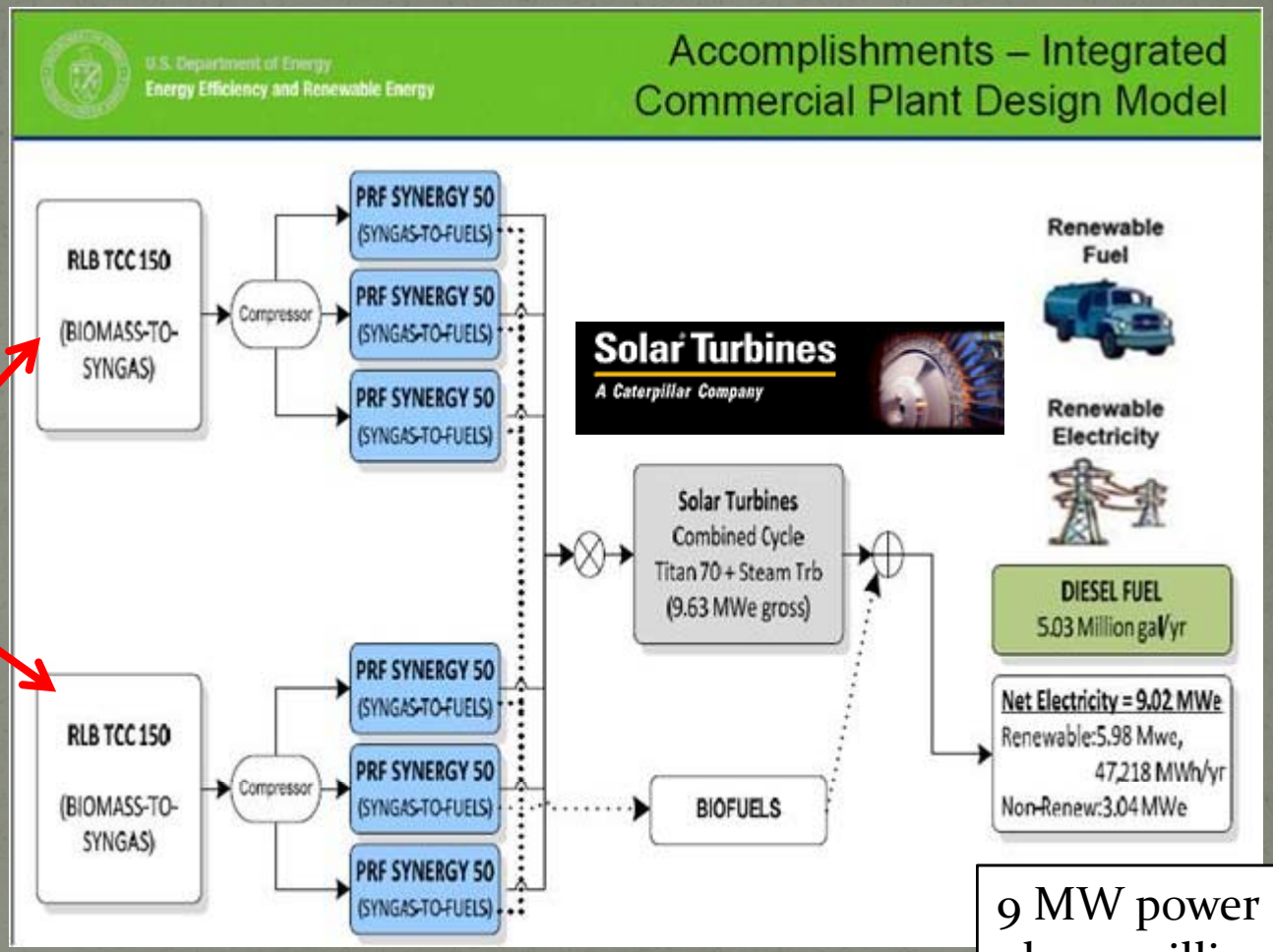
Common Local Questions and Concerns: *NOW ANSWERS (4 of 4)*

9) **What are the remaining hurdles before a plant is ready to build?**

1. Final successful results from the integrated technology#1 and technology#2 tests at Toledo this fall. Even though the syngas is much cleaner and more efficient than that of competitors, Red Lion and Pacific Renewable Fuels are working to make it even cleaner and more efficient.
2. Designing and building the machines to move the products through a full sized plant. Local farmers know that building machines to process and move straw and other ag wastes, liquids, and gases is just a matter of time and development until the machine works.
3. Funding and building the Plant. At the Peer Review, the USDA representative said he expected to be helping the 'Gridley Project' to get a USDA guaranteed loan. Also, a very large, respected, Engineering, Procurement and Construction company is very interested in funding, building, and operating the $58 million commercial plant in Gridley – including the new $3 million Gridley substation. That firm believes in these two new technologies.

Commercial 'Gridley Biomass Plant' Design

12 loads of rice straw/day feed 2 RBL 150 ton Biomass to Syngas Gasifiers



9 MW power plus 5 million gallons of Diesel

Appendix

Red Lion Biofuels' Syngas has H_2/CO that is in 1.8 to 2:5 Ideal Range

The 2:1 ratio makes fuel with most valuable fuel and the least waste. Note how much better RLB's system is than the others. The best of the others is only 1.1 H_2 to Carbon Monoxide ratio.

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A6: Syngas Composition - A Comparison with Other Gasifiers

The Composition of Syngas Generated from the RLB System Compared to the Syngas Generated from Other Thermochemical Conversion Systems (Cellulosic Biomass Feedstocks)

Sample Description	Output H_2 (Vol. %)	Output CO (Vol. %)	Output H_2/CO	Output CH_4 (Vol. %)	Output CO_2 (Vol. %)	Output N2, Ar) (Vol. %)
RLB System (1,000-1,800 °F)	47 ± 5	23 ± 3	2.1± 0.4	12 ± 2	15 ± 2	<1
CFB Air Blown System (from Gasifier) (1,650 °F)	6	13	0.46	6	13	62
CFB Air Blown System (with gas Cleaning/Enrichment (1,650 °F)	29	27	1.1	<0.01	29	15
Downdraft Air Blown System (1,560 °F)	22	19	0.86	ND	9	50
Fluidized Bed Air Blown System (1,560 °F)	21	23	0.91	<1	10	42
Circulating Fluidized Bed Oxygen Blown System (1,700 °F)	15	47	0.32	18	15	<1
Plasma Arc Air Blown System (>3,000 °F)	8	22	0.36	<1	20	50

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A5: Syngas Production from Various Biomass Feedstocks

The Composition of Syngas Generated from the Thermochemical Conversion of Cellulosic Biomass Feedstocks using Pyrolysis/Steam Reforming Without Oxygen (<0.9 Volume% O_2 Input)

Sample Description	Output H_2 (Vol. %)	Output CO (Vol. %)	Output H_2/CO	Output CH_4 (Vol. %)	Output CO_2 (Vol. %)
Rice Hulls	54	20	2.7	12	14
Rice Hulls	51	20	2.6	10	17
Wood (Oak)	45	29	1.6	13	13
Wood (Oak)	44	24	1.8	10	17
Rice Straw	38	22	1.7	15	23
Wood (Juniper)	46	23	2.0	11	18
Wood (Pine)	47	20	2.4	12	20
Wood (Pine)	52	26	2.0	6	17
Switch Grass	43	26	1.7	12	18

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Project Collaborators

- **City of Gridley:** Project Manager for DOE Funded Gridley Biofuels Project; Established 26 acre site for biofuels and bioenergy plant
- **Renewable Energy Institute International (REII):** Manages RD&D effort for Gridly Biofuel Project; evaluates emerging renewable fuel and energy technologies using "5E" assessments.
- **Pacific Renewable Fuels:** Development, Demonstration and Deployment of Syngas to Fuel and Electricity Production Technologies
- **Red Lion Bioenergy:** Development, Validation and Commercial Deployment of Pyrolysis/Steam Reforming Conversion System
- **Desert Research Institute:** Environmental Measurement, Modeling and Assessments; Renewable Fuel Evaluations
- **Other Collaborators:** Government (7); Institutes (1); Universities (4); Energy/Transportation Companies (2); Testing Laboratories (2)

Appendicies A1-A3

- **Northern California Power Agency:** Renewable Energy Customer; Municipal Bonding Support
- **National Renewable Energy Laboratory:** On-Line Monitoring of Syngas Contaminants using Molecular Beam Mass Spectrometry
- **Health Effects Institute:** Environmental and Health Assessments of renewable fuel and energy technologies
- **Solar Turbines - Caterpillar:** Design of Energy Efficient Gas Turbines for the Conversion of Syngas into Electricity

- **PACCAR:** Performance and Emissions Testing of Clean, Renewable Diesel Fuels in Heavy-Duty Trucks
- **Bureau Veritas**: Analytical laboratory Support; Environmental Compliance Monitoring

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A1: Other Project Collaborators

- **U.S. Department of Defense**: Support of Renewable Energy Testing Center (RETC) at McClellan Park
- **California Energy Commission:** Funding Support of Research, Development and Demonstration Projects
- **U.S. Forest Service:** Life Cycle Assessment, Forest Ecology R&D, Forest Fire Modeling; Global Climate Change Studies
- **California Department of Forestry:** Forest Ecology and Forest Health, Lifey Cycle Assessments; Forest Remediation Biomass to Renewable Fuels and Energy
- **California Air Resources Board:** Environmental R&D; Life Cycle Assessment Modeling; Climate Change Studies

- **University of California:** Research and Development Program Support; Provides Employees for Support of Projects
- **University of Washington:** Life Cycle Studies; Catalyst Research; Material Science
- **University of Toledo:** Pyrolysis/Steam Reforming Technology; Energy Modeling; Biomass Feedstock Studies
- **University of Nevada:** Waste Biomass to Energy and Fuel Technology Development

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ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8598

March 26, 2009

Members of City Council
City of Gridley
685 Kentucky Street
Gridley, CA

Dear Gridley Biofuels Project Team:

As the executive director of CIFAR (California Institute of Food and Agricultural Research) and associate director, external programs of the Energy Institute at UC Davis, I work closely with federal agencies including the United States Department of Agriculture. I, and my colleagues at UC Davis, are very excited about the advancement of the technologies associated with the Gridley Biofuels Project and thank you for your ongoing and excellent work in advancing this important area. I recently reviewed the test data from their agricultural waste gasification tests and am pleased to see their progress including a full end-to-end demonstration of agricultural waste to diesel fuel production.

As you know, this project is important to California and the United States for a variety of reasons. The United States agricultural industry produces a significant amount of agricultural waste each year. For example, Northern California farmers alone produce 2.3 million tons of rice straw and rice hulls annually, which creates a major disposal problem. In addition to agriculture waste disposal problems, farmers are also seeing the cost of their diesel fuel for equipment, heating and transportation rise dramatically. While there has been some pullback in the price of diesel fuel in recent months, it is predicted that the long term trend is for higher diesel fuel prices which will increase costs of harvesting and processing, thereby reducing profit margins for farmers.

The Gridley Biofuels Project will convert this waste into a product that is directly usable in the agricultural community. In addition, deployment of these small, integrated bio-refineries will be great for local economies and provide much needed high paying jobs. The results of this research, development, and demonstration project in 2010 is of great interest to CIFAR, USDA, and the UC system and we appreciate your ongoing support in advancing these vital technologies. By finding local solutions to our need for domestic sources of fuels while providing jobs and profitability for farmers is indeed vital to the health and security of our nation.
I am dedicated to assisting in better utilization of our agricultural base and commercialization of the important technologies being developed in the Gridley Biofuels Project.

Sincerely,

Sharon Shoemaker, Ph.D.
Executive Director, Ca
Associate Director, En
University of California

"... I recently reviewed the test data from their agricultural waste gasification tests and am pleased to see their progress..."

QUANTA SERVICES
MAKING CONNECTIONS

March 19, 2009

Dr. Dennis Schuetzle
Renewable Energy Institute International (REII)
5022 Bailey Loop Road
McClellan, California 95652

Dear Dr. Schuetzle:

Quanta Services ("Quanta") is a leading Engineering, Procurement, and Construction (EPC) provider of specialized services, delivering end-to-end network solutions for renewable energy industries as well as the electric power, telecommunications, and gas pipeline industries. We have over 14,000 employees, major offices in 40 states, and generated approximately $3.8B in revenue in 2008.

Our executive management team is committed to making Quanta one of the largest EPC players in renewable energy, and more specifically, biomass-to-energy is one of our key focus areas. Our management team may also consider strategic investments in key renewable energy assets as part of our plan.

Quanta is very interested in participating in, and potentially providing funding for, the development of the Gridley Biofuels Project upon the successful completion and operation of the proposed 25-ton per day pilot facility outlined in the response to DOE Funding Opportunity Announcement: DE-PS36-09GO99038 (*Production of Transportation Diesel Fuel and Renewable Electricity from Waste Biomass*). Quanta understands that the goal of the pilot facility is to generate sufficient technical and economic data from its construction and operation in the 2010-2013 timeframe.

Upon successful completion of this pilot facility, Quanta, as an EPC contractor and an equity participant, will work with Northern California Power Agency (NCPA), the City of Gridley, REII, and other project participants with a goal of developing a mutually agreeable funding and development package for a 150-ton per day, Commercial Demonstration facility in Gridley, California.

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Jim
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"Quanta is very interested in participating in, and potentially providing funding for, the development of the Gridley Biofuels Project upon the successful completion and operation of the ... pilot facility..."

Aberdeen Proving Grounds!

The End