ASES 2013 – 238 : FARMERS ELECTRIC CO-OPERATIVE, KALONA IOWA: AMERICA'S MOST PROGRESSIVE UTILITY?

Lawrence A. Gamble, P.E.
John Collins
Steve Fugate
Sustainable Living Department
Maharishi University of Management
1000 N 4th Street
Fairfield, Iowa 52557
e-mail: lonniegamble@yahoo.com
e-mail: jcollins@mum.edu
email: steve@greenworldbiofuels.com

Warren McKenna
Manager
Farmers Electric Cooperative
Kalona,
Iowa 52247
e-mail: wmckenna@feckalona.com

ABSTRACT

Farmers Electric Cooperative (FEC), located in rural Frytown /Kalona, Iowa and serving 640 subscriber/members, may have the most progressive renewable energy policy of any utility in America. They offer a wide range of incentives, including a feed in tariff, a solar garden/community solar project, efficiency incentives, load control, and remote real time metering. They effectively promote renewable energy and efficiency and have some of the highest rates of participation in their programs of any utility in America. This paper describes the programs, explores how they were created and how they have evolved, gives data on the results of the programs, and presents next steps for Farmers Electric Cooperative.

1. THE NEED FOR PROGRESSIVE ENERGY POLICY

Progress in developing policy for widespread adoption of distributed renewable energy in the electric grid lags the development of technology. We now have a wide range of technologies that would allow the provision of a significant amount of energy and capacity from renewable energy production facilities that are non-utility owned and widely distributed. Distributed renewable energy production and ownership has many well-known benefits such as grid reliability, security and enabling the closure of large, polluting power stations (1) (2) (3). We may be able to get 50 to 70% of our energy requirements from distributed renewable energy without radically changing the grid or how it is managed (4). Germany now gets up to half of their electrical energy requirement on sunny days from widely distributed PV (2). Germany's success is not due to extraordinary solar resources – Berlin has less than half the annual solar resource as Des Moines, Iowa. Nor is it due to proprietary technology – the technology used is readily available in the United States, although German demand has driven German manufacturers to become world leaders in the design and manufacture of residential and commercial grid tie inverters, PV panels, and other equipment used in building distributed energy systems.

The key innovation that has made Germany, Spain, and Japan world leaders in the deployment of distributed renewable energy is innovative policy that removes financial and institutional barriers to widespread implementation of renewable energy. One of the most well-known examples is the feed in tariff. These policies are well documented elsewhere (1) (2) (3). This paper describes the policies that have made Farmers Electric Cooperative, a small utility in a conservative community in rural Iowa, a US leader in implementing distributed renewable energy.

2. BACKGROUND ON FEC

2.1 OVERVIEW OF FEC AND IOWA ELECTRIC UTILITIES

Farmers Electric Cooperative, established in 1916, is the oldest electric cooperative in Iowa. It has 640 subscriber/members and has had about the same number for 20 years. It has 110 miles of distribution lines (6 subscribers per mile of distribution plant), $2.5 million in annual revenues, $6 million invested in plant (before depreciation), and 6 employees. In 2012, FEC purchased 22,645,572 kWh for resale to its subscribers.

Iowa, with a population of 3,074,186 (May 2012), has 1.5 million electric utility subscribers. Iowa has a relatively large number of electrical utility subscribers served by publicly owned entities: 45 Electric Cooperatives serve 223,000 customers and 137 Municipal Electric Utilities serving 212,000 customers. Two investor-owned utilities (Alliant Energy and MidAmerican Energy) have 1,100,000 customers between them. The rural nature of coop service areas is highlighted by these 1998 statistics (5).

TABLE 1: IOWA INVESTOR-OWNED AND RURAL COOP UTILITIES

	% of kWh sold in Iowa	% of miles of distribution line	Consumers per mile of distribution line
Investor Owned Utilities	76%	42%	35
Coops	11%	54%	6

In the early days of building the electric grid, coops were formed to serve areas that investor owned utilities did not deem profitable enough to serve.

At FEC, policy is set by a volunteer board of directors elected annually by the membership. Day to day management is by a general manager and staff. Much of the credit for the development of innovative incentives and policies for renewable energy is due to the leadership and commitment of general manager Warren Mckenna and his team of employees and consultants.

2.2 THE COMMUNITY

Farmers Electric Cooperative headquarters are in Frytown, Iowa. The FEC service area includes the Frytown area north of Kalona and parts of rural Washington, Johnson and Iowa counties. The subscriber profile is essentially rural and conservative.

The economic base is farming, value added agricultural products, and light manufacturing. FEC loads also include the Iowa Mennonite High School, Mid-Prairie Elementary Schools, and 6 large Churches north of Kalona Iowa, population 2,380. The rural area around Kalona is home to one of the largest populations of Amish and Mennonite families West of the Mississippi. The Amish families do not use electricity.

2.3 DESCRIPTION OF FEC ELECTRICAL NETWORK AND POWER SUPPLY AGREEMENTS

FEC has 110 miles of distribution plant, with distribution voltages of 12.4/7.2 kV. As of February 2013, FEC had 640 customers and 815 meters. In 2012 FEC bought 22,645,572 kWh per year at a cost of 5 cents per kWh. FEC's peak load is 4.4 MW. FEC connects to the eastern Iowa ITC Transmission grid with a 34.5 kV voltage connection at a substation located in Frytown Iowa. FEC has three 2 mw diesel generators that are used to lower its costs for peak power. They are dispatchable by MISO (Midwest Independent Transmission System Operators), a regional power grid management organization. The three generators run 10 - 100 hours per year and save the coop approximately $266,000 on costs for capacity. As part of its commitment to renewable energy, FEC uses 2% biodiesel to fuel the generators. One half of FEC's cost of power is for capacity and demand charges. FEC has 120 kW of hot water heaters and 120 kW of motor load on interruptible service, where the hot water heaters and motor loads can be cycled by FEC during high demand times.

As of February 2013, FEC had 15 customer owned solar electric systems connected to its grid, ranging in size from 2 kW to 20 kW with a total capacity of 135 kW. In addition, FEC operates a 25 kW solar garden project, located at its headquarters. So far, residential and commercial solar energy systems and the FEC organized solar garden project have connected at 120 volts single phase or 120/240 volts split phase. Overall, about 20% of subscribers have bought into solar PV.

2.4 REGULATION

In Iowa, electric utilities are regulated by the Iowa Utilities Board (IUB). Cooperatives and municipal electric utilities are exempt from rate regulation. The IUB occasionally adopts policy that affect Cooperatives. One policy recommendation is for all Iowa utilities to source 25% of electricity from renewable sources by 2025. This was the framework for the development of the renewable and efficiency incentives at FEC.

3. FEC AND THE 25% BY 2025 GOAL (25X'25)

A national broad alliance of diverse organizations has set the goal for the USA of 25% renewable by 2025. To date, 25x'25 has been endorsed by nearly 1,000 partners, 35 current and former governors, 15 state legislatures and the U.S. Congress through The Energy Independence and Security Act of 2007. This and the IUB endorsement of 25x'25 prompted FEC General Manager Warren Mckenna to develop a plan to reduce energy consumption and encourage renewable energy generation. The plan has three parts: 1) energy tracking and monitoring, 2) energy efficiency and conservation, and 3) renewable energy generation

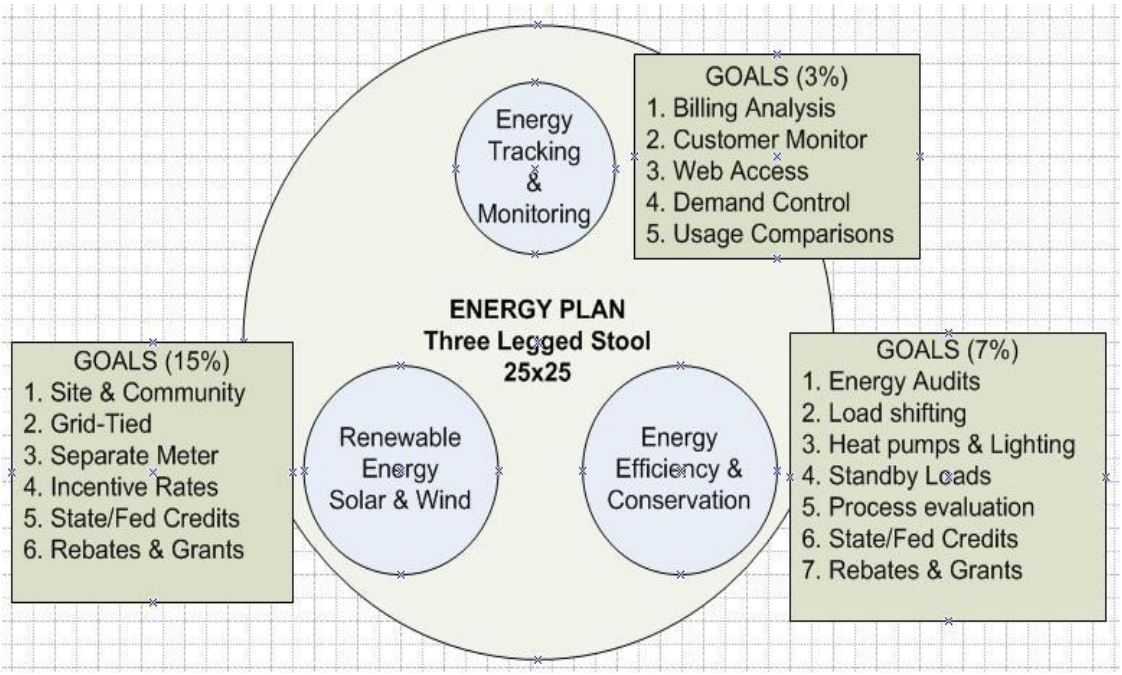


Fig.1: FEC's three part plan

3.1 ENERGY TRACKING AND MONITORING: 3% OF THE 25%

According to FEC manager Warren Mckenna, metering and monitoring are critical. He quotes Peter Drucker: "If you don't measure it, you can't manage it". Farmers Electric Cooperative (FEC) has installed an automated metering system (AMS) that allows real time monitoring of individual customer energy and capacity.

FEC installed automated metering reading 20 years ago and they are in the process of upgrading to an Advanced Metering Infrastructure (AMI) system for 2 way communications. This will allow FEC to integrate metering and demand control systems into one process. They have 125 water heaters and 120 HP of motors under direct load control. This system provides the means to monitor peak system loading and to cycle water heaters and motors to lower system peak demand. This allows FEC to maintain a very high 73% load factor which lowers demand charges and overall kWh cost. Load factors for small cooperatives are typically around 50%. (5)

FEC also utilizes metering data as an analysis tool to pinpoint member usage complaints. About 5% of its customers have geothermal heating and cooling and FEC

does a biannual metering analysis of all geothermal loads. Every year they find one or two systems that have malfunctioned before the customer is even aware of the problem. This has resulted in repairs being covered by warranty that may have otherwise gone undetected until after the warranty period. The metering and billing programs can flag abnormal usage, which often indicates a developing problem with equipment. For example, they have found malfunctioning water wells and notified customers well ahead of major system failures. The AMS is also useful in resolving disputes over subscriber bills - subscribers can be shown daily usage patterns.

FEC also calculates and provide usage comparisons for residential customers. Customer feedback is provided by charting the lowest, the highest, and then showing the customer how they compare along a usage graph. (7)

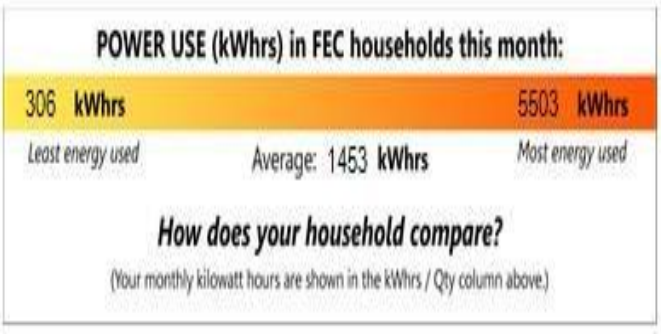


Fig. 2: Customer feedback graphic

Most importantly, the AMI system allows the utility to track and control line losses. Line losses are a primary factor in measuring the performance of any electric system. FEC has a low 3.2%/year line loss factor. Typical line losses for other coops in Iowa are approximately 6% - 10% with some as high as 20%. (7) FEC measures, monitors, and tunes their system holistically, comparing customer meters, the billing system, and substation metering. Substation metering includes real-time wholesale metering that records kWh purchased from the regional grid. The AMI system monitors real time kWh sales on each system feeder and phase, which can then be matched against purchased power to determine line losses.

3.2 ENERGY EFFICIENCY AND CONSERVATION: 7% OF THE 25%

The first step in developing energy efficiency programs was to eliminate programs that incentivized additional energy use. In 2010 FEC eliminated rebates and incentives that encouraged energy use and redirected their focus toward rebates, incentives and grants that result in the direct reduction of energy consumption. They have set a goal of spending 3% of gross revenue per year (approximately $75,000) on energy efficiency and renewable energy. One example is the elimination of the resistance water heater rebate and converting that to a heat-pump water heater rebate. FEC established cash incentives for shade trees, clotheslines, earth tubes, and pellet stoves. To encourage participation in the programs, FEC runs seasonal incentives blitzes, doubling a rebate for a short period of time.

3.3 RENEWABLE ENERGY: 15% OF THE 25 %

FEC has a wide range of renewable energy incentives. These include one of the first feed in tariffs in the US, cash incentives for installation of solar and wind equipment, a solar garden, and demonstration projects at a public and private school. Incentives are financed by a variety of methods, including a voluntary customer renewable energy support payments. Incentives apply to solar electric and wind systems. There are no incentives for solar thermal systems at this time. The utility has a Midwest Renewable Energy Association Certified Solar Site Assessor on staff. Each of the incentives is briefly described next.

3.3.1 Feed in Tariff

Renewable energy generation is metered separately from customer used energy. FEC calls this a buy all – sell all approach. Customers buy all of their energy from FEC, and sell all of their renewable energy to FEC in two separate transactions. Customers with renewable energy generation buy energy at FEC tariff rates currently 11.5 cents per kWh. Customers sell renewable energy to FEC through rates that are similar to a feed in tariff as follows:

- Calculate 25% of KWh used for the month.
- This amount of kWh generated by solar is purchased by FEC at 20 cents per kWh
- If more solar KWh are generated, they are purchased by FEC at 12.5 cents per kWh up to the amount of kWh that the subscriber uses that month.
- If more kWh are generated than the subscriber uses, these remainder are purchased at 6 cents per kWh.

Example:
Generated: 1000 kWh
Used: 600 kWh
25% of 1000 = 250 kWh
250 kWh @ 20 cents/kwh = $50
350 kWh @ 12.5 cents/kwh = $43.75
400 kWh @ 6 cents per kwh = $24.00

Total paid to customer for energy = $50 + 43.75 + 24.00 = 138.75
Customers with renewable energy on site are also required to participate in the Green Power Project funding mechanism at a cost of $ 3.00/month.

FEC has 135 kW of customer installed solar, a 25 kW solar garden, and a 20 kW wind generator. Total production is 190,000 kWh per year.

3.3.2 Cash Incentives for Solar, Wind, and Geothermal

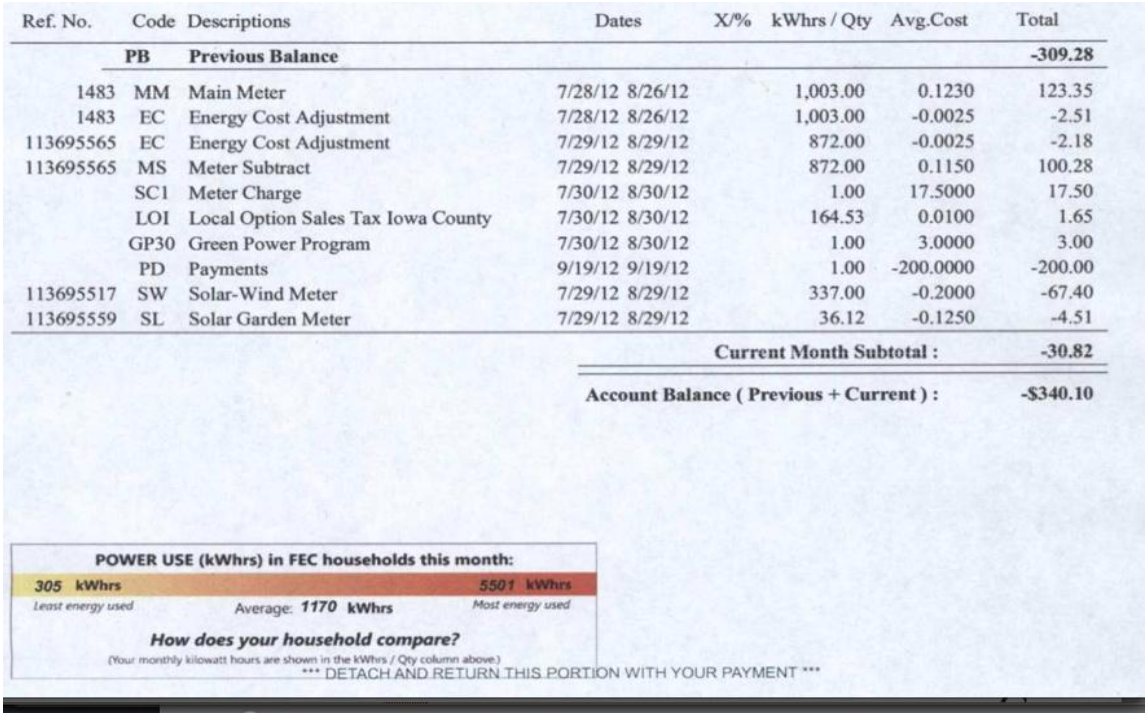
Cash incentives are available for solar electric systems, wind electric systems, and geothermal systems. For solar and wind, FEC offers a cash incentive of $ .50 cents per watt with a cap of $ 2500. If the cash incentive is used, the feed in tariff rate cannot be used. Customers choosing the cash incentive get a rate of 12.5 cents per kWh up the number of kWh used. If more renewable kWh are generated than the subscriber uses, they are paid at $.06 cents per kWh. Geothermal systems get a flat incentive of $400.

3.3.3 Solar Garden Project

FEC operates a community solar garden project that allows customers to purchase solar modules that FEC installs and maintains at a facility next to their office in Frytown. Monthly kWh from the solar garden are credited directly to the individual customer bill as if they had been generated at the customer location. FEC purchases the energy at12.5 cents per kWh. The solar garden allows those who can't use on site solar, like those without good access to sun and those that are renting, to get the benefits of solar. Current capacity of the solar garden is 25 kW, consisting of 112 modules rated at 235 watts each. To encourage wide participation, customers can only purchase up to 5 modules. Currently there are 70 customer/owners, including business, residential, and a Church. Twice a year, the solar garden is opened for purchase. Initially, module price was subsidized by FEC at a cost of $250 per module, installation, inverter capacity, and insurance included. Later offerings had modules priced at $500 each. Offerings of modules typically sell out in the first week of offering. Module owners are issued a certificate of ownership that can be transferred or sold between customer/members. The owner also has the option to sell the module back to the Cooperative at any time at a depreciated price. This is a very popular program!

Participation in the program is limited by a $20,000 per year budget for the solar garden, and time for FEC employees to do the installation.

Fig. 3: Solar garden photo



Ref. No.	Code	Descriptions	Dates	X/%	kWhrs / Qty	Avg.Cost	Total
	PB	**Previous Balance**					**-309.28**
1483	MM	Main Meter	7/28/12 8/26/12		1,003.00	0.1230	123.35
1483	EC	Energy Cost Adjustment	7/28/12 8/26/12		1,003.00	-0.0025	-2.51
113695565	EC	Energy Cost Adjustment	7/29/12 8/29/12		872.00	-0.0025	-2.18
113695565	MS	Meter Subtract	7/29/12 8/29/12		872.00	0.1150	100.28
	SC1	Meter Charge	7/30/12 8/30/12		1.00	17.5000	17.50
	LOI	Local Option Sales Tax Iowa County	7/30/12 8/30/12		164.53	0.0100	1.65
	GP30	Green Power Program	7/30/12 8/30/12		1.00	3.0000	3.00
	PD	Payments	9/19/12 9/19/12		1.00	-200.0000	-200.00
113695517	SW	Solar-Wind Meter	7/29/12 8/29/12		337.00	-0.2000	-67.40
113695559	SL	Solar Garden Meter	7/29/12 8/29/12		36.12	-0.1250	-4.51
						Current Month Subtotal :	**-30.82**
						Account Balance (Previous + Current) :	**-$340.10**

POWER USE (kWhrs) in FEC households this month:

305 kWhrs — *Least energy used* — Average: *1170* kWhrs — *5501* kWhrs — *Most energy used*

How does your household compare?

(Your monthly kilowatt hours are shown in the kWhrs / Qty column above.)

*** DETACH AND RETURN THIS PORTION WITH YOUR PAYMENT ***

Fig. 4: Sample bill showing 1003 kWh used, 337 kWh generated at the customer location and 36 kWh generated at this customer's share of the solar garden.

3.3.4 Demonstration Projects at Schools

Through their Solar Schools Program FEC has supported the installation of 1.8 kw pv systems at Mid Prairie Elementary School (a public school) and at Iowa Mennonite High School (a private high school). Both systems are on trackers and are in highly visible locations. One was partially financed by a local riverboat (gambling) foundation; the other was financed by a grant from the Iowa Power Fund. Both systems are net metered, offsetting kWh that would have been purchased from FEC. Based on the success of the demonstration project, the Iowa Mennonite School is in the process of installing a 50 KW PV system. This will be about 30% of their peak load, and will offset about 10% of their annual electrical energy usage.

FEC worked with the University of Northern Iowa (UNI) Center for Energy and Environmental Education (CEEE) Staff to provide school staff training and curricula in connection with these solar installations. The utility has been the driving force over the past few years at its local high school and elementary school, providing full facility energy audits, and incentives for follow-up improvements. Iowa Mennonite School has implemented recommendations from a comprehensive energy audit coordinated by FEC that cut energy use by 21 %.

4. Funding the Programs

Programs are funded partly through a voluntary $3 per month Green Power Project customer contribution. Customers can choose to contribute multiples of $3 that go toward funding the 20 cent incentive rate. Currently, approximately 70 customers contribute to the green power rate, which brings in about $270 per month. All customers with renewable energy systems must make at least a $3 monthly contribution. School demonstration programs were financed through grants obtained from a local casino and the Iowa office of Energy Independence,

The rest of the funding for the programs (approximately 65,000 per year) comes from FEC's general revenues.

5. PARTICIPATION IN THE PROGRAMS

The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) 2010 annual assessment of top utility green power programs shows Farmers Electric Cooperative (FEC), Kalona, is among the leaders. NREL developed "Top 10" rankings of green power programs for 2010 in several categories, including the percentage of customer participation. FEC ranked third in the nation in this category with over 11% of its members voluntarily contributing to the cooperative's Green Power Program, and 20% of its subscribers have participated in the solar programs.

Customer communications and feedback are a critical and important part of making this process work. A recent survey of owners revealed that making it easy to invest was just as critical as the connection to the environment.

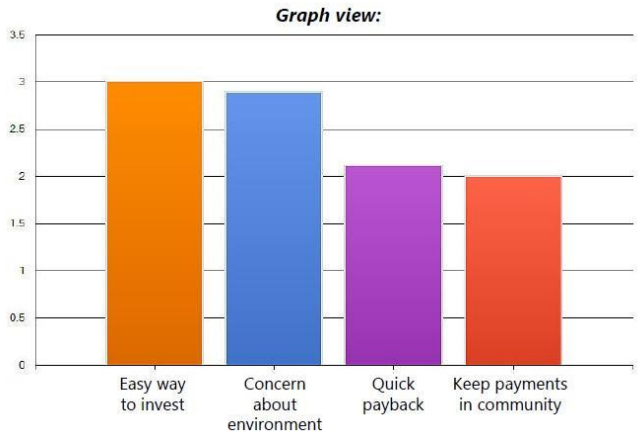


Fig.5: Customer motivation survey

FEC has hosted or directly participated in numerous meetings and tours centered on energy efficiency and renewable energy, including the CEEE Farm working group, RPGI meeting on renewable energy, National Solar Tour, IRENEW/Iowa Policy Project Solar Tour. The Manager serves on the University of Northern Iowa, Center for Energy and Environmental Education Train the Trainer committee, and is a board member of the Iowa Solar and Small Wind Trade Association. The utility has a Midwest Renewable Energy Association Certified Solar Site Assessor on staff.

6. FUTURE PLANS

A 500 kW solar farm has been approved, and between 50 and 150 kW of additional customer owned solar is expected to be installed in the summer of 2013. The high school is in the process of adding a 50 kW ground mount solar array. It is expected that the community solar garden will continue to grow. There have been several groups that have visited FEC renewable energy sites and it is expected that interest from these visits may result in an additional 500 kW of solar being installed in Iowa.

The 500 kW solar farm will be financed and owned by the Bank for Cooperatives, which is able to take the tax credits. The project will be located on the site of one of the largest customers of FEC, an organic egg production facility. The facility will be paid 1.5 cents per kWh in rent for the 4.5 acres of land the project will require. 0.5 cents of the 1.5 will be applied to a buy-in for the egg production facility. At the end of 10 years, the egg production facility will have the option of owning part or the entire 500 kW project.

A feasibility study was done for 1.5 MW wind project. The project would have resulted in a 1.5 cent per kWh raise in rates, and was rejected by the board of FEC. The project may be resubmitted in the future as the cost of energy rises.

General Manager Warren Mckenna consults on other projects in the region. Recently, he advised on the structure of a proposed 3 MW PV project at nearby Maharishi University of Management.

FEC will be 100 years old in 2016. By then it plans to have at least 1 MW of renewable energy installed. This will achieve the 25x'25 target 9 years early.

7. SUMMARY AND CONCLUSIONS

This paper describes how FEC, one of the smallest utilities in the US, located in a conservative rural community, with very little growth is subscriber base for the last 20 years, with no utility board mandate, has been able to implement a wide variety of renewable energy and efficiency incentives that US utilities thousands of times its size have not matched. The authors believe its success is primarily due to the vision and commitment of manager Warren Mckenna and the team he assembled to develop and promote these incentives in his community. Warren has worked tirelessly to promote renewable energy and efficiency programs in a way that his community and board can understand and accept. This approach emphasizes thrift, energy security (both price and availability), reliability, keeping dollars local, and local job creation.

This utility has chosen to take what Amory Lovins calls the soft energy path (4) to move from the traditional

outside-in energy supply model toward a more inside-out approach that includes all of the above as resources. They have done this in one of the most fiscally if not politically conservative areas in Iowa. According to Manager McKenna, "If it can be done here it can be done anywhere."

FEC considers the driving force behind the adoption of renewable is making it easier for customers to invest and making return on investment shorter than ten years. The only way to do this is for utilities, customers, and government to come together behind a national Feed-in-tariff that provides a standard metering and interconnection policy that mirrors what has been done around the world and now even here Farmers Electric Cooperative.

The nature of a cooperative is local ownership and control and providing a wide range of benefits to their communities, which are factors in the interest of the coop in developing these programs.

In 1916, FEC was a leader in bringing electricity to rural Iowa. Today, it continues to lead in the development of the highly reliable, distributed, renewables-powered electric grid.

If something exists, it is possible. FEC shows that progressive energy policy is possible. The authors hope that other utilities will look to FEC as they work to develop energy policy for a future grid that is powered by renewable energy and has the opportunity for local ownership and control.

8. SUMMARY POINTS

Metering, Monitoring, Tracking (measure it)

- Line loss 3.3% 2012, Iowa best among peers
- Reliability Indices, Iowa best among peers
- Analysis and preemptive customer notification on high kWh usage

Energy Efficiency and Conservation (shaping use and buying habits)

- Load Factor 73% 2012, Iowa best among peers
- Innovative rebate and grant programs and marketing
- Eliminated load building rebates
- Goal to spend 3% of gross revenue

Renewable Energy (easy investment and high participation)

- Green Power Project to fund RE, national recognition for participation rates
- Feed in rates -- separate metering, tied to consumptions, 10 year guarantee
- Community Solar Garden, over 10% customer participation rate
- 500 kW Solar Farm tied to organic egg processor load (approved for 2013)
- Education and eco-tourism bonus

9. REFERENCES

(1) Lovins, Amory, Winning the Oil End Game, Rocky Mountain Institute, 2005

(2) Lovins, Amory. Reinventing Fire: Bold Business Solutions for the New Energy Era, Rocky Mountain Institute, 2005, p 198

(3) Retrieved from http://www.huffingtonpost.com/2011/05/30/germany-nuclear-power-plant-shut-down_n_868786.html , 2001

(4) Morris, C., Pehnt, M., German Energy Transition: Arguments for a renewable energy future. Heinrich Boll Foundation.,2012

(5) Cleveland, Leslie (editor). Facts Concerning the Production and Consumption of Electricity in Iowa (2000)

(6) 4. http://en.wikipedia.org/wiki/Soft_energy_path about Lovins getting off fossil fuels and onto renewables

(7) 5. Iowa Policy Project. "Encouraging Energy Efficiency Through Competitions"