



2009
**Wisconsin Energy Independent
Community Partnership**

25 x 25 Plan for Energy Independence

SPRING GREEN, WISCONSIN

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Overview

The Village and Town of Spring Green and the River Valley School District were selected to be one of the first of ten pilot communities in the Wisconsin Energy Independence Community Partnership to develop a “25 by 25” Plan to increase our use of renewable energy and fuels. We hope that our program design can serve as a model for other communities who have similar characteristics, such as population, administrative and management capacity, and levels of technical knowledge or resources.

Goal There are three ways of stating the goal.

1. Increase renewable energy sources by 25% by 2025.
2. Reduce usage of energy from fossil fuels by 25% by 2025.
3. Obtain 25% of energy from renewable sources by 2025.

The Village, Town and School boards all have passed resolutions of intent to try to achieve 25% of their energy from renewable sources by 2025.

Program Design Spring Green's program design is intended to integrate renewable energy measures with energy efficiency, conservation and reduction measures. The premise is that if the goal is to obtain 25% of energy from renewable sources by 2025, one must first tackle reducing energy usage and maximizing energy efficiency. Then, one can properly size the renewable energy installations. Or, vice versa, if there were limited opportunities for renewable energy installations, then the goal would be primarily to reduce or minimize the growth of energy usage.

The program design consists of 1) preliminary identification of priorities for renewable energy projects, 2) renewable energy site assessments of solar electricity and solar hot water installations, 3) assessment of the potential of solid and liquid waste, 4) comprehensive energy audits of all buildings, 5) cost feasibility studies of energy efficiency measures for the most complex building systems, and 6) exploration of potential for other renewable sources (wind, bio-fuel, bio-mass).

This design makes maximum use of the resources and incentives provided by the Schools and Local Government Program of Focus on Energy. These are delivered via a subcontract with the Cooperative Educational Services Association (CESA). It also uses the providers of renewable site assessments and commercial building energy efficiency engineers that are certified by the Midwest Regional Energy Association (MREA).

Outcomes

Goal 1: Spring Green's Plan will increase existing renewable energy sources by 100% since there were no existing renewable, specifically solar electricity and hot water, energy installations.

Goal 2: Spring Green's Plan will reduce its dependence upon fossil fuel by 29% through combined energy efficiency, conservation and solar electricity and solar hot water measures.¹

Goal 3: Spring Green's Plan will reach 14% of its 25% goal of renewable or non-fossil fuel sources with solar electricity and hot water installations and bio-diesel.²

Spring Green EIC Team's analysis finds that combining energy efficiency measures with renewable solar installations, bio-diesel and the Wisconsin Renewable Source requirement, results in a total 2025 percentage of 6.3% from renewable sources.

Spring Green's Energy Independence Team and the governing boards of the Village, Town and River Valley School District have gained substantial awareness of the interconnectedness of the Wisconsin EIC Partnership objectives cited above. They are also aware of their ability to substantially "pilot" the growth of their community's energy usage by utilizing both renewable sources and reducing or minimizing growth of their energy usage through becoming more energy efficient.

The Village of Spring Green has submitted its application for the 2009 Energy Efficiency and Conservation Block Grant (EECBG) to fund the swimming pool solar hot water system, and efficiency measures at the Public Works Garage and the Wastewater Treatment Plant.

¹ Email December 16, 2009 from Sean Weitner, Energy Center of Wisconsin

² EIC Measures Spring Green v1, December 17, 2009, Sean Weitner, Energy Center of Wisconsin

What was measured? Why?

Energy Usage Energy usage for the previous three years was obtained from utility bills for natural gas, electricity, liquid propane gas, natural gas and diesel fuel for the years 2006, 2007 and 2008.

Inventory This included 17 *conditioned* structures, streetlights, tornado sirens and vehicles. Buildings included are:

- | | |
|---|--------------------------------|
| Village Hall | River Valley High School |
| Public Works Garage | River Valley Middle School |
| Wastewater Treatment Administration/Lab | Spring Green Elementary School |
| Wastewater Treatment Sludge | Arena Elementary |
| Well Houses #1 and #2 | Lone Rock Elementary |
| Swimming Pool | Plain Elementary |
| Library | |
| Town Hall/Garage | |

We did not measure two village park shelters, school booster concession stand or the unheated storage building at the wastewater treatment plant.

The village, town and schools combined have 12 diesel-powered and 11 gasoline-powered vehicles.

Diesel vehicles

- 2 dump trucks
- 1 sewer cleaner
- 1 street cleaner
- 1 loader
- 3 small groundskeepers
- 1 small tractor
- 1 tractor
- 2 snowplows

Gasoline vehicles

- 2 police cars
- 5 pick-up trucks
- 2 cargo vans
- 1 passenger car
- 1 riding mower

School buses were not included since the River Valley School District contracts transportation to Lamers Bus Services.

Analysis The Energy Center of Wisconsin's Baseline analysis found that our consumption was increasing at 14.5% a year! This was astonishing. We concluded that three years of data is insufficient to really understand what was happening. Two factors were identified: 1) the 2008 flood, and 2) heavy snow. Nor was the data normalized for temperature. The 2008 floodwater runoff and groundwater infiltration overloaded the

wastewater treatment plant for **four** months. This required residents to use Porta-Potties and minimize domestic water use. Snowfall in winter 2007 was TWICE the annual average.

The Energy Center of Wisconsin analyzed the proportion of energy from fossil fuel sources, proportion of energy use by type of building, and energy intensity (by volume) of selected buildings.

Spring Green's EIC Team identified our "**Energy Guzzlers**" by comparing kWh and Therm (converted to Btus) usage per building square footage as a rough indicator of efficiency. We also looked at the annual change in energy consumption for each of the 17 buildings. This caused the EIC Team to ask "why" and "what is happening in each building."

See Baseline Energy Consumption Data in the Appendix for the Energy Center of Wisconsin's analysis of energy usage. Also see Spring Green EIC Team Usage charts also in the Appendix.

Discoveries/Surprises

The findings from the Energy Center of Wisconsin's Baseline data are:

1. School buildings account for 75% of total energy consumption.
2. Natural gas for heating comprises 59% of energy resources. Electricity comes in second at 34%.
3. Water, that is, pumping and treating fresh and wastewater, consumes 13% of total energy used. For the Village of Spring Green to affect this would entail a major community education campaign on water conservation.
4. The least energy efficient (most energy intense--*all sources*) of selected buildings by volume, is:
 - Lone Rock Elementary School
 - River Valley Spring Green campus buildings:
 - River Valley High School
 - River Valley Middle School (includes district administrative offices)
 - River Valley Elementary School
 - Village Hall

5. The most energy efficient (least energy intense—*all sources*) of selected structures, by volume, are:

- Town Hall/Garage
- School warehouse
- Village Public Works Garage
- Library

In addition, the Spring Green EIC Team analyzed usage by square footage and type of energy. This further analysis helped pinpoint where energy efficiency/conservation measures identified by the Walk-Thru Audits are most effective.

1. Street Lights were a major cost item and significant electricity usage for the village.

2. Energy Guzzlers for electricity are:
- Wastewater treatment
 - Well houses #1 and #2
 - Street lighting
 - High School
 - Lone Rock Elementary School

3. Energy Guzzlers for natural gas are:
- Village outdoor swimming pool
 - Village public works garage
 - Well house #1
 - High school
 - Lone Rock and Arena elementary schools

The two small buildings (portable classroom and warehouse) of the schools, while inefficient for both electricity and natural gas, were quantitatively minimal users.

Total Projects Considered

Renewable Site Assessments Conducted– in priority order and why

H&H Solar Technologies, Madison, Wisconsin for the school and library sites, conducted renewable site assessments. Their report assessed maximum capacity as well as cost-realistic options. Jewell Associates, engineers, conducted the swimming pool solar hot water assessment that was reviewed by Focus on Energy.

FIRST. Village outdoor swimming pool solar hot water. This is a huge cost for heating and a significant outlay in the Village budget

~~SECOND. Spring Green Community Library solar electricity. While this building was an efficient energy user, its south-facing roof was ideal.~~

THIRD. River Valley High, Middle and Elementary schools were assessed for solar electricity. The Spring Green campus of these schools provided the greatest opportunity, with a lot of open land. Both cost/feasible sizing and maximum capacity were evaluated.

FOURTH. River Valley High and Middle schools were assessed for solar hot water.

FIFTH. Wastewater Treatment Plant. Could this possibly be converted to anaerobic digestion and produce enough heat for the plant itself, maybe more?

Renewable Site Assessments were not conducted for the following:

1. Town Hall/Garage. It is only used for meetings about 150 hours a year. The garage is occupied during working hours-except the one Patrolman is usually out. The total propane and electricity consumption was very small.
2. Village Hall. This 50-year-old building is not conducive to retrofitting and the site is tiny. Future use is unknown.
3. Well Houses #1 and #2. Total consumption is small.
4. River Valley elementary schools of Arena, Plain and Lone Rock. In the next 15 years the District must face the question of whether or which to keep these schools open. Enrollment is declining.
5. The River Valley warehouse and portable classroom also consumed little energy, however inefficient they are.
6. River Valley School District obtained several years ago a wind assessment of the Spring Green campus that determined it was not feasible.
7. Geo-thermal heating was not considered, but could be an energy efficient measure when new construction or major renovations are undertaken.

Energy Efficiency - Walk-Thru Audits

walk-thru audits:

Public Works Garage
Wastewater Treatment Control
and Sludge buildings
Village Hall
Library

We selected 14 of the 17 buildings for

River Valley High School
River Valley Middle School
Spring Green Elementary
Arena Elementary
Lone Rock Elementary

Town Hall/Garage

We were unable to get the Focus on Energy specialist on pumps (such as at the wastewater treatment plant), to schedule an audit in time for this report.

The remaining structures (pool house, school warehouse and portable classroom) are unheated or very small energy users.

All of the hundreds of energy efficiency/retrofits recommended by the Auditors were considered.

Cost/Feasibility Studies

Following the recommendations of the walk-thru audits of the high and middle schools, we obtained an HVAC Cost/Feasibility Study. These were most the complex systems of all the 14 audited buildings, and the high school energy usage for heating is the largest of all. The Study found that considerable efficiencies could be obtained at the High School, but less efficiency could be realized at the Middle School.

See Spring Green EIC Possible Measures in the Appendix for all projects considered.

Pathways to 25 x 25

First consideration is the Wisconsin Renewable Source requirement for Alliant Energy to generate 10% of electricity from renewable sources. A path that was not chosen by Spring Green entities is the purchase of renewable energy from Alliant Energy's Second Nature program. The reason is increased cost in a declining financial environment

Second pathway is the site-based cost/feasible renewable solar energy installations. These would generate only 1.6% of projected 2025 Btus. The alternative of maximum capacity installations (regardless of cost/feasibility) would still only reach 3.7%

Third, combining the first two results in 2.7% of 2025 Btus from renewable sources.

Fourth, the pathway to 25 x 25 must include reductions in current (2008) energy usage, to accommodate projected growth of 5.2% by 2025.

- a. Energy efficiency measures alone would reduce 2025 energy consumption by 20%. Renewable sources would then constitute about 6% of total 2025 Btus.

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~~b. Combining the energy efficiency reductions and removing Btus from the usage with renewable sources, results in renewable energy sources comprising 6.3% of total 2025 Btus.~~

See Spring Green EIC Possible Measures spreadsheets in the Appendix.

Why Energy Reductions?

A realistic projection of growth in energy usage in Spring Green is unknown. The 14.5% average annual growth for the last two years is not grounded in enough information. Even with our selected average annual rate of 0.3%, total increase would be 5.2%. H&H Solar Technologies assumes an annual inflation rate for natural gas of 7.8% and 5.95% for electricity.

Spring Green currently spends \$635,784 for heating and electricity. Using the above rates, compounded, by 2025 energy costs will be simply financially unsustainable.

Projects Selected – Explanation

Renewable Energy Projects Selected

<u>Project</u>	<u>Energy Offset</u>	<u>Year</u>
Village Outdoor Pool Solar Hot Water	33%	2010
Library Solar PV Electric	50-100%	2015
Bio-diesel	5%	2020
RV School Spring Green campus Solar PV		
Elementary	4.5%	Depends on
Middle	3 %	referendums
High	1.4%	and budget
High School Solar H ₂ O	< 1%	shortfalls.

We selected projects that achieved the greatest energy offset and were cost/feasible. Bio-diesel is the only source that costs less and generates a significant savings in fossil fuel usage.

Renewable Energy Projects Not Selected

Wastewater Treatment Plant Anaerobic Digestion. Larry Krom, contractor specialist in bio-digestion for Focus on Energy, indicated that the Gallons Per Day and amount of B.O.D. are too small to make it cost/feasible.

Maximum capacity installations of solar electric PV at the River Valley Spring Green campus generated significant offsets, but were prohibitively expensive. H&H Solar Technologies recommends that the schools install in phases.

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~~High School offset would be 4.5%~~

Elementary School offset would be 20.1%

Middle School offset would be 32%

Middle School Solar Hot Water installation would offset 6.8%, but is quantitatively less than that of the High School.

Energy Efficiency Measures Selected

All of the energy efficiency measures were included in our Plan. They encompass maintenance, operations/occupant behavior, equipment replacement/purchasing, lighting, HVAC and domestic hot water. Most are not expensive and many require no monetary outlay.

The measures with the highest impact (from highest to lowest) are:

1. Replacing street lights with LED lamps/fixtures
2. Insulation
3. Scheduling and staging ventilation with controls
4. Lighting occupancy sensors
5. Replacing CRT monitors with LCD monitors
6. Computer network controls

Potential Renewable Feed Stocks

Biomass Sauk County's biomass potential generally ranks in the top third of counties, according to the report Wisconsin Biomass Potential by County, by Brett Hulsey of Better Environmental Solutions. Here is the data stated in coal equivalent tons.

Corn Stover	33-53,000 tons/year
CRP grass	6-12,000 tons/year
Switch grass on CRP lands	50-100,000 tons/year
Wood slash	15-33,000 tons/year

Total biomass potential is 62-87,000 tons/year.

There is a lack of processing and hauling capacity in the Spring Green area. Wood chipping enterprises and other biomass processing enterprises are needed. Muscoda which is 30 miles distant, has a lumber company that supplies Meister Cheese Company located next door. TimberGrowers is a micro-managed forest company located in Spring Green but is small.

Bio-diesel Frontier Services Cooperative has a diesel fuel station located in Spring Green, but does not supply bio-diesel. Company executives have indicated an interest depending upon demand. This needs to be explored.

Dairy Animal Waste Manure Hanour, a large dairy enterprise, manages its manure in various ways. There is a nascent cooperative in Richland Center. None is accessible to Spring Green's government energy needs.

Existing Unknowns – Necessary Information for Future

- For purposes of this pilot 25 x 25 Plan, we excluded consideration of the following unknowns:
 - Village Hall renovation/expansion or new construction addition to library.
 - River Valley School District enrollment is declining. A major referendum is scheduled for 2011. This provides an opportunity to implement solar energy installations, but also to discuss the future of the elementary schools in Arena, Lone Rock and Plain and use of the Spring Green campus.
 - Economic activity such as Cardinal Glass expansion or success of Furthermore Brewery. Both are heavy water users.

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~~Unless the cost and efficiency of solar electric and hot water technologies are significantly reduced and increased, OR, the price of energy dramatically rises, the village, town and schools will likely only implement renewable energy projects at the time of major roof renovations, or construction of new buildings.~~

- Another unknown is a significant increase in incentives or availability of grants. It will be necessary to reduce simple paybacks to less than half the life of the measure. The reason is so that the energy savings from the last half of the life can be utilized to eventually replace the installation.
- Public works garage and wastewater treatment could be assessed for solar electric. There is also potential to phase up to the maximum solar PV installations at the River Valley School District's Spring Green campus.
- The potential to develop a wood waste economic sector is unexplored.

Action Steps – Immediate & Long – Term

1. River Valley School District will develop policies for occupant behavior and operations.
2. Train and set up U.S. EPA's online Portfolio Manager for River Valley Schools and the Village of Spring Green.
3. Suggest that the Village and River Valley School District and Town establish Energy Savings Accounts.
4. Pursue a bio-diesel supplier and do more education of Village and Town staff. Meet with Lamers Bus Service.
5. Initiate discussions with Alliant Energy on street lighting.
6. Investigate potential for creating wood chipping and hauling capacity sufficient to interest River Valley School District in a new wood slash/chip district heating system for the Spring Green campus.
7. Continue the EIC Teams in the schools, village and town.

Energy Independence Team Members

Elected Officials: Doug Feiner, Village Board of Trustees
Jerry Schmidt/John McKenna, Township Board of Supervisors
Dennis Crowley, River Valley School Board

Volunteers: Paul Kardatzke, Avenue Architects
Julie Kardatzke, Architect LLC
Doug Jones, a retiree from Johnson Controls
Ed Lilla, Jewell Associates, engineers
Linda Donnelly, A.I.C.P. – EIC Coordinator

Staff: Ed Lilla, Village engineer
Jenny Pappas, Village Deputy Clerk/Treasurer
Greg Wipperfurth, Village Public Works Director
Carl Hayek, Business Manager, River Valley School District
Amy Synnes, River Valley High School English teacher
Brad Haas, Town Patrolman

FOR FURTHER INFORMATION CONTACT:

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Appendix: Baseline Energy Consumption Data – Spreadsheets

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