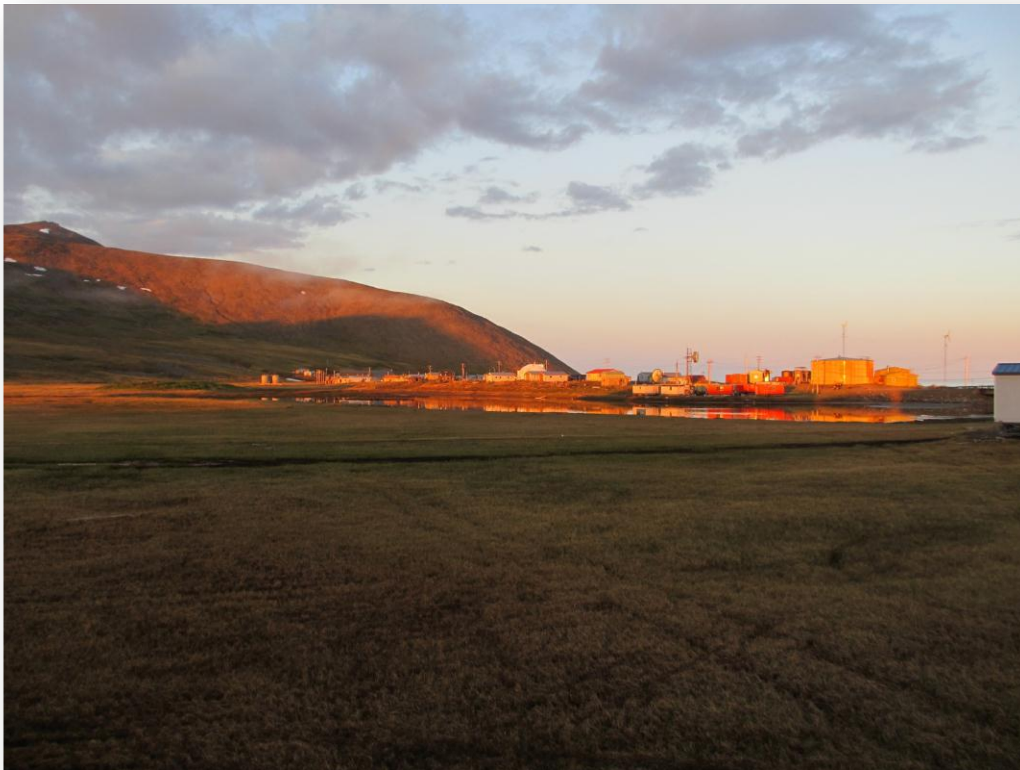

Wales Biomass Energy Feasibility Study

This feasibility assessment considers the potential for heating community buildings in Wales, Alaska with woody biomass

Funding for this report was provided by Alaska Energy Authority and USDA Forest Service

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Dalson Energy

Contents

Contacts 3

Executive Summary 5

Regional Biomass Information 5

Available Fuels 6

Site Specific Analysis: IRA Office and Community Building 8

General Description of Opportunity and Challenges 8

Technology or Installation Options Assessed 8

Project chart 9

Preliminary Cost Estimating 10

Economic Analysis 11

General perspective of project viability, and recommended next steps 13

Conclusion 13

Contacts

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Trip Summary

Thomas Deerfield (Consultant) traveled to Wales in early July, 2012, and met with Sean Komonaseak, Jr. the President of Native Village of Wales (NVW), along with several other NVW staff and community members. In addition to the Community meeting, he surveyed potential buildings, including the Village IRA building, the Clinic and the Washateria. The School was closed and the Principal and maintenance staff were not available to open it up for inspection.

Consultant hired several local community members to make up a site visit team, including the rental of a boat and ATV.

With local assistance, the team toured the coast by open skiff boat and then by 4-wheel ATV up and down the coastline from Wales Village. Uncommonly good weather and visibility allowed the team to see well from offshore as well as the driving and walking coastal survey. Consultant also chartered a flight up and down the coast at low levels for aerial visual observation and photography. On-shore survey included taking MC (moisture content) measurements and photographs of numerous logs and driftwood accumulations.

Consultant compared these observations and recordings to similar surveys recently done by Dalson Energy at other locations in Norton Sound—Stebbins, St Michaels, Stuart Island (aka Egg Island), Unalakleet, Nome, Elim, etc.

Executive Summary

Analysis completed in the report suggests that heating of community buildings with biomass is not likely to be viable from local wood sources, except as a small auxiliary form of heat.

The only locally available biomass fuel is coastal driftwood and is limited. Pellets could be imported, and there are (allegedly) vendors able to barge in cordwood from upriver forest sources (Yukon River). Consultant was unable to get any firm quotes for price and availability for imported cordwood. Transport down the river delta to tidewater and then up the coast to Tin City or Wales is a very challenging proposition. Pellets are available in-State from North Pole and Ketchikan, and could be shipped to ports for water-transfer to Wales. Outside pellets are also available from Canada and the Pacific Northwest. The extremely high delivery costs of pellet fuels appear to make that option unrealistic, at this point.

Converting community buildings in the Village to wood heating systems would require several times more cordwood than has traditionally been cut from local beaches, and that would likely create competition with the local personal-use firewood cutters. It is also very unlikely that a sustained "recharging" of the driftwood supply would be reliable over the life of a biomass system, when specific patterns of ocean current and storms drive the accumulation of driftwood on the beaches near Wales.

Specifically, Dalson Energy estimates that a cordwood system of the scale necessary to heat the community IRA building would require up to about 40 cords annually of seasoned firewood, or 40 tons of pellets. The basic equipment necessary to harvest 40 cords of wood would include a tracked or 4WD wheeled tractor or forwarder, at least one or two trailers and a 4WD truck, a firewood processor, preferably with a shear-head (rather than a saw) and a small bobcat for village transport. Additionally, several chainsaws and all related safety equipment, and a large collection of saw-chains and files would be required. The salt and sand embedded in driftwood is especially hard on chainsaws.

Regional Biomass Information

Regionally available biomass is coastal driftwood. There are no significant river deltas (with upstream forests), anywhere near the point of the peninsula. Therefore the driftwood logs near Wales appear to be coming from much farther distances. For comparison, the driftwood collections in Norton Sound villages have the benefit of the Yukon and Kuskokwim Rivers transporting thousands of tons of wood from upriver forests.

The species observed as driftwood logs near Wales appeared to be mostly Spruce, Poplars, Aspen, Willow and Alder. Most logs were stripped of all bark, weathered and very difficult to determine age or species with accuracy.

The salt content of saltwater driftwood is also an operational issue, since the combination of salt and (combustion) heat creates acids that are especially hard on steel and refractory materials. Boiler manufacturers typically void the warranties on their equipment when saltwater driftwood is being burned in their boiler systems.

Available Fuels

Cordwood

There are no local commercial firewood suppliers. Local community members estimate that they harvest a total of 4-10 cords per year in total. Consultant notes the typically wide variation in the village definition of the volume in a cord of wood. Consultant was told that there are just 4 currently operating woodstoves in the village.

Harvesting and processing of these resources is traditionally done by a few individuals from Wales using open skiff boats, 4-wheelers pulling small trailers, chainsaws, winches and ropes. The process is very labor-intensive, given the widespread location of the solid logs and the difficulty of the terrain—sandy and rocky beaches, creek crossings, shore-side lakes and impassible bluff coastline areas.

Dalson Energy conducted a survey of available driftwood during the site visit. Although there are significant driftwood piles and collections on beaches within 10 miles in either direction from the village, most of it is widely dispersed and of widely varying age and quality, judged as potential firewood.

Figure 1: Driftwood on coast of Wales.

Pellets

The option to import pellets was considered, as the already high cost of imported fossil fuels tends to justify the import of alternatives that were formerly considered too costly. Pellet boilers are relatively simple to operate and maintain, the fuel can be stored in an annual supply, and the systems can be either (radiant heat) stoves or (hydronic) boilers tied into existing oil systems.

As there is no port in Wales, oil is delivered by barge and pumped through a floating hose from off-shore fuel barges. Pellets or cordwood would have to be delivered by beach landing craft and hand-loaded for transfer to local storage. For that reason, (40 pound) bagged pellets (or small bundles of cordwood) are likely the only current method available for shipping.

Most other imported commodities are shipped by small aircraft, and the high weight and volume of pellets or cordwood make that option unlikely to be viable.

Current costs of pellet fuels are in the range of $300 to $400/ton delivered to a port in Anchorage, Seward, or Valdez. Shipping to Tin City or Wales was quoted at over $1,000/ton.

Site Specific Analysis: IRA Office and Community Building

General Description of Opportunity and Challenges

The Consultant was asked to assess the viability of heating the community building with a biomass heating system: the IRA Office and Community Building.

The IRA (Indian Reorganization Act) building in Wales is typical of IRA buildings in many other Interior communities. It is approximately 7 years old, has moderate insulation, large windows, no HRV (heat recovery ventilator), and could benefit from further weatherization upgrades.

The representative of the community, NVW President Sean Komonaseak, is very interested in reducing the heating costs for the building to ensure its long-term viability as a community resource.

The facility is approximately 4,000 square feet, has offices and meeting space, sleeping rooms for guests, a full kitchen and modern bathrooms, however no running water or sewer service. Maintenance appears to be adequate, however the building's energy use could be improved by weatherization upgrades, including more insulation, door and window seals, and better ventilation, ideally in the form of an HRV.

Technology or Installation Options Assessed

If the project building were to offset a high percentage of its heating oil usage with biomass, it would require an estimated 40 cords of firewood or 40 tons of pellets. Dalson Energy always recommends that the most realistic goal is to offset a high percentage of fossil fuel use, but it is not wise to attempt 100% offset. In all cases, the recommendation is to maintain the existing oil system for peak use, backup and in case of shortage of biomass fuel for any period in the future.

Given feedback from the community members and the driftwood survey, it appears unlikely that a biomass heating project would be able to reliably procure 30-40 cords of wood annually from local sources, especially without endangering the personal-use firewood supply.

Imported cordwood, although allegedly available, was not considered due to inability to obtain a quote from any regional vendor, and the obvious challenges of beach delivery and transport.

Therefore, imported wood pellets were the only option considered. Current transportation costs appear to make that option unrealistic as well.

Project chart

Building Name	IRA Office and Community Building
Building Owner	Sean Komonaseak, Sr, President, Native Village of Wales (NVW)
Contact Information	907-664-3062
Square Footage	4100 square feet
Gallons per year	5,280 gallons
PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	Functional, expensive to operate.
What is the staff or building manager's interest in biomass heating?	Interested but curious about how it might work.
Description of current heating system	oil-fired hydronic boiler
Available space (within existing structures or space for newly constructed building)	no
Street access	good
Delivery access	Pellets or cordwood would have to be delivered by beach landing craft and hand-loaded for transfer to local storage. For that reason, (40 pound) bagged pellets (or small bundles of cordwood) are likely the only current method available for shipping.
Fuel storage space	Would need be be incorporated into a container.
Building or site constraints (topography, permitting, historical preservation, etc.)	No available developed space.
Options for biomass boiler system (fuel type, technology type, building type)	Loads would justify a cordwood or pellet heating system.
Estimated boiler size:	165,000 btu/hr

Preliminary Cost Estimating

Initial investment: Wales IRA Office & Community Building

Biomass System	
System Rating -- Btu/hr	164,000 btu/hr
Buffer tank	380 gal.

	footnote		*notes*
Building and Equipment Costs (B&E) $			
Pellet storage structure	A	$ 60,000	
Pre-Fabricated Boiler System			
Base price	B	$ 186,000	
Shipping to Port City	C	$ 20,000	
Local delivery	C	$ 10,000	
Plumbing and electrical	C	$ 2,500	
Site Prep	C	$ 4,500	
Installation	C	$ 9,000	
Subtotal-B&E Costs		***$ 292,000***	
Rural and Remote Factor -- 15%		***$ 43,800***	
Contingency -- 20%		***$ 58,400***	
Grand Total		***$ 394,200***	
Soft Costs $			
Project Management	C	$ 31,536	8% of B&E
A/E Design Services	C	$ 23,652	6% of B&E
Fire Marshall Plan Review			pre-approved
Equipment Commissioning and Training	C	$ 4,000	
Construction Management	C	$ 31,536	8% B&E
Subtotal -- Soft Costs		$ 83,728	
Recommended Project Budget -- Design and Construction Costs		**$ 446,128**	

Footnote

A	Square bulk silo or pre-fabricated building with V-shaped storage trough
B	Based on quotes from viable suppliers
C	Estimate

Economic Analysis

AEA B/C Model_Wales IRA Office & Community Building

	Project Description	
	Community	Wales
	Nearest Fuel Community	Wales
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Native Village of Wales
	Project Title	Wales IRA Building
	Category	

Results				
NPV Benefits	$114,397			
NPV Capital Costs	$402,574	Low	$	900
B/C Ratio	0.28	Med	$	1,000
NPV Net Benefit	($288,177)	High	$	1,200

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	5,280
Displaced Petroleum Fuel	total lifetime gallons	132,000
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	54
Avoided CO2	total lifetime tonnes	1,340

	Proposed System	Unit	Value
1	Capital Costs	$	$ 402,574
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	4,224
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	0.000015
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	165,000
	Heating Capacity Factor	%	86

			Units	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Heating																	
	Proposed																	
		Renewable Heat	gallons displace	-	-	-	-	-	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224
	Entered Value	Renewable Heat Scheduled Repairs	$ per year	$ -	$ -	$ -	$ -		$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320
	Entered Value	Renewable Heat O&M	$ per year	$ -	$ -	$ -	$ -	$ -	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
6	**Entered Value**	Renewable Fuel Use Quantity (Biomass)	green tons	$ -	$ -	$ -	$ -	$ -	32	32	32	32	32	32	32	32	32	32
7	**Entered Value**	Renewable Fuel Cost	$ per unit	$ -	$ -	$ -	$ -	$ -	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
		Total Renewable Fuel Cost	$ per year	$ -	$ -	$ -	$ -	$ -	$ 32,000	$ 32,000	$ 32,000	$ 32,000	$ 32,000	$ 32,000	$ 32,000	$ 32,000	$ 32,000	$32,000
		Proposed Heat Cost	**$ per year**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**
	Base																	
		Fuel Use	gallons per year	-					5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280
		Fuel Cost	$ per gallon						$7.00	$7.14	$7.28	$7.43	$7.58	$7.73	$7.88	$8.04	$8.20	$8.37
	Entered Value	Fuel Scheduled Repairs	$ per year	$ -	$ -	$ -	$ -	$ -	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200
	Entered Value	Fuel O&M	$ per year	$ -	$ -	$ -	$ -	$ -	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750
		Fuel Cost	$ per year	$ -	$ -	$ -	$ -	$ -	$ 36,960	$ 37,699	$ 38,453	$ 39,222	$ 40,007	$ 40,807	$ 41,623	$ 42,455	$ 43,305	$44,171
		Base Heating Cost	**$ per year**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 37,910**	**$ 38,649**	**$ 39,403**	**$ 40,172**	**$ 40,957**	**$ 41,757**	**$ 42,573**	**$ 43,405**	**$ 44,255**	**$ 45,121**

			Units	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	PV
	Heating																		
	Proposed																		
		Renewable Heat	gallons displace	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	4,224	
	Entered Value	Renewable Heat Scheduled Repairs	$ per year	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	$ 320	**$5,572**
	Entered Value	Renewable Heat O&M	$ per year	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	**$139,305**
6	**Entered Value**	Renewable Fuel Use Quantity (Biomass)	green tons	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	
7	**Entered Value**	Renewable Fuel Cost	$ per unit	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	
		Total Renewable Fuel Cost	$ per year	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	$32,000	
		Proposed Heat Cost	**$ per year**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$ 40,320**	**$702,098**
	Base																		
		Fuel Use	gallons per year	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	
		Fuel Cost	$ per gallon	$8.53	$8.70	$8.88	$9.06	$9.24	$9.42	$9.61	$9.80	$10.00	$10.20	$10.40	$10.61	$10.82	$11.04	$11.26	$11.48
	Entered Value	Fuel Scheduled Repairs	$ per year	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	$ 200	**$3,483**
	Entered Value	Fuel O&M	$ per year	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	$ 750	**$13,060**
		Fuel Cost	$ per year	$45,054	$45,955	$46,874	$47,812	$48,768	$49,743	$50,738	$51,753	$52,788	$53,844	$54,921	$56,019	$57,139	$58,282	$59,448	**$799,953**
		Base Heating Cost	**$ per year**	**$ 46,004**	**$ 46,905**	**$ 47,824**	**$ 48,762**	**$ 49,718**	**$ 50,693**	**$ 51,688**	**$ 52,703**	**$ 53,738**	**$ 54,794**	**$ 55,871**	**$ 56,969**	**$ 58,089**	**$ 59,232**	**$ 60,398**	**$816,495**

General perspective of project viability, and recommended next steps

The original idea of using locally sourced driftwood as fuel for a biomass heating system for the Wales IRA building does not appear to be viable. The cost of imported fuel oil (currently at $7/gallon) could justify the import of pellet fuel, despite the high cost and logistical challenges, however due to the lack of existing infrastructure or other customers in the region, shippers are quoting delivery costs from Anchorage in excess of $1,000/ton.

Wales could apply for a woodstove to supplement heat in the IRA building. Wales may also need small-scale equipment to more efficiently harvest and process the limited driftwood that is available, however harvest equipment is not eligible for the Renewable Energy Fund. A short list of equipment might involve an ATV with a heavy-duty winch and cable, an ATV cordwood trailer and a couple chainsaws with extra chains and chain sharpening tools, as well as safety equipment. Grant programs will usually fund safety and operator training as well.

If NVW chooses to take those next steps toward biomass heating, the recommendation is to apply for a Renewable Energy Fund grant from AEA. Deadline is September 24, 2012. The AEA website is:

www.akenergyauthority.org/

Additionally, the Consultant notes that NSEDC (Norton Sound Economic Development Council) has a Community Energy Fund with $1Million dollars designated for energy projects in Wales. There have been no applications for these funds to date, according to Paul Ivanoff, Grant Program Coordinator. NSEDC believes that small wind systems may be viable, if they are more correctly sized to mini-grids and are more easily operated and maintained than large wind turbines (of the scale that KEA installed), similar to the systems successfully deployed in Shaktoolik and Pedro Bay.

Any grant applications, either to AEA or NSEDC will require full written collaborative agreement between the City, Tribe and Corporation. In other words, the community must find the path to full collaboration, and speak with one unified voice. Anything less will not qualify for assistance from either agency. The potential benefits to the community are great, and the incentives are rich.

Conclusion

Biomass energy systems, at a scale beyond small wood stoves, have not been deployed to date in remote coastal communities, due to the logistical and financial challenges of fuel acquisition. However, as fossil fuel costs escalate, and as the biomass industry and infrastructure evolve in Alaska, new opportunities are emerging.

The renewable aspect of biomass fuels will tend to stabilize the overall costs per delivered BTU for space heating, so even as the harvest, processing and transportation costs of biomass fuel will be incrementally affected by escalating fossil fuel costs, the net effect will be more stable biomass fuel price when compared to fossil fuel costs.

Wales is located in a very difficult place to justify importation of fuels that are any less BTU-dense than fossil fuels. The single best recommendation is to tighten up the buildings with weatherization and energy efficiency measures. Hopefully the transport of biomass fuels will become more widespread and therefore less costly, over time.

Meanwhile, Dalson Energy recommends energy audits, energy efficiency upgrades and community unification for the seeking of available grant funding for other options, specifically small scale wind turbines, with battery and hot water storage.

About the Consultant

Dalson Energy is a Renewable Energy Consulting and Technology Research firm based in Anchorage, Alaska. Dalson Energy staff and partners have decades of experience in construction project management, project development consulting and renewable energy technology research. Dalson Energy teams with licensed engineers, architects and designers in Alaska, Canada and Lower 48.

Dalson Energy has worked with Alaska Energy Authority, Alaska Center for Energy & Power, University of Alaska Fairbanks, Washington State CTED (Community Trade & Economic Development) and California Energy Commission on biomass energy technology research.

Dalson Energy's President, Thomas Deerfield, has been involved in biomass energy RD&D since 2001, winning grants and managing projects with NREL (National Renewable Energy Labs), USFS (US Forest Service), and CEC (California Energy Commission).

Thomas managed the field-testing of biomass CHP systems, including the first grid-connected biomass gasification CHP system in the U.S. (2007). Thomas coordinated the design and creation of the first prototype Biomass "Boiler in a Box" in Alaska, in 2010. That Garn-based system is now installed in Elim, in the Bering Sea region.

Thomas founded Shasta Energy Group (SEG), a 501c3 nonprofit, and managed wind energy research, biomass energy feasibility studies, energy efficiency for buildings, and hydronic heating system research design and development (RD&D). He also initiated a rural economic development think tank and has engaged his writing skills to assist many other renewable energy project initiatives.

Wynne Auld is a Biomass Energy Specialist with Dalson Energy. She focuses on assessing opportunities for woody biomass heating, and assisting communities in developing wood energy projects. Over the past few years she has supported the business development of integrated biomass energy campuses in Oregon and Idaho, especially related to their energy initiatives. Her efforts have included marketing Campus biomass heating products to major wholesalers and retail buyers, and planning and developing Campus sort yards.