

# *Pacific Northwest Sustainable Energy Demonstration Energy Independent Communities*

## **First Quarter Report**

### **Introduction**

The goal of this project is to move a Pacific Northwest community (Vashon-Maury Island) from importing all its energy, to energy independence based on locally-produced renewable energy. The first phase of our study (funded by Paul G. Allen) addresses the engineering and economic potential of moving to energy sustainability. Our next phase will look at public outreach and policy issues, such as the benefits and barriers to using different ownership mechanisms, and permitting, contracting and business issues for developing a business plan.

Over the first quarter of our project, we have been gathering data on the energy use and renewable energy availability on Vashon-Maury Island. That effort is essentially complete. In summary, there is more exploitable, renewable energy available on the island than there is energy consumption, even when one considers fossil fuel consumption.

### **Energy Use**

According to the 2000 census there are 10,000 people living on Vashon-Maury Island. During the summer months, that number increases to an estimated 12,000. There are approximately 6100 households on the island, about one half of which are heated by electricity (mostly baseboard heat). Natural gas supplies the heat for 940 households. Electricity consumption represents nearly one-half of the total energy consumption on the island.

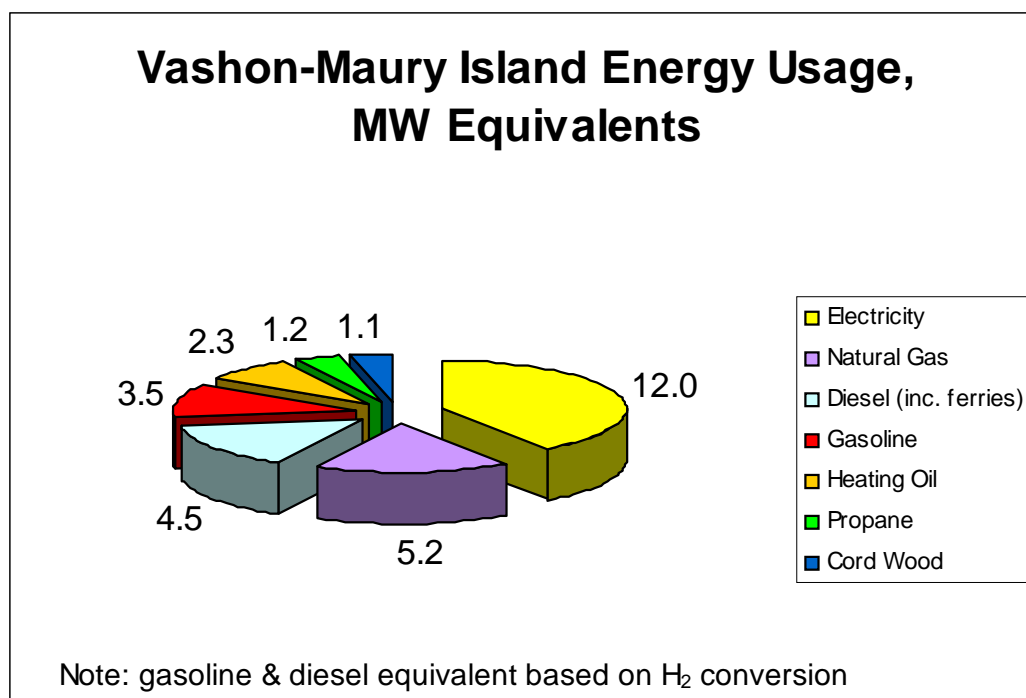
Both the electricity and gas usage patterns follow the same daily and seasonal patterns. During the summer, energy consumption is relatively low and unvarying throughout the day. In the winter, the energy use is relatively high, with substantial peaks in the morning and evening hours. The morning peak is higher than the evening peak. We can infer that use of fuel oil, firewood and propane likely follow the same use patterns.

We obtained estimates of energy usage directly from vendors and transporters, with the exception of the LPG usage, which was estimated as being one-half of the heating oil usage, on an energy basis. The data is summarized below. These are preliminary estimates, which will be finalized in our next report.

**Table 1 Energy Usage on Vashon-Maury Island**

Energy Source	Annual Usage	Units	MW Replacement
Electricity	12	MW	12
Natural Gas	153,000,000	Cubic Feet	5.2
Diesel (incl. Ferries)	2,180,000	Gallons	4.5
Fuel Oil	500,000	Gallons	2.3
LPG	380,000	Gallons	1.2
Firewood	2,150	Cords	1.1
Gasoline	1,700,000	Gallons	3.5
Total			29.8

Note that the equivalencies for diesel and gasoline are based on the conversion to hydrogen fuel cell cars through electricity → electrolysis for H<sub>2</sub> → Kinetic energy for the vehicle. Simple energy conversion would make these figures two to three times higher, because the internal combustion engine is only about 20% efficient, and the diesel engine about 30% efficient, while the entire electricity to hydrogen fuel cell energy efficiency is about 60% efficient. Thus these figures represent the amount of electrical energy that would have to be generated to replace the gasoline and diesel engines with hydrogen fuel cells. The figure below depicts these results graphically.



With some exceptions, the per capita energy use on the island appears to be rather high relative to other parts of Washington State and the USA.

**Table 2 Per Capita Energy Use**

<b>Energy Type</b>	<b>Units</b>	<b>Vashon</b>	<b>WA State<sup>i</sup></b>	<b>USA<sup>ii</sup></b>
<b>Electricity</b>	kWh	10,384	5,568	4,069
<b>Nat Gas</b>	cu ft	14,952	12,216	16,786
<b>Fuel Oil</b>	gal	49	8	21
<b>LPG</b>	gal	38	14	22
<b>Wood</b>	cord	0.21	0.12	0.07
<b>Gasoline</b>	gal	167	445	459
<b>Diesel</b>	gal	215	117	132
<b>Population<sup>iii</sup></b>	#	10,123	5,894,121	281,421,906

We believe that the gasoline estimates of consumption are somewhat underestimated because the cost of gasoline is usually a few cents higher per gallon than gasoline on the mainland. As a result, islanders typically fill up the tank off-island if the opportunity presents itself.

### **Energy Resources**

Information about energy resources on the island are more ambiguous than for energy uses on the island, because the exploitable energy is technology dependent and also because the size of the energy resource itself is typically not measured, but must be inferred from other data. The energy resources can be divided into wind, solar, tidal and biomass. There is no exploitable geothermal energy on the island, and the hydropower potential is too small to commercialize.

Vashon-Maury Island is in a level 2 wind resource area, which is a very low level resource. Recent advances in the development of wind turbines do make this level of resource a possible commercial source, but probably at no more than about 16% of rated capacity. We estimate that there is at least the potential for 45 Megawatts of rated capacity on the island, and possibly even more.

The solar power on the island is substantial as well. About 12.5% of rated capacity can be obtained from photovoltaic resources in the Seattle area<sup>iv</sup>, and each installed watt requires about 0.1 square foot of space. To produce the energy required to run the island, it would be necessary to cover 560 acres of the island with PV cells, or 0.87 square miles, or 2.4 % of the island. This is a little larger than the current roof space of the island. The disadvantage to solar is that it only makes energy during summer months—and it is currently quite expensive.

Tidal power can potentially be extracted from two locations on the island: Colvos Passage (to the west of the island), and Quartermaster Harbor, between Vashon and Maury Islands. Full calculations have not been performed, but preliminary estimates

indicate that between one and six megawatts of electricity may be available from this resource without unduly affecting shipping and boating concerns.

Biomass power is the most difficult energy source to evaluate. We have gathered information about the following resources:

- Sewage sludge
- Septage
- Industrial Food wastes
- Municipal Solid Waste
- Wood wastes
- Landfill gas

We have evaluated their potential looking at anaerobic digestion, gasification, and low temperature thermal systems. At the current time, we estimate that the total available energy is about one megawatt.

### **Future Work**

We are currently working at getting more precise technology-based estimates of renewable energy potentials for the different energy sources on the island. In addition, our consultant, Princeton Energy Resources International is evaluating the financial aspects of the different technologies: costs, returns, price supports and the like will be analyzed.

A white paper outlining all this information will be made available on the web in July. It will provide a guideline for other communities to evaluate their renewable energy potentials, by laying out the information resources, technology limitations and financial constraints of each of the renewable energy technologies.

We are moving ahead to make this project a reality. The next phases of the project, which include policy analysis and more community outreach, are essential to actually accomplishing our goal of energy sustainability.

### **Disclaimer**

The work discussed here is the sole responsibility of the Institute for Environmental Research and Education. IERE is responsible for any errors herein.

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<sup>i</sup> State Energy Data Report, 1999 Energy Information Administration

<sup>ii</sup> Ibid.

<sup>iii</sup> US Census Bureau 2000 figures

<sup>iv</sup> Philip Malte Personal Communication