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Energy Independent Community

an evaluation
for

Bloomfield
EST. 1855

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economic development

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Energy Independent Community

An evaluation for the

City of Bloomfield, Iowa

Conducted by

The Iowa Association of Municipal Utilities

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IOWA economic development

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Executive Summary

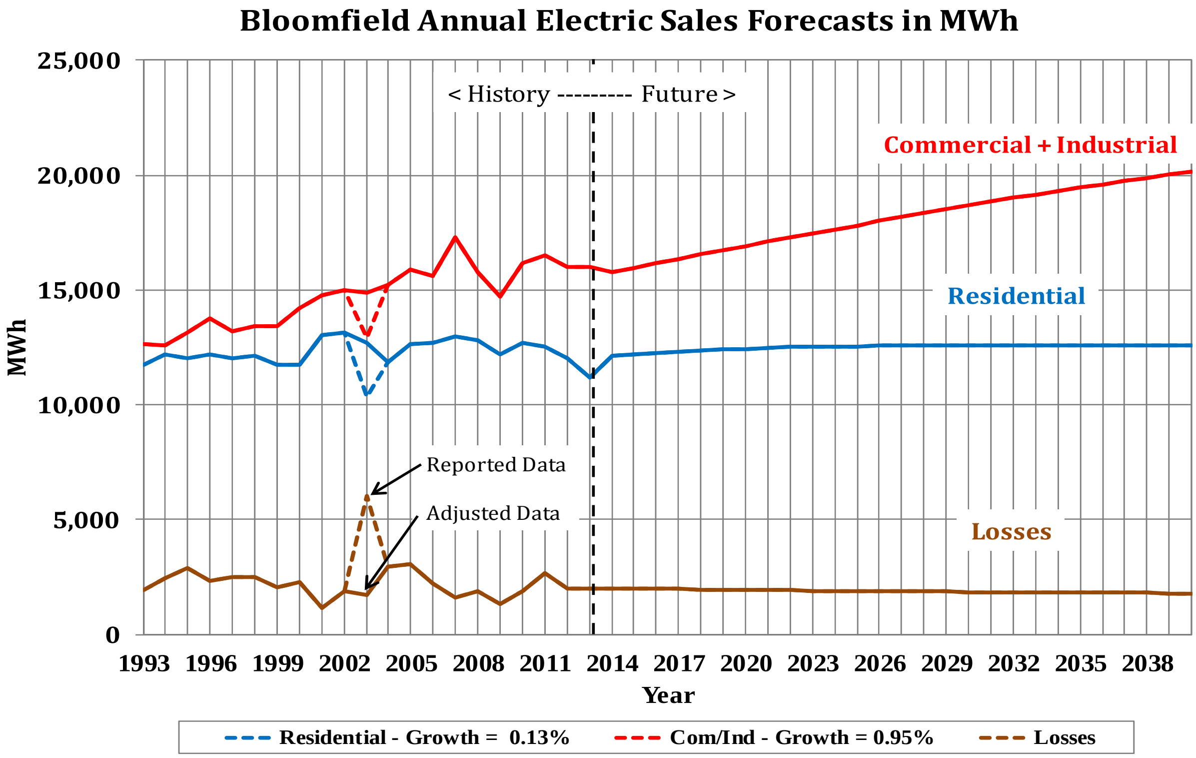
This study looked at the technical and financial feasibility of the city of Bloomfield (City) becoming energy independent. Could the City obtain most of its energy from local resources given the declining cost of solar and wind power?

Since there are no local natural gas wells, and there are very limited potential sources of methane from biodigesters, it is nearly impossible to eliminate the City's dependence on outside natural gas. The energy efficiency programs analyzed could potentially reduce natural gas usage by 14%. Although a significant amount of natural gas space heating could be converted to geothermal or air source heat pumps, it is not usually economical to spend the money to convert a heating system if electricity prices are above about 7-8 cents per kWh, which is less than the City's current residential electric rate and comparable to its commercial and industrial rates. Therefore, the City would need to develop an incentive rate to motivate its customers to switch from natural gas heating to electric heating. Even if it were practical and desirable to convert all residential natural gas space and water heating needs to electricity, doing so would only reduce gas consumption by about 50%. In summary, it would be very difficult to become energy independent from outside natural gas, and the decisions necessary to make this happen would be outside of the City's control.

Unlike natural gas, it is technically feasible for the city and its customers to become independent in terms of electric use. Therefore this study focused on the technical and economic factors for reducing the City's dependency on outside sources of electricity. The City's connection to the regional electric grid brings significant benefits in terms of economy and reliability, and there would be no practical reason for being disconnected from this regional grid. However, if the City could produce more electricity such that it would still be receiving electricity at times and then delivering electricity at other times to offset its receipts, then over the course of a year it would be a "net zero electricity" community. For purposes of this study, achieving this "net zero electricity" was deemed to be a practical way of being "energy independent" from an electricity usage perspective.

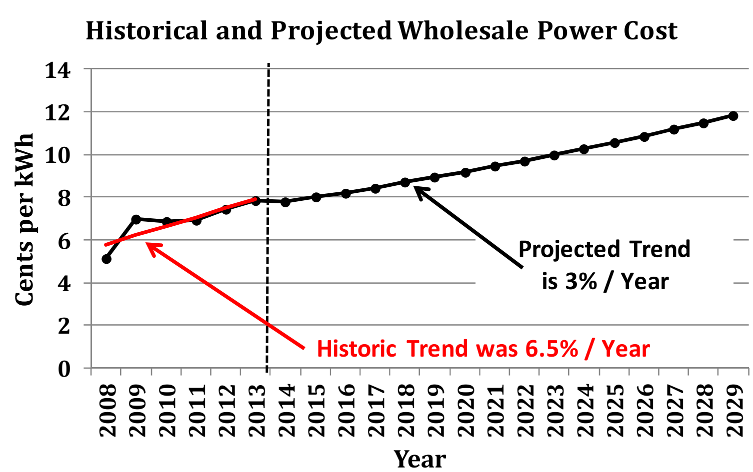
Since this is a forward-looking study, it was necessary to project the City's electricity needs into the future, based on a Business As Usual (BAU) scenario. The consultants correlated the Bloomfield Municipal Utility's historic electricity sales to its customers with local economic, demographic, and weather data to develop statistically based models for future electricity needs. Figure Executive Summary-1 (ES-1) on the following page shows the resulting projection of electricity usage for the residential customers and the combined group of commercial and industrial customers. The forecast predicts average annual growth of about 1.0% in the commercial / industrial customer usage and only about 0.1% growth in residential usage.

FIGURE ES-1



For many years the City has purchased nearly all of its electricity needs from wholesale suppliers that bring in electricity generated from large power plants in the region. Although this has historically been a very economic source of electricity, many smaller coal-fired power plants will be retired due to tighter pollution standards, which will tighten the regional demand-supply balance. Together with increasing natural gas prices, wholesale power prices are widely expected to increase in the future. The future prices for wholesale purchased power are a significant factor in evaluating the economics of becoming energy independent. Figure ES-2 illustrates the average price of wholesale power that the City has purchased since 2008, along with projections for the next 15 years. The short red trend line indicates that recent prices have increased an average of 6.5% annually. Since past yearly variations in the cost per kWh are due in part to the summer weather, there will likely be similar variations in the future. However, in this study, the wholesale power rates are assumed to increase 3% annually over the 15-year study period.

FIGURE ES-2



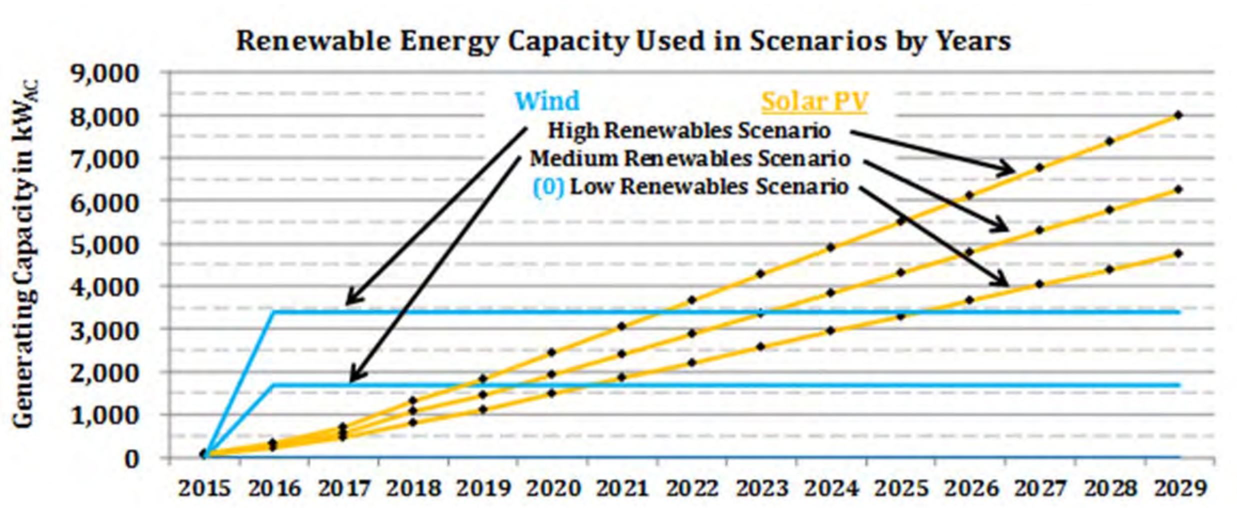
Six different strategies or scenarios were developed, evaluated and compared to the Business As Usual (BAU) scenario as part of a process of becoming more energy independent over time. A description of these strategies and goals is shown in Table ES-1.

TABLE ES-1 – Summary of Strategies Developed and Evaluated to Become More Energy Independent

#	Name	Description	Goal	Local Generation Added
1	BAU	Business as usual	Status Quo	None
2	EE	Implement a comprehensive set of Energy Efficiency (EE) programs to reduce electricity usage as much as economically practical	Reduce electricity usage gradually over a ten-year implementation period by 23%	None
3	DLC	Install Direct Load Control (DLC) equipment that intermittently interrupts central air conditioning compressors and electric water heaters during peak load periods	Reduce summer peak loads and wholesale power demand charges	None
4	PS	Use the City's dual-fueled diesel generators during high load periods to reduce the monthly or annual peak usage	Reduce peak loads and demand charges by Peak Shaving (PS) with the existing diesel generators	None
5	Low RE	Contract with companies to install, operate, maintain, and sell power to the City from solar photovoltaic (PV) arrays in and adjacent to the City so as to use Renewable Energy (RE)	Reduce electricity usage and increase locally generated electricity to reduce net electricity purchases by 50% compared to BAU	Use power from 6,800 kW_{DC} of solar power installed over a 15-year period in large arrays and on rooftops
6	Medium RE	Like Scenario 5, but with more solar PV, plus buying power from a local wind turbine	Reduce electricity usage and increase locally generated electricity to reduce net electricity purchases by 75% compared to BAU	Use power from 8,900 kW_{DC} of solar power installed over 15 years, one large wind turbine, and 130 kW of micro-turbines
7	High RE	Like Scenarios 5 and 6, but with even more solar PV and wind power	Reduce electricity usage and increase locally generated electricity to reduce net electricity purchases by 100% compared to BAU	Use power from 11,400 kW_{DC} of solar power installed over 15 years, two large wind turbines, and 130 kW of micro-turbines

As Table ES-1 indicates, the purpose of the strategies is to make the City's consumers of electricity as energy efficient as possible, by implementing a comprehensive set of energy efficiency programs over a 10-year period. These programs reduce customers' power bills as well as the City's wholesale power purchases. As energy efficiency programs are implemented, other strategies will also be implemented to trim and shave the utility's peak demands, which would further reduce the City's wholesale power costs. As these strategies are adopted, then using locally produced renewable energy (RE) becomes the next most economical thing to do to become more energy independent. Scenarios 5, 6 and 7 evaluate the economics of reducing outside energy purchases by 50%, 75%, and 100% respectively over a 15-year period. At the 100% level the City will generate or purchase enough locally produced energy to offset the energy that is used during times with no or little solar or wind power, thereby making the City "net zero energy", or energy independent. Figure ES-3 depicts the amount of renewable energy in the Low, Medium, and High Renewables scenarios.

FIGURE ES-3



The use of biodigesters, geothermal energy, and energy storage batteries were also evaluated. Although these technologies will likely be cost effective for certain applications, more in-depth evaluations would be required to determine the amount and cost of these resources. Because of their smaller anticipated financial impact on the study results, they were not included in these strategies. If more in-depth evaluations show their cost effectiveness, then including them would hopefully reduce the cost of becoming energy independent.

The technical analysis included hourly load and generation simulations for the 15-year period that determined what renewable energy resources might be reasonably expected to be available to serve the City's load at any specific hour, based on historical wind patterns and solar insolation levels. From this simulation, the amount of outside wholesale power that was needed to serve the remaining load was calculated. A financial model for the City's electric utility was built, so that the financial impact of implementing these strategies, as well as selling fewer kilowatt-hours (kWhs) to customers, could be evaluated. This evaluation determined the amount of revenue and needed electric rate increases to maintain a reasonable operating margin. The costs to both the City's utility and its electric customers was determined for each of the six strategies and compared to the BAU scenario.

The graph in Figure ES-4 illustrates how the energy savings and new local energy resources collectively achieve the 50%, 75%, and 100% self-sufficiency goals.

FIGURE ES-4

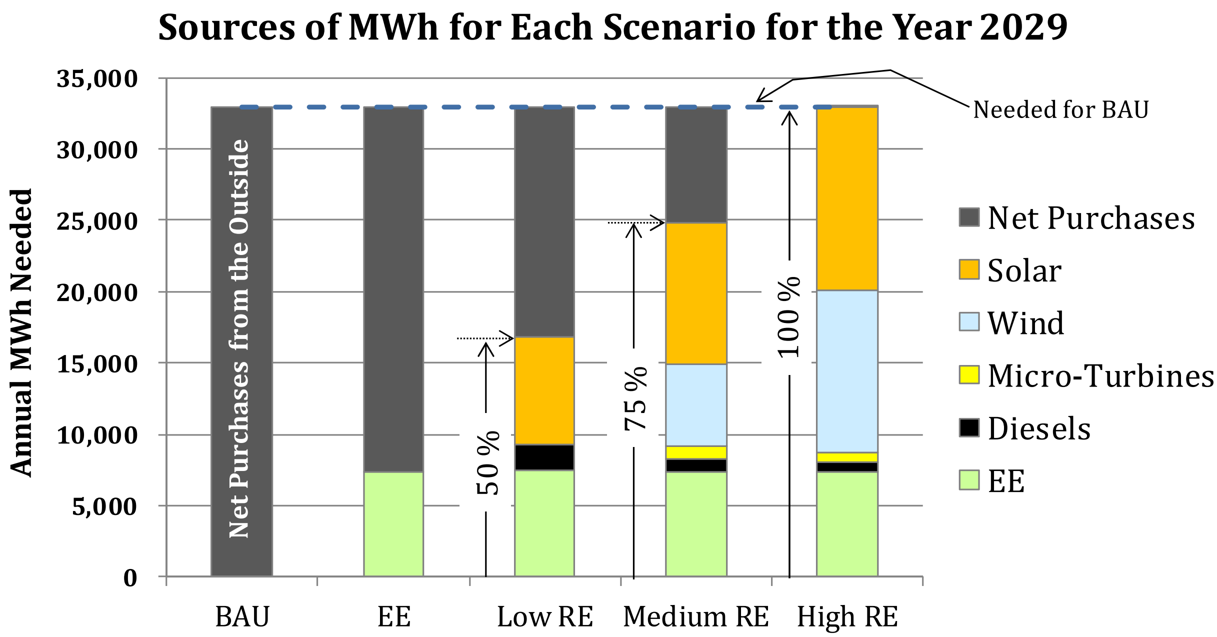
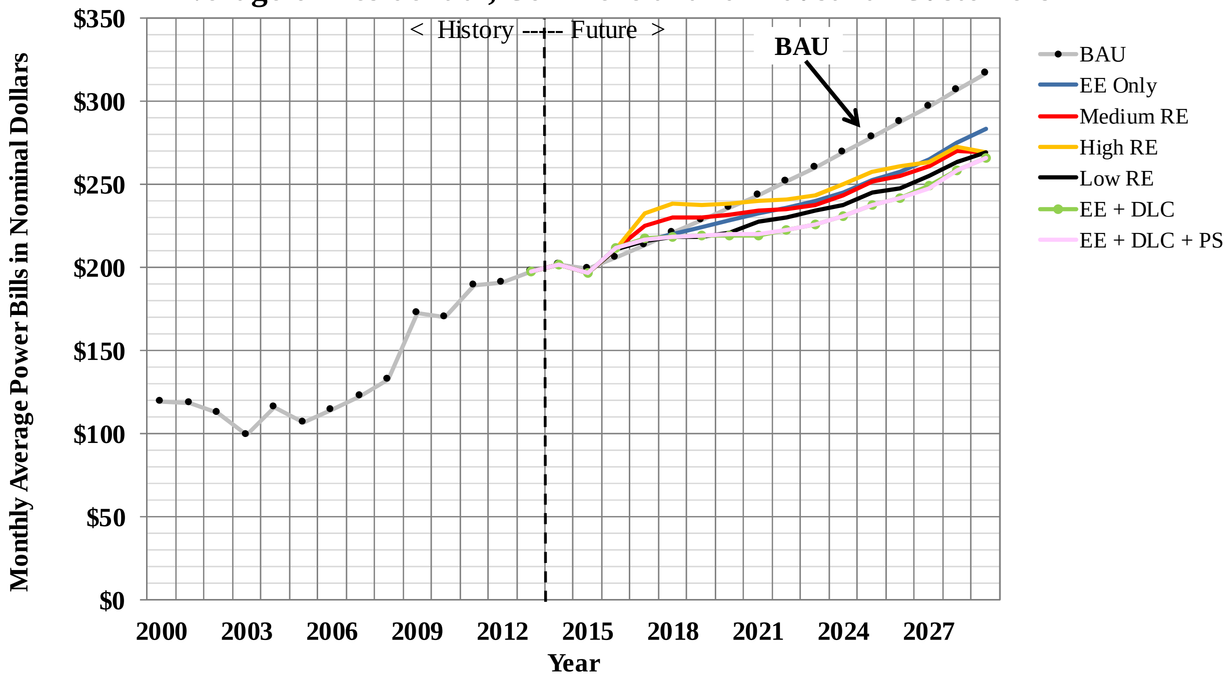


Figure ES-5 depicts the average historical and projected average monthly electric bills for the BAU and six alternative strategy scenarios over the next 15 years. These bills include all residential, commercial, and industrial customers.

FIGURE ES-5

Bloomfield's Monthly Average Power Bills
Average of Residential, Commercial and Industrial Customers



As the graphs suggest, the customers would expect to pay noticeably lower power bills in the longer-term future for all of the six alternative strategies compared to the BAU scenario. Customers' bills would be higher during the first three or four years with Medium and High Renewables scenarios and then become less than the BAU after five years.

Table ES-2 on page 5 provides a summary and comparison of the results of the financial analysis of all seven scenarios. It provides the results from both the utility's perspective (green shading) and the customer's perspective (yellow shading). From the utility's perspective, its operating costs are lower than the BAU scenario for all six of the alternative scenarios. This operating cost includes all of the utility's operating costs, less credits for any excess generation sales back to the grid. The utility's operating margins are essentially the same for all seven scenarios. From the customer's perspective, they save money for all of the six alternative scenarios over the 15-year period compared to the BAU scenario.

TABLE ES-2

Summary of Results from Financial Analysis of All Seven Scenarios											
		Results from the Utility's Perspective							Results from the Customer's Perspective		
		Utility Operating Costs (Includes Revenue Credits for Sale of Excess Solar and Wind Generation)		Average Cost of Resource Over the 15-Year Study Period in ¢ / kWh					Customer Power Bills Over the 15-Year Period		
Scenario Number	Description	15-Year Total	Savings	EE / DLC	Whole-sale Power	Solar PV	Wind Power	Excess Power Sales	Total	Savings Compared to BAU	Average Monthly Bill Savings
		$1,000's	$1,000's	¢ / kWh	¢/kWh	¢/kWh	¢/kWh	¢/kWh	$1,000's	$1,000's	$
	Column Number 2	3	4	5	6	7	8	9	10	11	12
1	Business As Usual	$ 58,420	$ -	-	9.8	-	-	-	$ 63,190	$ -	$ -
2	Energy Efficiency Programs	$ 55,060	$ 3,360	3.5 (EE Only)	10.1	-	-	-	$ 59,380	$ 3,810	$ 15
3	EE + Direct Load Controls	$ 52,260	$ 6,160	-0.3 (EE+DLC)	9.3	-	-	-	$ 56,890	$ 6,300	$ 25
4	EE + DLC + Peak Shaving	$ 52,260	$ 6,160	-0.3 (EE+DLC)	8.4	-	-	-	$ 56,900	$ 6,290	$ 25
5	All of the Above + Low Renewables	$ 53,240	$ 5,180	-0.3 (EE+DLC)	8.6	7.5	-	7.7	$ 57,840	$ 5,350	$ 21
6	All of the Above + Medium Renewables	$ 54,780	$ 3,640	-0.3 (EE+DLC)	9.9	7.5	5.8	7.8	$ 59,340	$ 3,850	$ 15
7	All of the Above + High Renewables	$ 55,950	$ 2,470	-0.3 (EE+DLC)	12.0	7.5	5.8	7.4	$ 60,500	$ 2,690	$ 11

The results of this study clearly indicate that starting an aggressive energy efficiency program and installing direct load control equipment will save utility customers money. Furthermore, it appears that adopting the Low Renewables strategy would likely save all customers money in the long run. The Medium and High Renewables strategies are also shown to save customers money. However, the savings are less, and given the uncertainties in forward-looking studies, the savings are much less certain. There is no doubt that any of these alternative strategies can be accomplished. Of course, some further evaluation and planning would be required to implement these strategies.

To achieve any of these savings, any new power supply contract needs to incorporate more flexibility and incentive for the City to manage its peak demand and add renewable energy.

The implementation of these strategies would result in more local jobs and business due to the energy efficiency programs. Furthermore, the installation of the wind and solar power generation for the 100% self-sufficiency would result in about $35 million of solar and wind power investment in the community, which brings additional construction, operation, and maintenance jobs.

Although nearly all utilities in Iowa have energy efficiency programs and some renewable energy in their power supply, no Iowa or Midwest utility has yet attempted to get a majority of its needs from a combination of aggressive energy efficiency programs coupled with solar and wind power. Comprehensive planning would be required, and the key to accomplishing this goal will be having a core group of community leaders that can motivate the community to achieve these goals.

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