ENERGY CENTER
OF WISCONSIN

**PREPARED BY**
Energy Center of Wisconsin

# ACHIEVING 25×'25 GOALS FOR ENERGY INDEPENDENT COMMUNITIES

## RESULTS FROM THE 2009 PILOT PROGRAM

2010

ECW Report 252-1

# Achieving 25×'25 Goals for Energy Independent Communities—DRAFT

*Results from the 2009 Pilot Program*

2010

*Authors*

Sean Weitner, Energy Center of Wisconsin

455 Science Drive, Suite 200

Madison, WI 53711

608.238.4601

www.ecw.org

Project Manager

Sean Weitner

Energy Center of Wisconsin staff who contributed to this project includes Doug Ahl, Lee DeBaillie and Scott Schuetter.

## TABLE OF CONTENTS

## REPORT SUMMARY

The Energy Center of Wisconsin provided analytical support for the Wisconsin Office of Energy Independence’s Energy Independent Communities 2009 pilot program. The 10 communities in the pilot were asked to assess their baseline energy usage, set a goal to have renewable energy account for 25 percent of their projected 2025 energy consumption, and develop a plan to execute energy efficiency and renewable energy measures to accomplish that goal. The Energy Center assisted in the baseline assessment so that the communities could better understand their energy usage, and analyzed the communities’ plans to determine how close they came to meeting their goals.

Two communities included large-scale renewable measures whose generation greatly exceeded their municipal needs. Excluding the large-scale measures and including purchased renewable energy, six communities meet or exceed their goals, with another two communities within 20 percent of their goals. **Taken together, the 10 communities accomplish 98 percent of their collective 25×’25 goal: they,reduce their overall 2025 fossil fuel-based energy consumption by 30 percent; and they reduce their 2025 carbon dioxide emissions by 40 percent.** (For this scenario, see Table 8 and Figure 9.)

With the inclusion of the two large-scale renewable measures previously excluded, the communities collectively exceed their 25×’25 goal by nearly three times even without including purchased renewable energy. In this scenario, wind turbines account for 84 percent of the renewable generation. (For this scenario, see Table 6 and Figure 6.) Excluding renewable purchasing as well as those two large-scale renewable projects, only three communities met the 25×’25 goal and the 10 communities together accomplish 72 percent of their collective 25×’25 goal. (For this scenario, see Table 7 and Figure 7.)

The two projects whose generation exceeded their respective municipal needs also carried a cost that was many times those communities’ annual energy budget. While we excluded these projects from some of our analyses, it is important to note that municipalities advocating bold projects can be seen as leading by example: by contemplating large-scale renewables and announcing their interest, the two 2009 pilot EI communities in question have already received attention from developers looking to site such projects.

## ENERGY INDEPENDENT COMMUNITIES

The Energy Center of Wisconsin partnered with the Wisconsin Office of Energy Independence (OEI) on OEI's initiative to award Wisconsin communities with funds to develop a plan for decreasing the consumption of fossil fuels and increasing the consumption of renewable energy in the municipal segment. Of the many communities that competed for the funds, 10 were awarded:

- Brown County
- Chequamegon Bay (including the cities of Ashland, Bayfield and Washburn, the towns of Bayfield and La Pointe, the counties of Ashland and Bayfield, the Red Cliff tribe and the Bay Area Regional Transit authority)
- Columbus
- Evansville
- Fairfield
- Marshfield
- Oconomowoc
- Osceola, including the school district
- Platteville and Lancaster
- Spring Green, including the school district

Certain characteristics of these communities are presented in Table 1.

**Table 1. Population and climate characteristics of the 10 pilot Energy Independent Communities**

| EI Community | Population[1] | County | Minimum Temp.(°F)[2] | Maximum Temp.(°F)[2] |
|---|---|---|---|---|
| Brown County | 245,018 | Brown | 17.0 | 69.5 |
| Chequamegon Bay | 31,221 | Ashland/Bayfield | 17.3 | 67.4 |
| Columbus | 5,093 | Columbia | 16.8 | 71.3 |
| Evansville | 4,957 | Rock | 16.8 | 71.3 |
| Fairfield | 1,098 | Sauk | 15.7 | 71.4 |
| Marshfield | 18,267 | Wood | 14.5 | 70.2 |
| Oconomowoc | 14,172 | Waukesha | 18.9 | 71.2 |
| Osceola | 2,209 | Polk | 9.5 | 68.1 |
| Platteville/Lancaster | 10,297/3,920 | Grant | 15.7 | 71.4 |
| Spring Green | 1,497 | Sauk | 15.7 | 71.4 |

### "25 BY '25"

Each EI community was asked to develop a plan to have 25 percent of their municipal energy usage come from renewable sources by 2025—also known as the "25 by '25" model, a goal each municipality had to agree to pursue as part of the proposal process. Municipal energy usage is concentrated in four segments:

- Building energy use (electricity and thermal energy)
- Outdoor lighting (electricity)
- Municipal water and wastewater (electricity and thermal energy)
- Fleet liquid fuel consumption (unleaded and diesel)

The communities' collective energy usage by segment, as well as by energy type, is shown in Figures 1 and 2. Remember that these communities have substantially different compositions—some include school districts (whose energy consumption can equal or exceed that of municipal government), some do not have wastewater facilities, and one is a county rather than a city or town. Figures 1 and 2 show the aggregate energy consumption of this diverse mix of 20 cities, towns, counties, tribes, school districts and transit authorities.

---

[1] Estimated 2008 population from U.S. Census Bureau (http://factfinder.census.gov). Chequamegon Bay population for Ashland and Bayfield counties.
[2] County-level normal minimum and maximum temperature, monthly. (Wisconsin Blue Book 2009 – 2010, Pg. 698)

**Figure 1. Total 2008 energy consumption in EI communities by segment (Total: 602,000 MMBtu)**

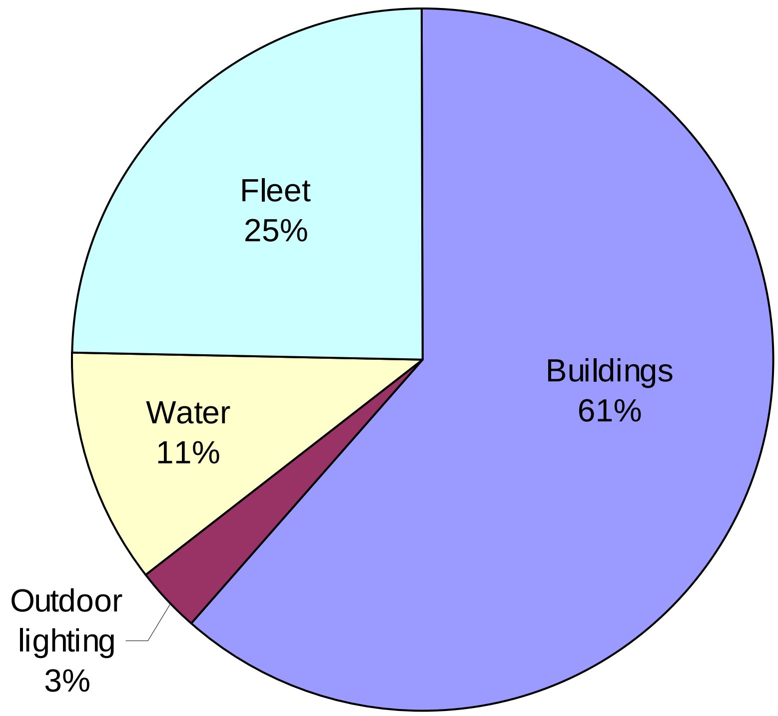
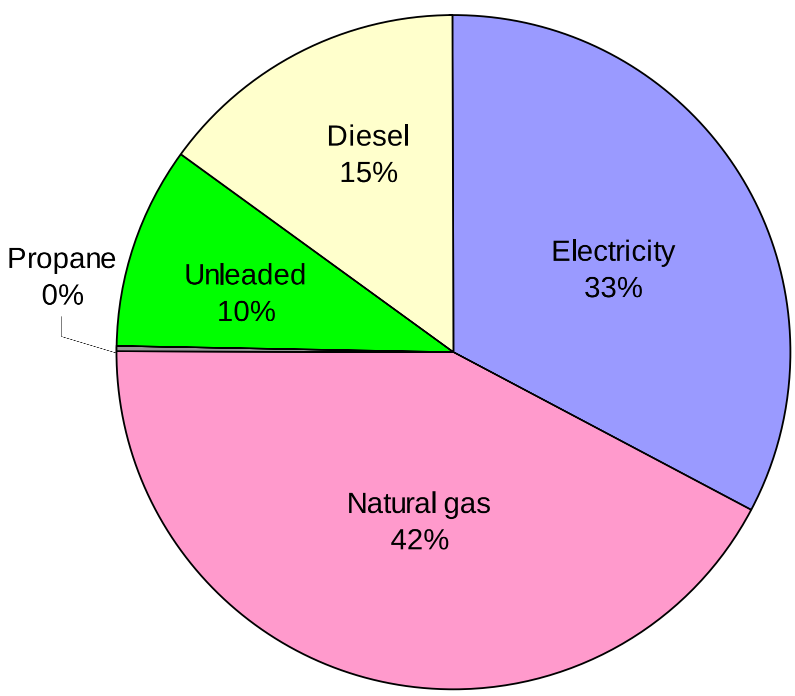



**Figure 2. Total 2008 energy consumption in EI communities by energy type (Total: 602,000 MMBtu)**



## PLAN DEVELOPMENT AND EVALUATION

When evaluating buildings, communities or other systems, the Energy Center pursues a three-step approach:

1. Determine an energy consumption baseline
2. Set goals
3. Develop measures to meet those goals

To assist the communities in this effort, the Energy Center produced two tools. The first tool was a template for collecting community energy use in the four segments mentioned above. Upon completion, this template was submitted to the Energy Center for evaluation and analysis, with the communities receiving a set of tables and charts that showed how each segment and each fuel type contributed to their energy use baseline. (See Figures 3 and 4 for examples.) The second tool was a template for entering information about energy efficiency and renewable measures. Upon completion, this was also submitted to the Energy Center, with the communities receiving an interactive portfolio that showed the results of a life-cycle cost analysis of each measure and the impact that implementation would have on their projected baseline. (See Figure 5 for an example.)

### DETERMINING THE BASELINE AND 2025 ENERGY USAGE PROJECTION

Communities were asked to provide energy consumption data for the period of January 2006 to December 2008 in each of the four segments. While three years of data were helpful to the communities in identifying trends and monthly fluctuations, this range was insufficient to allow the Energy Center to confidently normalize the data for an "average" year. Five to 10 years of data would be a better range for assessing an accurate energy use baseline. One way that a community can build up this data record for their buildings is to begin using energy use tracking software such as the free Portfolio Manager tool developed by the US EPA, which collects data on a monthly basis and allows community energy managers to keep abreast of energy expenditures.

The most dramatic changes to municipal energy usage occur when a building goes offline or comes online, or adds or loses functions (such as a department moving from one building to another), and such occurrences appeared in many of the communities' data submissions. We therefore used unaltered 2008 baseline data as the foundation for developing a 2025 projection, giving us a snapshot of the most recent building, waste/wastewater and fleet portfolio. We also analyzed their 2008 baseline to give the communities a concrete picture of how their municipal energy is expended. Examples of this analysis are presented in Figures 3 and 4.

**Figure 3. Osceola baseline, total consumption by segment (Total: 42,624 MMBtu)**

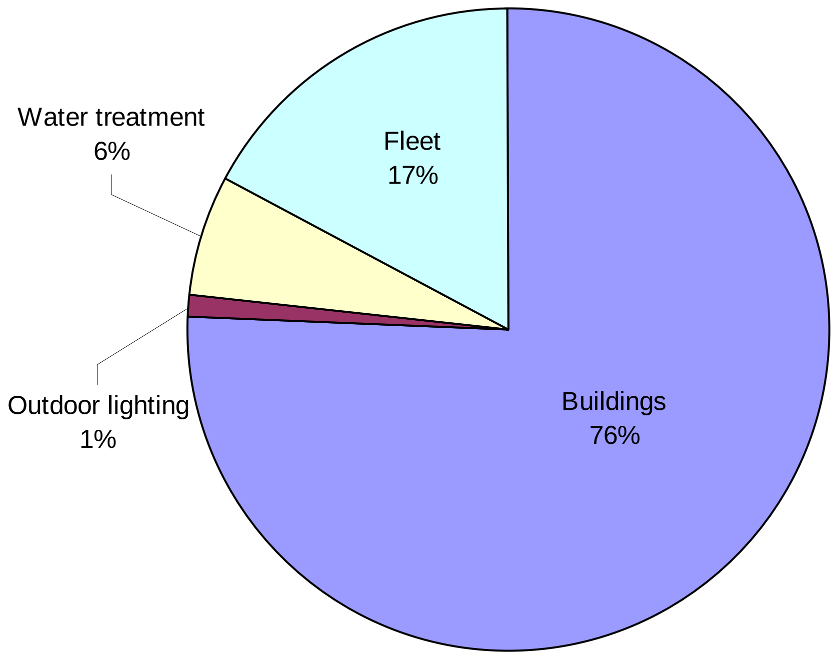
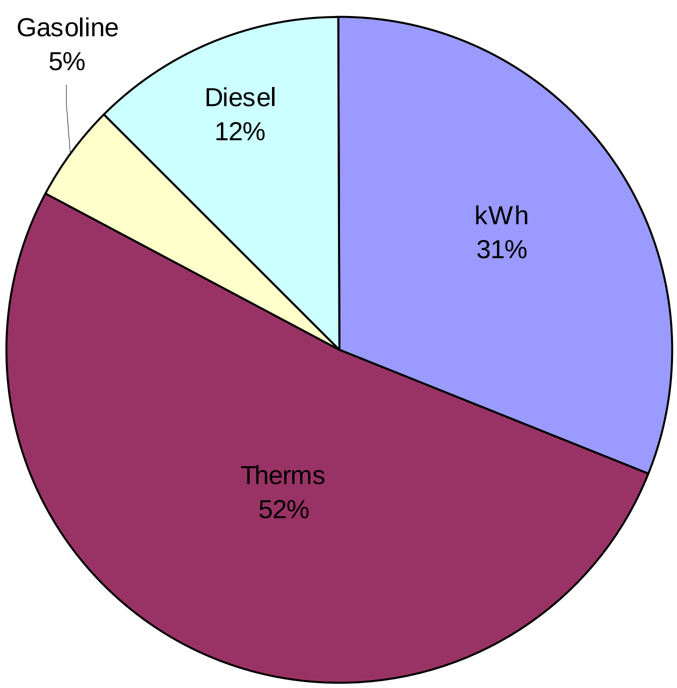



**Figure 4. Osceola baseline, total consumption by energy type (Total: 42,624 MMBtu)**



In order to estimate 2025 energy usage, it was necessary to determine the rate at which energy consumption will increase from the 2008 baseline. While we left to the municipalities the final decision of determining the annual rate at which their energy consumption would increase, we gave them three values to contemplate:

- The population growth rate projected for their municipality or county by the Wisconsin Department of Administration[3]
- A discounted revision of that population growth rate which reduces the rate by the proportion of total municipal energy usage attributable to buildings[4]
- The annual growth rate representing the observed increase in energy consumption from 2006 to 2008

The growth rates selected by each community are presented in Table 2.

[3] 2008. "Wisconsin Population 2035." Wisconsin DOA Division of Intergovernmental Relations. Oct. 2008. Retrieved in 2009 from http://www.doa.state.wi.us/docview.asp?locid=9&docid=2108.
[4] This approach was developed in consultation with other experts in municipal energy usage, on the premise that some energy uses such as wastewater and fleet grow in direct relationship to population, while municipal building energy usage will tend to grow at a less direct rate.

**Table 2. EI communities' selected annual municipal energy usage growth rates and energy use projections**

| EI community | Annual *municipal energy* growth rate[5] | 2008 baseline (MMBtu) | 2025 projection (MMBtu) |
|---|---|---|---|
| Brown County | 1.1% | 269,766 | 324,905 |
| Chequamegon Bay | 1.0% | 96,815 | 114,658 |
| Columbus | 0.5% | 18,768 | 20,428 |
| Evansville | 1.4% | 12,472 | 15,797 |
| Fairfield | 0.2% | 197 | 203 |
| Marshfield | 0.1% | 49,041 | 49,882 |
| Oconomowoc | 0.5% | 40,002 | 43,541 |
| Osceola | 1.0% | 42,624 | 50,480 |
| Platteville/Lancaster | 2.0% | 36,835 | 51,578 |
| Spring Green | 0.3% | 34,486 | 36,288 |
| Average (weighted by 2008 baseline) | 0.95% | | |
| Estimated annual Wisconsin *population* growth rate, 2010-2025[3] | 0.68% | | |

[5] Brown County selected the population growth rate. Columbus, Fairfield, Marshfield, Oconomowoc and Spring Green selected the discounted population growth rate. Chequamegon Bay, Evansville, Osceola and Platteville/Lancaster generated their own grown rate.

## SETTING THE GOALS

The stated goal of the 25×'25 program is that 25 percent of all municipal energy in 2025 should come from renewable sources. Applying a uniform growth rate to all energy uses allows us to determine the amount by which each energy source is projected to increase, but for the purposes of 25×'25 goal-setting, we converted all energy into Btu equivalents, using the factors in Table 3. The 25×'25 goal applies to this aggregate energy usage, as opposed to having to separately achieve 25 percent renewable energy in each of the segments.

**Table 3. Btu conversion factors (MMBtu = 1,000,000 Btu)**

| | |
|---|---|
| Kilowatt-hours (kWh) | 3,413[6] |
| Therms natural gas | 100,000[6] |
| Gallon propane | 91,600[7] |
| Gallon unleaded fuel | 124,000[8] |
| Gallon diesel fuel | 139,000[8] |

[6] Value retrieved from http://bioenergy.ornl.gov/papers/misc/energy_conv.html
[7] Value retrieved from http://www.human.cornell.edu/che/DEA/outreach/upload/CompareHeatFuels.pdf.
[8] Value retrieved from http://tonto.eia.doe.gov/energyexplained/index.cfm?page=about_energy_units

Looking only at the municipalities' accomplishments by the 25×'25 metric will understate their accomplishments in terms of reduced reliance on fossil fuels, or reduced carbon emissions. To explain why, consider the following example:

> A municipality with projected 2025 energy usage of 10,000 MMBtu plans to institute an energy efficiency measure that saves 500 MMBtu and a renewables measure that generates 500 MMBtu.
>
> To accomplish their 25×'25 goal, this municipality first discounts their 2025 energy use projection with the energy efficiency measure:
>
> (10,000 – 500) = 9,500 MMBtu
>
> and so their goal, which is 25 percent of this revised projection, is
>
> 9,500 × 25% = 2,375 MMBtu.
>
> The 500 MMBtu renewables measure therefore accounts for
>
> 500 ÷ 2,375 = 21% of a 25×'25 goal

Let us now consider the same example, and suppose a different goal of 25 percent fossil fuel reduction.

> To accomplish their goal of 25 percent fossil fuel reduction, the municipality has their goal set at
>
> 10,000 × 25% = 2,500 MMBtu
>
> The 500 MMBtu energy efficiency measure and the 500 MMBtu renewables measure contribute equally to the reduction of fossil fuel consumption—the former through avoided consumption, and latter through renewable generation. These two measures therefore account for
>
> (500 + 500) ÷ 2,500 = 40% of a 25% fossil fuel reduction goal

As we see, the 25×'25 goal privileges renewable energy over energy efficiency. **While energy efficiency reduces the overall goal, only renewable energy can meet the goal that remains.** This privilege is important if Wisconsin wants to encourage renewable generation: under the second strategy where energy efficiency measures contribute equally with renewables measures, it would be possible to achieve a 25 percent reduction in fossil fuel use with zero renewable contributions. **Energy efficiency savings tend to be more cost effective than renewable measures and/or require significantly less up-front cost, while delivering valuable and immediate benefits in terms of reduced fossil fuel consumption and carbon dioxide emissions, as well as reduced costs to municipal government.**

**EVALUATING MEASURES**

The Energy Center performed a life-cycle cost analysis on each community's measures, using the savings-to-investment ratio (SIR) of the measure as a more discriminating indicator than simple payback. Where simple payback simply relates the installed cost of the measure to the annual cost of energy saved, the SIR uses present-value dollars and can account for periodic non-energy expenses such as maintenance.

The general formula for the SIR is

$$SIR_{A:BC} = \frac{\sum_{t=0}^{N} S_t / (1+d)^t}{\sum_{t=0}^{N} \Delta I_t / (1+d)^t}$$

| | | |
|---|---|---|
| $SIR_{A:BC}$ | = | ratio of present-value savings to additional present-value investment costs of the mutually exclusive alternative (A) relative to the base case (BC) |
| $S_t$ | = | savings in year t in operational costs attributable to the alternative |
| $\Delta I_t$ | = | additional investment-related costs in year t attributable to the alternative |
| t | = | year of occurrence |
| d | = | discount rate |
| N | = | length of study period in years[9] |

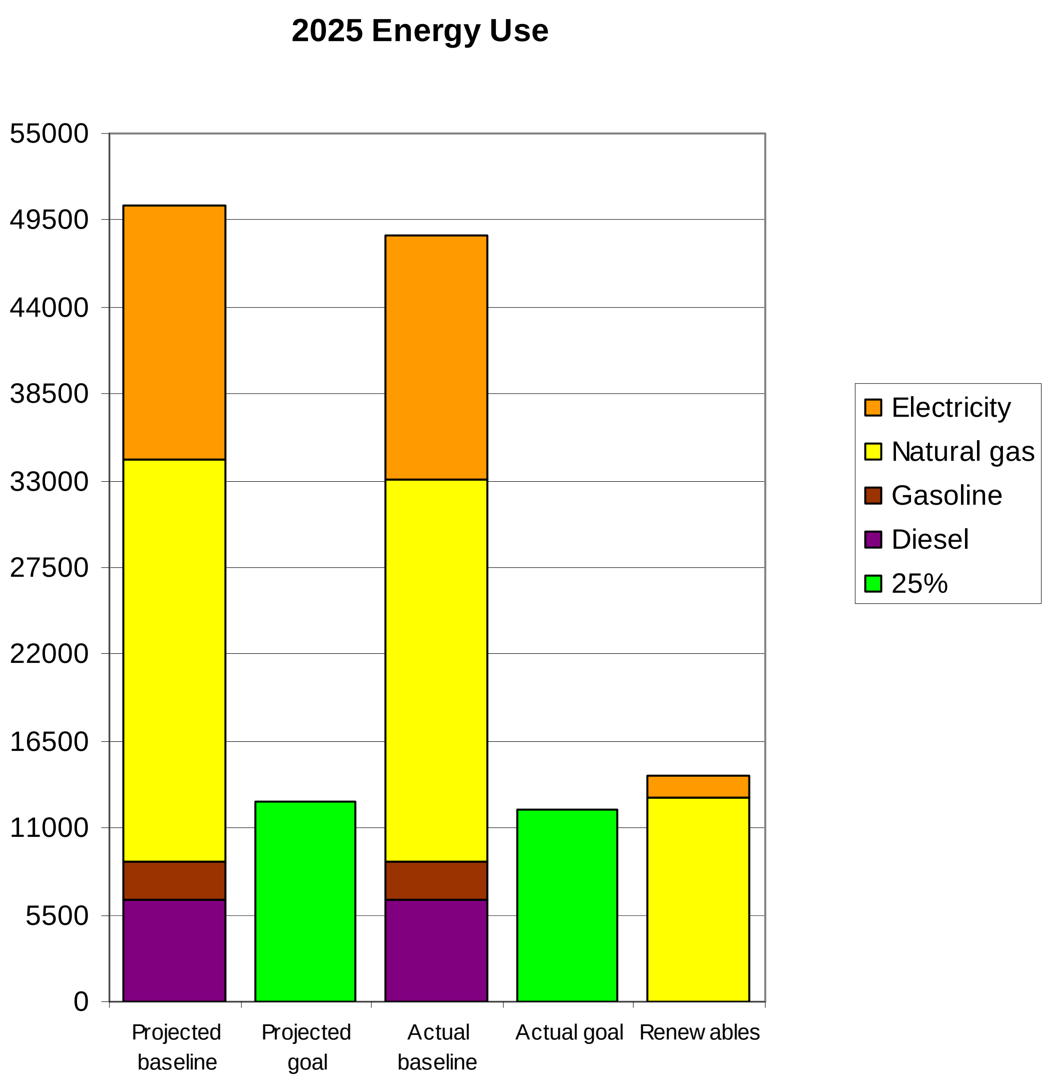
The measure analysis tool uses US Department of Commerce energy price indices and discount factors to separately account for inflation and fuel price escalation.[10]

[9] Fuller, Sieglinde K. and Stephen R. Petersen. 1996. "Life-Cycle Costing Manual for the Federal Energy Management Program." US Department of Commerce Technology Administration, National Institute of Standards and Technology. Office of Applied Economics, Gaithersburg, MD. February 1996. Retrieved online at http://www.bfrl.nist.gov/oae/publications/handbooks/135.pdf

[10] NISTIR 85-3273-24 (Rev. 5/09) "Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis – 2009," USDOC. Retrieved online at http://www1.eere.energy.gov/femp/pdfs/ashb09.pdf

An example of part of the measure analysis tool's output is given in Figure 5. The first column shows the 2025 projection absent any changes; the second column shows the commensurate 25 percent goal; the third column shows the impacts of energy efficiency to reduce the projected baseline; the fourth column shows the corresponding new 25 percent goal; and the fifth column shows how different kinds of renewables have been built up to meet and exceed that goal.

**Figure 5. Osceola measure portfolio (118 percent of 25×'25 goal reached)**[11]




The measure analysis tool allows communities to enter any number of projects and individually "activate" or "deactivate" them in order to see how different portfolios might achieve their goals, and what impact these choices have on total installed cost, total present value dollars and other metrics. This permits them to evaluate multiple paths to 25×'25.

[11] Osceola's portfolio includes another measure that, if activated, raises their goal achievement. See Table 5 for more information.

The tool is designed for iterative use—the template, when completed, is analyzed and the communities can use that analysis to select a portfolio of measures that achieves their goal. In our case, however, no community submitted so many measures such that it had multiple alternative scenarios from which to choose. For our purposes, it is safe to proceed assuming that every community "activates" every project, making only certain exceptions (see Table 5). This "everything activated" approach puts every opportunity forward, identifying where communities are eager to see money invested, and can serve as a guide to developers or technology vendors competing for the best implementation sites.

### Scenarios for meeting 25×'25 goals

Table 4 shows the three scenarios we will investigate.

**Table 4. 25×'25 scenarios considered**

| *Renewable and efficiency measures activated* | *Purchased renewable electricity and fuels measures activated* | *Location* |
|---|---|---|
| All | None | Table 6 |
| Most | None | Table 7 |
| Most | All | Table 8 |

In Table 6, we will consider only customer-sited[12] renewables and exclude the purchase of renewable energy in the forms of renewable electricity sold by utilities and renewable transportation fuel. Generation from renewables projects such as wind farms will be credited to the municipalities developing these projects, even if the intention for the project is to sell the energy being generated to a utility.[13] (Note that Wisconsin's current Renewable Portfolio Standard requires that all electric utilities include at least 10 percent renewable energy in their generation mix by 2015. All communities' renewables portfolio includes this component at no incremental cost.)

[12] "Customer-sited" means sited by an end-use customer and at least partly interconnected to that customer's energy use infrastructure. A wind farm may or may not be customer-sited; a wind turbine that helps power the wastewater treatment plant at which it is located would be customer-sited. For the purposes of this report, every renewables measure proposed by a community that requires construction or installation is customer-sited.

[13] Later, when we consider the purchase of renewable electricity as an option, an observer might worry about double-counting—one community meets their goal from their own wind farm, while another community meets their goal purchasing electricity from the utility to which that wind farm's generation is sold—but the energy demands of these 10 communities are dwarfed by the amount of renewable electricity available for purchase in Wisconsin, so this is not a concern.

In Table 7, the Energy Center considers a similar scenario, except that certain measures are excluded. Our technical criterion for this exclusion was whether the measure's installed cost is more than five times the municipality's reported annual energy expenditures.[14,15] This criterion excludes two very large measures, as shown in Table 5; the omission of these measures is the only difference between Tables 6 and 7.

**Table 5. Measures whose cost is more than five times annual energy expenditures**

| EI community | Project | Energy generated | Installed cost before incentives | Reported annual energy budget |
|---|---|---|---|---|
| Marshfield | 38 MW wind farm | 100,000,000 kWh | $ 12,000,000 | $865,709 |
| Osceola | Anaerobic digester | 231,417 therms | $ 7,500,000 | $820,084 |

While our technical criterion was used as a "reasonableness filter," it must be noted that Marshfield and Osceola have, within two months of finalizing their 25×'25 plans, been contacted by developers interested in these projects.

[14] The selection of the fivefold factor was meant to indicate that these projects are of a significant magnitude relative to the municipality's current budget. Many measures did not have broken-out incremental costs for the related energy systems—for instance, Evansville's $7 million wastewater treatment plant upgrade. The full cost of these projects, and everything that they represent beyond just an opportunity to capture energy efficiency or generate renewable energy, is not relevant for this exercise.

[15] Five of the EI communities reported their annual energy budgets to the Local Government Institute. We looked at the ratio of the stated energy budget to that municipality's subtotaled operating and capital expenditures in the Feb. 2010 Wisconsin Department of Revenue report "County and Municipal Revenues and Expenditures, Bulletin no. 108," and then compared similar fractions to the other five communities' operating and capital expenditures in order to estimate their energy budgets. The DOR report was retrieved online from http://revenue.wi.gov/slf/cotvc/cmreb08.pdf.

**The first case, presented in Table 6, includes all renewable and energy efficiency measures but no purchased renewable energy. Only four communities meet the 25×'25 goal, but taken together the communities exceed their collective goal by nearly three times.** Note: not every measure developed by the communities included a cost estimate due to estimating difficulties, potentially underestimating all total installed costs in these tables.) The distribution of goal achievements is repeated in Figure 6, with the communities of Marshfield and Osceola shown as the orange dots "off the charts." The collective goal, shown by the blue diamond, is likewise off the chart.

**Table 6. 25×'25 goals with all customer-sited renewables, without purchased renewables**

| EI community | Projected 2025 energy usage [MMBtu] | Projected 2025 energy usage after efficiency [MMBtu] | Total renewables [MMBtu] | Percent of 25×'25 goal achieved | Installed cost before incentives |
|---|---|---|---|---|---|
| Brown County | 324,905 | 310,840 | 81,635 | 105% | $19,581,829 |
| Chequamegon | 114,658 | 109,852 | 4,340 | 16% | $3,667,296 |
| Columbus | 20,428 | 19,455 | 1,147 | 24% | $730,489 |
| Evansville | 15,797 | 14,475 | 3,760 | 104% | $8,766,021 |
| Fairfield | 203 | 203 | 39 | 76% | $60,490 |
| Marshfield | 49,882 | 39,418 | 348,767 | 3539% | $16,358,909 |
| Oconomowoc | 43,541 | 37,668 | 2,768 | 29% | $1,343,802 |
| Osceola | 50,480 | 48,530 | 37,508 | 309% | $9,511,193 |
| Platteville/Lancaster | 51,578 | 50,700 | 2,534 | 20% | $443,176 |
| Spring Green | 36,288 | 29,052 | 1,265 | 17% | $1,349,167 |
| *Total* | 707,760 | 660,192 | 483,763 | 293% | $61,812,372 |

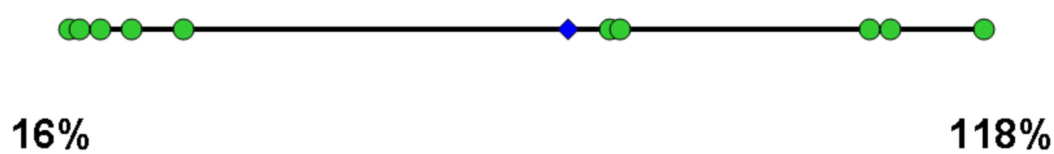
**Figure 6. Distribution of goal achievements under the Table 6 scenario**

In Table 7, we see that without the excluded projects and with no purchased renewable energy, only three communities meet the 25×’25 goal, and the communities taken together met less than three-quarters of the goal. Figure 7 again shows the goal achievement distribution, with the blue diamond representing the collective goal achievement.

**Table 7. 25×’25 goals with customer-sited renewable measures whose cost is less than five times annual energy expenditures, without purchased renewables**

| EI community | Projected 2025 energy usage [MMBtu] | Projected 2025 energy usage after efficiency [MMBtu] | Total renewables [MMBtu] | Percent of 25×’25 goal achieved | Installed cost before incentives |
|---|---|---|---|---|---|
| Brown County | 324,905 | 310,840 | 81,635 | 105% | $19,581,829 |
| Chequamegon | 114,658 | 109,852 | 4,340 | 16% | $3,667,296 |
| Columbus | 20,428 | 19,455 | 1,147 | 24% | $730,489 |
| Evansville | 15,797 | 14,475 | 3,760 | 104% | $8,766,021 |
| Fairfield | 203 | 203 | 39 | 76% | $60,490 |
| Marshfield | 49,882 | 39,418 | 7,567 | 77% | $4,358,909 |
| Oconomowoc | 43,541 | 37,668 | 2,768 | 29% | $1,343,802 |
| Osceola | 50,480 | 48,530 | 14,367 | 118% | $2,011,193 |
| Platteville/Lancaster | 51,578 | 50,700 | 2,534 | 20% | $443,176 |
| Spring Green | 36,288 | 29,052 | 1,265 | 17% | $1,349,167 |
| *Total* | 707,760 | 660,192 | 119,422 | 72% | $42,312,372 |

**Figure 7. Distribution of goal achievements under the Table 7 scenario**



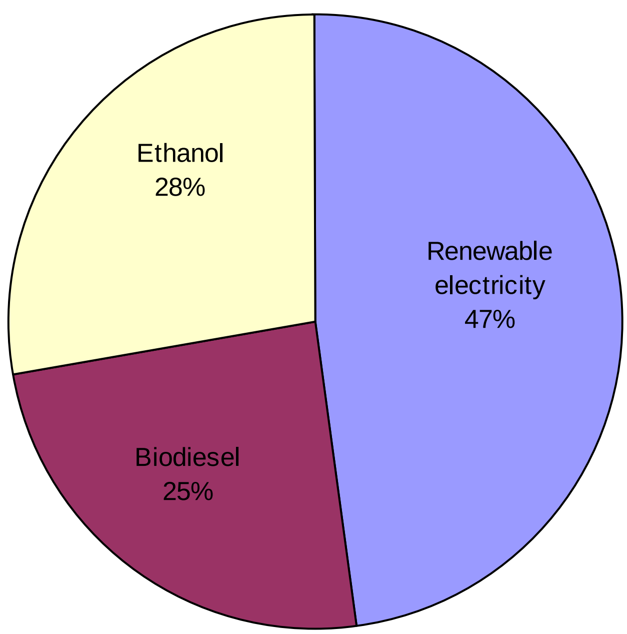
As the previous tables indicate, communities were challenged to achieve their 25×'25 goal using only customer-sited renewables and not generation-scale projects. Customer-sited renewable projects included solar photovoltaic, solar hot water, geothermal systems, biomass combustion, wind farms, anaerobic digesters and landfill gas turbines, but many of these systems only make sense when paired with compatible existing energy end uses—for instance, solar hot water requires an existing hot water demand. Economies of scale very quickly begin to matter, and smaller municipalities may not be able to justify the same projects as larger communities (e.g., anaerobic digesters need a certain flow rate of effluent to become cost-effective).

For these communities, purchased renewables become an important way to reach their 25×'25 goals. Purchased renewables under consideration include:

- Renewable electricity from utilities
- Ethanol as an unleaded gasoline substitute, particularly as E85 for flex-fuel vehicles
- Biodiesel as a diesel substitute, in blends ranging from B20 to B100

Figure 8 shows, on an MMBtu basis, the relative amount of each kind of purchased renewable energy identified in the communities' plans.

**Figure 8. Composition of purchased renewable energy (56,012 MMBtu)**




**For a community committed to 25×'25 or similar goals, the ability to purchase renewable energy allows them to participate in those more favorable economies of scale. They do so, however, by providing money to an outside entity, and primarily only receive the transactional benefit of the purchased renewable energy. This can have a lower cost than investing in assets; however, if**

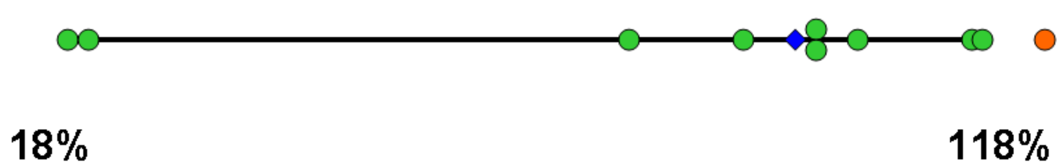
**community A invests in costly renewables projects while community B pays a premium for purchased renewable energy, at the end of 10 years, community A has an asset of persisting value and generation potential that community B does not.** This will likely create a discussion among communities trying to determine how to reach their own renewable energy goals.

**Table 8 again excludes the measures in Table 5 while including purchased renewable energy, making it perhaps the most realistic portfolio.** We see that six communities meet their goals and another two are within 20 percent. Taken together, the communities achieved 98 percent of their collective 25×’25 goal. The goal achievement distribution is shown in Figure 9, with the blue diamond representing the collective goal achievement and the orange dot representing Fairfield, whose renewable energy purchases push it “off the chart.”

**Table 8. 25×'25 goals with most customer-sited renewables and purchased renewables**

| EI community | Projected 2025 energy usage [MMBtu] | Projected 2025 energy usage after efficiency [MMBtu] | Total renewables [MMBtu] | Percent of 25×'25 goal achieved | Installed cost before incentives |
|---|---|---|---|---|---|
| Brown County | 324,905 | 310,840 | 90,839 | 117% | $19,581,829 |
| Chequamegon | 114,658 | 109,852 | 27,405 | 100% | $3,839,390 |
| Columbus | 20,428 | 19,455 | 4,851 | 100% | $754,609 |
| Evansville | 15,797 | 14,475 | 3,760 | 104% | $8,766,021 |
| Fairfield | 203 | 64 | 39 | 243% | $106,990 |
| Marshfield | 49,882 | 39,418 | 9,118 | 93% | $4,408,909 |
| Oconomowoc | 43,541 | 37,668 | 7,501 | 80% | $1,374,630 |
| Osceola | 50,480 | 48,530 | 14,367 | 118% | $2,011,193 |
| Platteville/Lancaster | 51,578 | 50,700 | 2,534 | 20% | $443,176 |
| Spring Green | 36,288 | 29,052 | 1,296 | 18% | $1,350,051 |
| *Total* | 707,760 | 660,053 | 161,708 | 98% | $42,636,798 |

**Figure 9. Distribution of goal achievements under the Table 8 scenario**



### Fossil fuel reduction accomplishments

As discussed in the example on page 10, overall fossil fuel reduction is also a worthwhile metric. Table 9 examines the same scenario as Table 8, but splits out the relative contributions from energy efficiency and renewable energy. If 25 percent fossil fuel reduction was a goal, then eight communities would achieve that goal and a ninth community would come within 1 percent of the goal, with the communities collectively reducing their fossil fuel consumption by 30 percent.

**Table 9. 2025 fossil fuel reduction from energy efficiency and renewables**

| | Projected 2025 energy usage | Total energy efficiency | | Total renewables | | Projected 2025 energy usage after reductions | | Installed cost before incentives |
|---|---|---|---|---|---|---|---|---|
| EI community | [MMBtu] | MMBtu | % | MMBtu | % | MMBtu | % | |
| Brown County | 324,905 | 14,066 | 4% | 90,839 | 28% | 220,000 | 32% | $19,581,829 |
| Chequamegon Bay | 114,658 | 4,805 | 4% | 27,405 | 24% | 82,448 | 28% | $3,839,390 |
| Columbus | 20,428 | 973 | 5% | 4,851 | 24% | 14,604 | 29% | $754,609 |
| Evansville | 15,797 | 1,322 | 8% | 3,760 | 24% | 10,716 | 32% | $8,766,021 |
| Fairfield | 203 | 139 | 69% | 39 | 19% | 25 | 88% | $106,990 |
| Marshfield | 49,882 | 10,464 | 21% | 9,118 | 18% | 30,300 | 39% | $4,408,909 |
| Oconomowoc | 43,541 | 5,874 | 13% | 7,501 | 17% | 30,167 | 31% | $1,374,630 |
| Osceola | 50,480 | 1,950 | 4% | 14,367 | 28% | 34,163 | 32% | $2,011,193 |
| Platteville/Lancaster | 51,578 | 878 | 2% | 2,534 | 5% | 48,165 | 7% | $443,176 |
| Spring Green | 36,288 | 7,236 | 20% | 1,296 | 4% | 27,756 | 24% | $1,350,051 |
| *Total* | 707,760 | 47,708 | 7% | 161,708 | 23% | 498,345 | 30% | $42,636,798 |

### Carbon dioxide reduction

Another way to frame fossil fuel reduction is as carbon dioxide emission reduction. For our purposes, carbon dioxide reduction is a matter of avoided fossil fuel consumption, and so energy efficiency measures are again on par with renewable measures.

**Table 10. Carbon dioxide (lb $CO_2$) conversion factors**

| | |
|---|---|
| Kilowatt-hours (kWh) | 1.692[16] |
| Therms natural gas | 11.708[16] |
| Gallon propane | 12.67[17] |
| Gallon unleaded fuel | 19.54[17] |
| Gallon diesel fuel | 22.37[17] |

Table 11 shows a 40 percent reduction in carbon dioxide emissions for the scenario presented in Table 8.

**Table 11. Carbon dioxide reduction**

| | lbs $CO_2$ |
|---|---|
| Projected 2025 $CO_2$ emissions | 151,387,488 |
| $CO_2$ reduction from measures | 60,748,516 |
| Percent reduction | 40% |

The 61 million lbs (27,555 metric tons) of $CO_2$ avoided by this portfolio is equivalent to the annual emissions from 64,000 barrels of oil, 144 railcars of coal, 5,300 passenger vehicles, or the energy use of 2,500 homes.[18]

[16] PA Consulting. 2008. Focus on Energy Evaluation Semiannual Report (Second Half of 2007) Final: March 17, 2008
[17] Energy Information Administration. "Fuel Emission Factors." Retrieved online in 2009 at www.eia.doe.gov/oiaf/1605/excel/Fuel%20Emission%20Factors.xls
[18] US EPA Greenhouse Gas Equivalencies Calculator. Retrieved online at http://www.epa.gov/RDEE/energy-resources/calculator.html

## CONCLUSIONS

The pilot program succeeded in getting its participant communities to take a new analytical approach to their energy consumption. **Almost every community expressed that closely tracking their energy consumption was a novel idea, and EIC team members seemed unanimous in their appreciation of a baseline analysis that showed just how their community used energy.** Furthermore, the process engaged them in developing thoughtful approaches to achieving their 25×’25 goal, and it does not appear that any community was able to proceed in a strictly “business as usual” fashion, instead developing original, out-of-the-box solutions as to how they could more fully participate in an energy-independent future.

The 25×’25 model demands renewable energy generation at a scale that can pose a challenge to smaller communities, illustrated by those that participated in the pilot program. Having communities pay utilities for renewable electricity should prove to be an effective market driver for encouraging increased renewable development in Wisconsin and in the region, but at the cost of disassociating the communities’ payments with ownership of the related assets. A third path might be for neighboring communities to work together to see if they can jointly achieve favorable economies of scale. **This is an opportunity for local governments to increase collaboration, ensure that these investments are made locally, and maximize generation while minimizing up-front costs.** For example, one large wind farm should prove to be a better investment of time and money than trying to develop four wind farms whose aggregate size in comparable.

While evaluating a project portfolio in terms of fossil fuel reduction or carbon dioxide reduction is explicitly not the goal of this process, these vantages provide new insight into what the 25×’25 process has accomplished. In Table 8, “25×’25 goals with most customer-sited renewables and purchased renewables,” we see six communities exceeding the 25×’25 goal, but Table 9 shows that for that same portfolio, nine communities reduced their fossil fuel consumption by 24 percent or more, and Table 13 shows that this portfolio results in a 40 percent reduction in carbon dioxide.

As we look forward to working with the 2010 EI communities, we expect iterative process improvements will improve their experience. As proponents of the three-step energy evaluation model, it seems particularly important to us that all communities be required to get their baseline data in as early as possible so that their early efforts at measure ideation are informed by an accurate understanding of their community’s energy-intensive processes**. It makes sense for the communities to pursue tools such as US EPA’s Portfolio Manager, a freely available, nationally used tool for recording monthly building energy data. (Portfolio Manager has some limitations, and does not capture categories such as outdoor lighting or fleet vehicles.) For the major energy end use of buildings, it provides a place for perpetual data tracking, and comparative results about each building so that building operators can understand its relative performance.**