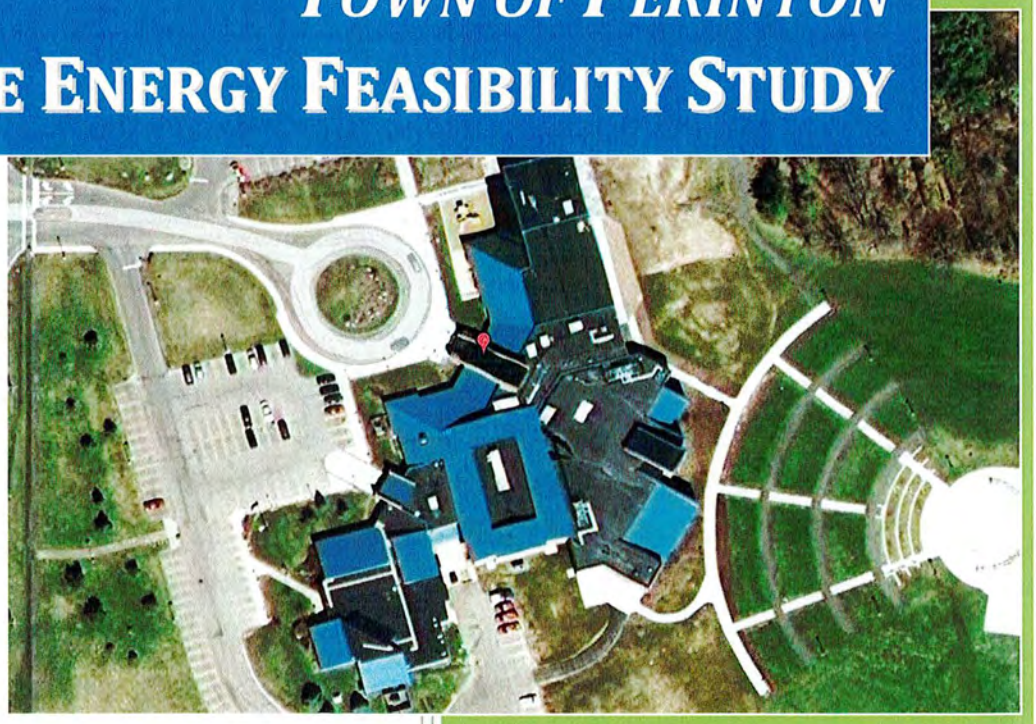
Appendix F: Alternative Energy Feasibility Study

TOWN OF PERINTON
ALTERNATIVE ENERGY FEASIBILITY STUDY



APRIL 11, 2012

SUBMITTED BY:

LARSEN ENGINEERS

TOWN OF PERINTON

ALTERNATIVE ENERGY FEASIBILITY STUDY

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A. EXECUTIVE SUMMARY

Larsen Engineers was retained by the Town of Perinton to perform an Alternative Energy Feasibility Study to evaluate its Town Hall / Community Center Facility (Town Hall Complex) for energy conservation and long term energy generation options.

The Town Hall Complex has been evaluated on current energy consumption and costs, as well as opportunities to reduce future energy needs. The information gathered and analysis performed during this study is planned to be used to select projects for implementation under various grant programs or capital improvements to conserve energy as well as reduce energy costs associated with operating the Town Hall Complex by implementing Green Energy Technologies to off-set existing electrical and natural gas usage. By combining conservation and green energy concepts, this facility would be able to substantially reduce its energy demand and annual energy costs. The Report also covers the economic feasibility factors and sources of financing to make the improvements in a cost effective manner.

Various options of Energy Conservation concepts and Green Energy Technologies were analyzed as part of this Study. The Conservation measures evaluated included: lighting retrofits, heat circulation and destratification units, and new heating systems. The renewable energy options evaluated included: Geothermal, Wind, Solar Panels and Solar Hot Water Systems. Each was evaluated for their feasibility, cost, and energy savings to determine which would be the most beneficial. Specific measures or areas for improvement were evaluated by integrated energy modeling to achieve reasonable estimates of energy savings and are expressed in terms of Return on Investment, Life-cycle cost, and source energy saved.

The following table shows the recommendation for energy conservation measures and alternative energy generation.

SUMMARY TABLE: POTENTIAL ECM'S AND ALTERNATIVE ENERGY GENERATION

Project No.	Project Description	Capital Cost $	Annual Cost (30 yrs @ 3%)	Annual Savings	Recommendation
1	Lighting Retrofits	$11,000	N/A	1,369.00	Implement
2	Install VFD Controls	$12, 000	N/A	TBD	Implement
3	Heat Circulation Fans	$1,800	N/A	TBD	Implement
4	Boiler replacement	$160,000 to $250,000	TBD	TBD	Prelim. Study
5	Parking Lot & Outdoor Lighting	TBD	TBD	TBD	Prelim. Study
6	Solar PV system 100 kW	$400,000	$23,200	$5,000	Wait for Grant
7	Solar Thermal Energy	$110,000	$6,380	$3,262	Prelim. Study
8	Wind Turbine 500 kW	$1,750,000	$101,500	$67,500	Wait for Grant
9A	Geothermal System (partial)	$105,000	TBD	$4,141	Prelim. Study
9B	Geothermal System 100%	$1,750,000	$131,000	$131,966	Prelim. Study

B. BACKGROUND

The Town of Perinton is located in Monroe County, southeast of the City of Rochester. The Town has a population of 46,462 residents according to the 2010 US Census.

The Town of Perinton believes that ongoing planning is a necessary function of good government. It has always been in the forefront of innovation and practical problem solving, whether the focus is to protect its environment, make the community more livable for its citizens, attract and retain business, or reduce unnecessary spending. The Economic Stimulus initiatives at the federal level have provided Perinton with a funding mechanism so it could invest in energy efficiency, renewable energy and other energy related projects. Rather than using all of the funds on "bricks and mortar" projects, Perinton has elected to maximize its investment with studies to investigate the long term applications and benefits of sustainable energy sources.

Why would a community that for years has benefitted from the low energy costs of Fairport Electric (which primarily uses hydropower from Niagara Falls) look for alternate energy solutions? Because it is the right thing to do. Because lower energy costs save money. Because alternative energy attracts and creates "Green" jobs. Because Town leadership stimulates

individual energy stewardship. Because being prepared and proactive is better than leaving decisions about future cost of energy in the hands of others.

Perinton has shown its interest and leadership in sustainability and energy conservation for many years. It has encouraged and partnered with Waste Management in their recycling programs and methane gas generation. It has partnered with the Village of Fairport and the Fairport School District on the construction of a joint fueling facility. It consolidated its Public Works operations and uses innovative technology to reduce energy consumption at the Community Center. It sponsors an annual Household Hazardous waste collection / electronic recycling day that in 2010 collected 18.3 tons of waste and 40 tons of used / broken electronics. The Town also provides wood chip mulch to its residents from the yard debris it collects.

C. PROJECT TASKS

The project began with a "get started meeting" with Town staff and officials. This meeting established a core group of Town staff that represents the stakeholders and was able to help guide the Study.

The Study continued with an informational orientation with the Town Public Works Department and a field tour of the facility with Town staff and Labella Associates (consultant for Town Energy Master Plan). Record drawings and power consumption data was collected. ***Appendix A*** shows the annual energy use *(December 2008 – December 2009)*. Field measurements and observations were made related to the energy consuming units and potential retrofits to conserve electric power.

Several field visits to the Town Hall Complex were made throughout the duration of the Study including alternative energy experts from Solar, Wind, and Geothermal industries.

Energy modeling was performed on the data to evaluate seasonal trends and to establish base line loads for both electric and gas consumption. Based on the 2009 energy bills, the electric load for the complex was 2,914,200 kWh and the natural gas load was 147,267 Therms. Priority areas were assessed based on the size, age and cost of operations for different parts of the facility with a focus first on energy conservation and secondly alternative energy technology implementation.

The data evaluation and conceptual design of various options were completed to develop a strategy for overall reduction in energy use and to produce Green power to replace current forms of energy.

Multiple progress meetings were held during the project and a public information booth was set up on April 9th, 2011 where the community members were given the opportunity to visit the Town Hall as part of an Earth Day 2011 event.

Fairport Electric was consulted and they indicated that a lighting retrofit incentive program was to expire at the end of the Year 2010. In order to take advantage of these incentives, Larsen prepared a summary report and submitted it to Fairport Electric before the deadline and was successfully approved for implementation in early 2011 (***Appendix B***). This Study includes a Wind power evaluation; therefore, the grant application to Fairport Electric also included the installation of a Wind measuring system to record the actual site wind data. With actual wind data available, a full wind power assessment can be performed to aid in the design and to create realistic power production projections for the potential long term wind generation at this site.

The facility HVAC equipment has been reviewed to assess the potential for an alternative heating system for the buildings and the Recreation Pool Complex. It was noted that the pool temperature for the water and the indoor air are kept elevated to control the chlorine odor see table below. Disinfection and operating air temperatures at other large public pools were researched to identify possible retrofits to reduce operating costs without sacrificing the public safety aspect of the pool operation.

Item	Lap Pool	Leisure Pool
Surface Area	3,286 SF	3,285 SF
Volume	142,600 gallons	52,545 gallons
Pool Temperatures (air temperature is 84°)	83 degrees Fahrenheit	84 degrees Fahrenheit

Geothermal energy potential was evaluated based on published soils and subsurface geologic data to undertake a desktop assessment of economic feasibility for certain older parts of the Town Complex that has an electric heat system and can benefit from geothermal technology. ***Appendix C*** includes a report from True Energy Solutions.

The orientation of existing roofs for solar PV installation was reviewed and assessed for the sizing of the solar PV generation potential for a roof mounted system.

This site offers significant wind potential to generate power during the high energy cost season. There are various forms of small-medium size wind turbines that could be potentially located on the site. This requires careful consideration of aesthetic factors. The best wind potential would be at the similar height (150 to 200 ft) as the existing communication towers on south side of the Town Hall Complex. It is possible to produce enough electricity at this site to meet all of the annual electrical demand on a net metering basis, if grants are available and supported by the Town residents.

D. COMMUNITY FEEDBACK

This Study started with clear communication from Town staff and our understanding that the Town of Perinton wishes to evaluate their energy costs and find ways to conserve and generate power using alternative energy technologies that are affordable and practical for implementation. The preliminary findings of this Study were presented on display boards at the Town's Earth Day / Energy Fair celebration on April 9th, 2011. Several visitors appreciated the intent of the project and the effort being made by the Town to control long term energy costs while also looking at short term energy conservation measures. The final report is planned to be shared with the community in the near future.

E. DEVELOPMENT OF AN ENERGY STRATEGY

The total Electricity and Gas consumption data tables conveys the current demand and costs for operating and maintaining the Town Hall Complex. The first priority would be to reduce the energy demand by implementing conservation concepts. The second priority is to evaluate alternative energy concepts for payback/initial cost, reliability, and maintenance frequency, etc. This strategy has been developed based on the cost benefit analysis of sizing alternative energy systems. If the base energy load of a building can be reduced, then overall alternative energy generation system(s) can therefore be sized based on this reduced base load and save upfront system cost and long term energy use.

ENERGY CONSERVATION CONCEPTS:

1. ***Reduce consumption by energy efficiency:*** new light fixtures, efficient motors boilers etc.
2. ***Reduce energy by conservation:*** use timers, day light sensors to control lights, use variable frequency drives to control recirculation pumps etc.

Energy Conservation Project Options:

The Town of Perinton has been active in reducing energy costs via conservation and energy audits. Energy audits were performed by consultants to evaluate potential energy conservation measures. The strategy for reducing energy demand reduction starts with improving energy efficiency and implementing simple conservation measures.

It should be noted, that as part of this conceptual level Study, the total energy usage was available but the incremental use of the energy for each sub system has not been readily available. The Siemens energy management system should have this data available for further engineering analysis prior to any replacement when the old system reaches its useful life or under grant incentives currently available from Iberdrola under the Custom Measure Program.

Larsen has reviewed the past reports and made field observations to assess the potential of conservation measures at this facility. Site specific energy conservation options have been identified and further explained below.

1. LIGHTING RETROFIT PROJECT *(PROJECT 1)*

Practicable conservation measures associates with a lighting retrofit project would include the installation of light and motion detectors to automatically turn off the lights under unoccupied or day lit conditions, as well as replacing 571 T-12 lamps with T-8 lamps and replacing 4 H10 lamps with CFLs. It would be advisable to look at the options to allow greater daylight harvesting near the ceiling so that artificial lights can be dimmed down under sunny days. These changes would result in a projected energy usage reduction of 35,109 kWh per year or 24% of the total annual electrical energy demand for this facility, thus saving the Town $1,369.25 per year.

Fairport Municipal Commission has offered financial assistance in the amount of $11,000, through their Commercial Energy Efficiency Program to purchase necessary T8 and CFL lamps. The labor to install the new light bulbs can be completed by Town maintenance staff. The grant application submitted to obtain these funds can be found in ***Appendix B.***

2. INSTALL VARIABLE FREQUENCY DRIVE (VFD) CONTROLS *(PROJECT 2)*

The hot water supply to heat the building and pool water has the potential to reduce electrical energy by installing VFD controls on the six (6) water circulation motors to deal with the variable demand and reduce the flow rates. The estimated budget cost is approximately $12,000, with a savings of over $4,000 per year are anticipated.

Savings estimates are based on an average heating system run time of 4000 hours/year and a power output matched (7.5 hp) variable frequency drive. The pool motors are likely operating more than 4000 hours/yr and thus could result in higher savings. Calculations were done assuming: a hp to Kw conversion factor of 0.746, an adjustable frequency drive power ratio of 0.4, an existing uncontrolled drive, and an electrical rate of $0.05/KwH. This yields an annual energy savings of 13,428 KwH per drive and an estimated savings of $4,028 a year with all 6 pumps switched to VFDs.

These savings projections will be verified and updated during preliminary design phase after review of the annual operating data stored in the Siemens computer based energy management system. The energy usage in each main component of the HVAC system should be reviewed to accurately project the potential savings from VFD as part of the engineering before implementation. This would required detail monitoring for all the equipment to determine its electric or gas consumption along with the run time dated extracted from the energy management system. Similar VFD motor controls on the water circulation pump for heating the old Town Hall is also beneficial to reduce electrical energy pumping demand by 20-30%.

3. HEAT CIRCULATION AND DESTRATIFICATION PROJECT *(PROJECT 3)*

White Airius Fans on Ceiling

Air temperature readings in the high ceiling areas of the Aquatics Center are significantly higher than those near the floor. Heat circulation and destratification units could be mounted near the top of the ceiling in the pool area to help reduce the heating requirements of this area. These units mix the warm ceiling air with the cooler floor air, thus increasing the temperature where people swim and work. As this happens, it will require less energy to comfortably heat the pool deck area, allowing thermostats to be lowered and energy savings realized. ***Appendix D*** shows an example of these types of Fans. Four (4) of these Fans would adequately "thermo equalize" the pool area and are estimated to cost about $1,800. Based on manufacturer's information and experience at other locations, the energy saved by installing these units could be in the range of 10-15%.

Airius Fans Mounted on ceiling, Rec. Center- Fort Collins, CO

Larsen recommends further field evaluation prior to implementation since the supplier is willing to install a demonstration unit to observe the performance in actual field location. These units can also be considered for the gym and fitness area for better air distribution at lower energy costs by replacing old fans with higher energy demands. The implementation of this technology will be based on results and performance observed during the demonstration phase.

4. BOILER REPLACEMENT PROJECT *(PROJECT 4)*

Significant energy savings, of approximately $32,000 can be achieved by replacing one of the two large natural gas boilers in the Community Center with a multiple modulating condensing type high efficiency boiler. This type of boiler has the ability to operate at various loads with a much higher efficiency than the existing boiler; thus, reducing the current gas consumption.

Benchmark Low NOx Boiler

Efficiency Difference - existing vs condensing boiler	24.0%
Total Gas Savings -Therms (less DHW production)	32150.40
Cost/Therm	$1.00
Cost Savings	$32,150.40

The estimated capital cost could range between $160,000 to $250,000 and is based on an evaluation of the current mechanical layout and ease of equipment removal. Please note that further engineering will be required in order to develop more accurate cost estimates and energy savings projections.

5. PARKING LOT AND OUTDOOR LIGHTING *(PROJECT 5)*

There are efficient lamp replacements available with lighting controls that can provide programmable lighting levels based on occupancy and time of the day. This retrofit option should be evaluated so that lighting zones on weekdays and late night hours can be programmed to avoid illuminating the entire parking lot when only the area adjacent to the building could be lit and all lights turned off when sufficient daylight is available in the morning. This project concept could be further developed in the design phase with cost and projected energy savings.

6. POOL DISINFECTION ALTERNATIVES (For Enhancing the Air Quality and Reducing the Water-Air Temperature Requirement for Heat Load Reduction)

Our research of Green swimming pools indicates that some modifications to the disinfection system could help reduce the chlorine demand, which allow the Town to lower the water and air temperature in the pool area, thus reducing heating costs. An example of this type of "Green" disinfection has been instituted in the City of St. Paul, Minnesota where they have used a sphagnum moss system as a natural way to improve their pools water quality, while reduction the chemical or chlorination loads. They have experienced positive results

since the change to this natural system, with attendance reacting record levels and maintenance cost being cut in half. This approach may not be practical at this time but could be evaluated further when the existing system requires replacement, modification or significant maintenance.

ALTERNATIVE ENERGY CONCEPTS:

1. ***Use Solar PV panels*** on roof tops or ground mounted to produce electricity during the days when sun shines or partly cloudy days.
2. ***Use Wind Turbines*** in windy areas to generate power during appropriate wind days above 5 MPH wind speed.
3. ***Use Solar Thermal technology*** to heat water and produce heat energy to offset natural gas consumption required to heat pool water.
4. ***Use a Geothermal System*** **with heat pumps** to provide both heating and cooling for spaces by exchanging heat with the subsurface soil mass around the geothermal wells.

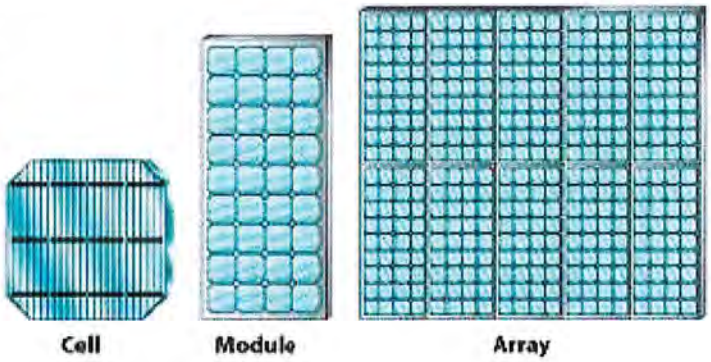
Please note that following Section F contains additional information on alternative energy options.

F. POTENTIAL ALTERNATIVE ENERGY GENERATION OPTIONS

Alternative energy refers to energy sources that are renewable and are thought to be "free" energy. For purposes of this report these energy generation options include Wind, Solar and Geothermal. Each of the alternative energy options described below includes a generic explanation about what it is and how it works. For additional information, specific layout details or for technical literature on these systems, the design phase would be the appropriate time to complete it. Based on our assessment of the existing mechanical HVAC systems, we evaluated the capacity and feasibility of these alternative energy sources as well as estimated the capital investment and energy savings if such systems were to supplement or provide a part of the electrical demand of this facility. Local mechanical contractors familiar with the installation and maintenance of these systems also completed a site visit to ensure the feasibility of incorporating these systems into the existing mechanical make-up of this facility.

1. SOLAR- PHOTOVOLTAIC (PV) SYSTEMS *(PROJECT 6)*

Photovoltaic (PV) systems are usually composed of numerous solar arrays, which in turn, are composed of numerous PV cells.



Photovoltaic (PV) materials and devices convert sunlight into electrical energy, and PV cells are commonly known as solar cells. Photovoltaic's can literally be translated as light-electricity.

First used in about 1890, "photovoltaic" has two parts: photo, derived from the Greek word for light, and volt, relating to electricity pioneer Alessandro Volta. Photovoltaic materials and devices convert light energy into electrical energy, as French physicist Edmond Becquerel discovered in 1839.

The basic PV or solar cell produces only a small amount of power. To produce more power, cells can be interconnected to form modules, which can in turn be connected into arrays to produce yet more power. Because of this modularity, PV systems can be designed to meet any electrical requirement, no matter how large or how small the demand might be.

The alignment of the solar PV units must face south to get the optimum power production and have no shadows cast on the system during the day. East and West orientation are less ideal but are also possible. *(Source DOE web site)*

Based on the roof orientation of the Town Complex, it appears that an approximate 100 kW PV system could be installed on the Town Hall and Community Center Roof. (***Appendix F***) This would consist of approximately 425 solar panels, each rated at 235 watts, measuring approximately 40" x 66". Although the cost of a solar PV system is decreasing, current cost projections are around $4.00 per watt. Therefore, the total capital cost could be around $400,000.

The amount of electricity produced from a 100 kW Solar PV system would be 125,000 kWh per year or about 4.3% of the annual electric consumption. The annual value of power

produced would be $5,625 at 4.5 cents/kWh (average cost including demand charges). The service life of the solar PV cells is about 25 to 30 years and therefore, if an 80% grant, rebate or tax incentive was available then the local share of 20% could be financed with a long term 30 year loan of $80,000 at 4% interest. In this case the annual uniform debt service payment would be $4,626 which is less than the current solar PV generation value of $5,625 per year. This option is only justifiable if significant grant funding is made available to cover the project cost.

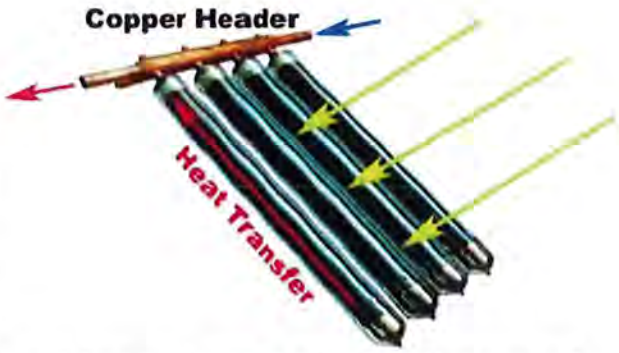
2. SOLAR- THERMAL ENERGY COLLECTION SYSTEM *(PROJECT 7)*

THERMAL COLLECTORS: HEAT PIPES AND EVACUATED TUBE TECHNOLOGY

The operation of the solar thermal collector is as follows:

(i) **Solar Absorption:** Solar thermal energy is absorbed within the evacuated tubes and is converted into usable concentrated heat.

(ii) **Solar Thermal Transfer:** Copper heat pipes transfer the thermal energy from within the solar tube into the copper header.



(iii) **Solar Thermal Storage:** A thermal transfer solution (water or glycol mixture) is pumped through the copper header to a heat exchanger in the building. As the solution circulates back through the copper header, the temperature is raised by 5-10°C / 9-18°F.

EVACUATED TUBES

The most efficient thermal collector on the market, the glass tubes absorb solar thermal energy for use in water heating. The tubes have a double wall, the area between the inner and outer layers of the wall are evacuated (a vacuum). This acts as a thermos to keep heat from escaping into the atmosphere.

The evacuated tubes are glass tubes manufactured from strengthened borosilicate glass. The tubes have a double outer layer; the outer layer is fully transparent to allow solar energy to pass through unimpeded. The inner layer is treated with a selective optical coating which causes energy absorption without reflection. The inner and outer layers are fused at high temperatures at the end leaving an empty space between the inner and outer layers. All air is pumped out of the space between the two layers (evacuation process) creating the thermos effect which stops conductive and convective transfer of heat which might otherwise escape into the atmosphere. Heat loss is further reduced by the low-emissivity nature of the type of glass that is used.

New solar heating technologies such as those described above are available using the natural sun light to heat the pool water. A preliminary report from True Energy Solutions (***Appendix C***) includes details about the various factors for further consideration of this option. Summary of these recommendations is included here. A single or two separate solar thermal systems could be used and tied into the existing pool heating loop or domestic hot water boilers. A practical option would be to consider a Solar Thermal system sized to replace 20% to 30% of the base pool heating needed to supplement the gas heating system. The cost of the solar thermal system to provide 25% of the water heat is projected to be approximately $110,000 and would result in a savings of 3,262 Therms or $3,262 per year. This savings would represent 2.5% of the present cost per year for the natural gas usage.

The land space required for such installation would be an area of 20,000 Sf and 3000 Gallons insulated storage tank.

Considering the long payback on investment it can only be feasible with grants or other financial incentives. The grants and incentives for such alternative energy concept may be secured in the future by applying to the appropriate Utility company or New York State agency.

3. WIND ENERGY PRODUCTION SYSTEM *(PROJECT 8)*

Wind is a form of solar energy. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. Wind flow patterns are modified by the earth's terrain, bodies of water, and vegetative cover. When "harvested" by modern wind turbines, this wind flow, or motion energy, can be used to generate electricity.

HOW WIND POWER IS GENERATED

The terms "wind energy" or "wind power" describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks such as turning, or a generator can convert this mechanical power into electricity to power homes, businesses, schools, and the like.

WIND TURBINES

Simply stated, a wind turbine is the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator producing electricity.

WIND TURBINE TYPES

Modern wind turbines fall into two basic groups; the horizontal-axis variety, like the traditional farm windmills used for pumping water, and the vertical-axis design, like the eggbeater-style Darrieus model, named after its French inventor. Most large modern wind turbines are horizontal-axis turbines. Examples of different types of wind turbines can be found in ***Appendix H***.

The site offers significant wind potential for power generation. The amount of power produced is directly related to the year around wind speeds available at a given installation height. An example of available wind from web- databases is shown in ***Appendix G***.

The annual electrical energy use indicates the total annual consumption of 1,480,000 kWh per year. Assuming that annual hours of wind power production are 3,000 hours per year, a 500 kW size wind turbine would produce 1,500,000 kWh per year, thereby substantially meeting the annual electrical use. A 500 kW wind turbine would have an approximate rotor diameter of 130' and mounted on a monopole tower approximately 150' tall. The total installed cost of the wind turbine with a 500 kW capacity is estimated to be 1.75 Million Dollars. If a 50% grant was available, then the local 50% share of the cost financed over 30

years at 4% interest rate would result in a debt service cost of $50,750 per year. The value of the 1.5 million kWh produced at 0.045 / kWh would be $67,500. Therefore energy savings can exceed the cost, if a 50% grant can be obtained and with low interest long term financing.

Aesthetic considerations are critical in an environmentally sensitive community and therefore a single large turbine may not be preferred by the community and Town Leaders. A Wind Garden concept of multiple smaller wind turbines including 3- 5 smaller units of 100 KW size could be considered. Cost of the turbines and future financial incentives would determine what is practical and aesthetically acceptable for the Town of Perinton at this location.

Wind energy potential is attractive for electrical power production in the high value time periods of winter. The visual aspects of various wind mill designs are critical to evaluate based on community input. Traditional tall wind turbines with three blades could offer the best economic value but may not be deemed desirable by the local residents. Alternatively, the small micro turbines clusters or vertical axis design are now available and able to meet the needs while offering more acceptable visual features. These smaller wind generators are a little less efficient than the larger wind turbines due to their mounting heights and in general would cost slightly more for the increased labor and infrastructure requirements.

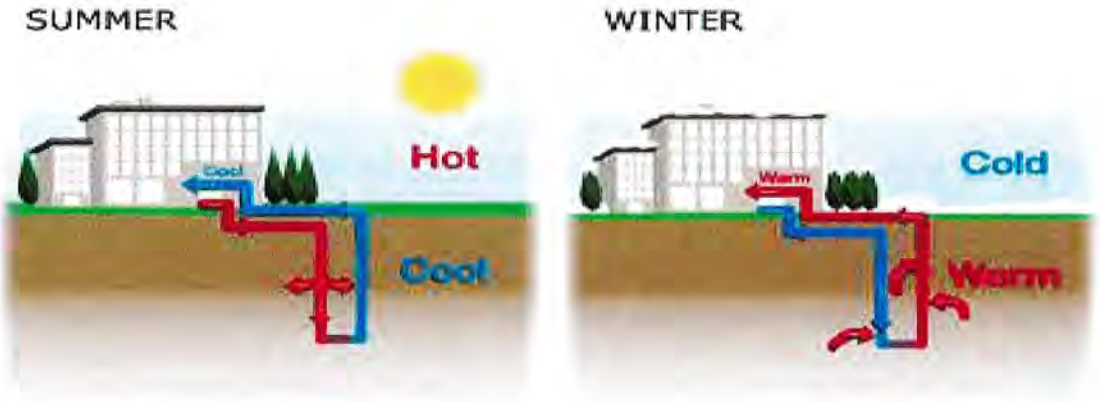
The Town Hall site does have two communication towers that may be used for mounting a small micro-turbine and wind gauge for collecting the data over time. Larsen submitted a request for funding to Fairport Electric in 2010 and received their approval to conduct the wind measurement study.

4. GEOTHERMAL HEATING AND COOLING SYSTEMS *(PROJECT 9)*

Geothermal technology uses the natural temperature of the earth to heat and cool homes or commercial buildings. Geothermal heating systems have a series of underground pipes filled with liquid. The liquid acts as a go-between, moving the heat from the ground to the building. Example of heating the building in the winter:

1. The liquid moves through the underground pipes
2. The liquid gets warmed up by the heat in the ground
3. The warm liquid moves through the pipes into the building
4. A geothermal unit compresses the liquid's warmth to a higher temperature
5. The geothermal unit sends the heat to the building space through air circulation

When it comes to cooling the building in the summer, the process is simply reversed. Heat is extracted from the building interior and then exchanged backs with the soil around the vertical tubes carrying the heat exchange fluids.



This existing HVAC system for the old town hall utilizes a loop serving multiple heat pump units. The existing boiler and chiller could be replaced with a water to water geothermal system. This system would consist of a well field located just to the south side of the building and a new water to water geothermal system. The geothermal system would be connected to the existing building central distribution loop that supplies the existing independent heat pump systems. A review of such options has been done by True Energy Solutions and can be found in ***Appendix C*** for further review.

The estimated capital cost associates with a system like this is approximately $105,000 with an estimated cost savings of $4,141/year or 34% of total building energy savings. With long payback periods this is a long term investment which can become affordable with grant incentives.

Alternatively a gas fired modular boiler would be much cheaper at a cost of $20,000 as part of a fuel switching approach. The gas fired boiler would replace the existing inefficient electric heater- boiler and chiller system and tie into the existing building distribution loop. The gas fired boiler would be more efficient than the current electric heating system. Detailed engineering evaluation should be made prior to implementation. It was also noted that the existing 26 heat-pump units in the Town Hall are nearing the end of their useful life and, as conservation measure, replacing these units can increase the efficiency by 20-25%.

The system cost for a geothermal system goes down with larger scale as the drilling cost of the vertical wells is spread over larger capacity. Mechanical contractors have looked at the total energy use of the Towns heating system for the building and pool heating and sized

the system to serve this need using the base loads to be furnished by the new system. The capital cost required for a full scale system is estimated to be 1.75 Million Dollars for a 200 ton system. Such scale project would be feasible with grant funding from a Utility Company or New York State agency. The annual debt service to finance such a system at 4% interest and 30 year financing would be $101,500 per year. If the operating cost of the heat pump system is $30,000 per year, then total cost would be $131,500 which is close to the avoided cost of gas energy at the current price level. Although this system could be possible it would require a significant change to the existing equipment use and configuration.

G. FINDINGS AND RECOMMENDATIONS

1. With the current low cost of municipal electricity, it is not economically feasible to generate "Green" energy as the only source of power for this complex. However, the Town does have the potential to undertake a combination of projects to reduce its energy demands, while supplementing its primary power source with alternative energy technologies. Although not all energy conservation or alternative energy concepts described within this study are appropriate at this time; either because they are justifiable without significant outside funding or are unpractical for this type of facility, there are others that could be implemented and would result in increased energy efficiency and lower energy costs. These include the lighting retrofit project; the variable frequency drive control project; as well as the electric to gas conversion project for the heating system in the Town Hall portion of the complex.

2. Further assessment of the energy use profile in various building function should be made to learn what potential savings can be achieved via energy efficiency and conservation. This would require detail measurement and monitoring of each electric and gas load in order to better understand its specific run time and energy consumption. For example, a more detailed look at a partial geothermal system for the Town Hall portion of the complex and a solar thermal system to supplement the pool heating demands should be further evaluated as a way to further reduce energy demands.

3. The potential for wind energy is attractive for the complex, particularly during the high demand seasons, like winter. However, the visual aspects of a wind mill may be deemed less than desirable by local residents. As with many of the Alternative Energy Concepts, this technology only seems worth detailed evaluation if significant outside grant funding sources can be obtained.

4. Solar PV power is the most expensive and only possible if 80-90% grant funding was available to cover the capital cost due to the current low price of electricity from Fairport Municipal Corporation. The roofs can accommodate about 100kW system if the grant funds made it feasible to implement.

H. IMPLEMENTATION PLAN

ENERGY FUTURE – STRATEGY?

The Town cost for electric and gas service to the complex is approximately $275,000 per year. The strategy for energy management requires a step by step approach and the first step should be conservation and energy efficiency as short a term measure.

Assuming that the various energy conservation measures are implemented, the total demand are projected to be reduced by 20% to 30% by changing the current old lighting and controls and retrofitting the recirculation pumps with VFD etc.

With the current low cost of municipal electricity, it is not economically feasible to generate alternative Green energy on site. However, if significant funding is available as grant, then as a long term measure, the remaining electrical demand could be met with new energy production sources such as Wind and Solar. The Town should seek funding for such a system and use low rate long term financing to make the annual cost comparable to or lower than the current cost of power.

To better summarize a energy implementation plan, an integrated approach to reducing current energy demands, while increasing existing energy efficiencies has been outline below:

Approach	Cost	Savings / Year	Time Frame
1. Lighting Retrofit Project	$0 (labor only)	35,109 kWh ($1,369.25)	Year 1
2. Geothermal TH - *OR* -	$130,000.00	TBD	Years 1-2
Electric to Gas Conversion (TH)	$65,000.00	TBD	
3. VFD Project	$12,000.00	80,568 kWh ($4028.00)	Years 2-3
4. Evaluate in Detail: Condensing Boilers in Recreation	$200,000	32150 Therms ($32,150.00)	Year 4-5
5. Evaluate in Detail: Solar thermal for Supplemental Energy For HW in Recreation	$110,000	3262 Therms ($3262.00)	Years 4-5

I. FINANCING OPTIONS AND FUNDING SOURCES

Energy costs are escalating over time and any investments made to either conserve or generate power need to be made on a life cycle basis using a 25 to 30 year time span to spread out the cost. There have been several energy conservation and Green power generation incentives and grants in New York State, through the Utility Company, and other programs that make it possible to cover 50% or more of the capital cost. The Town should take advantage of these resources in implementing future energy projects.

The basic concept is to pay for the improvements from the current operating costs using the grants and low rate term loans. The Fairport Municipal Corporation Grant for lighting improvements is an example. RG&E or NYSERDA incentives for the gas conservation should be evaluated to determine the local cost and paybacks for the retrofits to replace the old heating equipment with a large geothermal system.

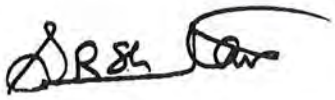
The cost of implementation depends on the incentives available to provide grants, rebates, tax credits or low cost long term loan financing. Since the Town already spends approximately $275,000 per year at the current energy cost, it would be desirable if the Town can meet their needs by using an energy conservation and alternative energy generation approach at the same or lower cost via retrofit investments in energy projects. This will assure that all future escalations in the cost of energy have no affect on Town energy budgets since the demand will be met by new sources of alternative energy, financed over the life cycle of the system over a long term.

We have used simple cost recovery factors to calculate the annual costs for illustration purpose only and recognize that Municipal financing would have a schedule of payment that combine the principal and interest amount for each year.

The local Town share of investment in Solar PV or Wind Turbines should be financed over 20-30 years since it is like becoming a power producer and the life of these Green energy generation systems is 25-30+ years with routine maintenance. Based on the actual performance results after conservation, and collecting the actual wind data, the Solar and Wind power system could be sized to meet the goals set by the Town.

With the help from grant funds and long term low interest financing, it may be possible to become self sufficient energy producer in 10 years! These energy improvements will also set an example for the Town residents to follow and control their cost of energy.

Respectfully Submitted By:



S. Ram Shrivastava, P.E., LEED AP
President Larsen Engineers

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- Information about Free Home Energy Audits
- Displays and demonstrations on:
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  - Solar Energy
  - Geothermal heating and cooling
  - Hybrid and alternative fuel vehicles
- Raffle Prizes Every ½ Hour
- Children's Activities

Saturday
April 9, 2011
9 am to 1 pm
Perinton Community
Center, Room 204

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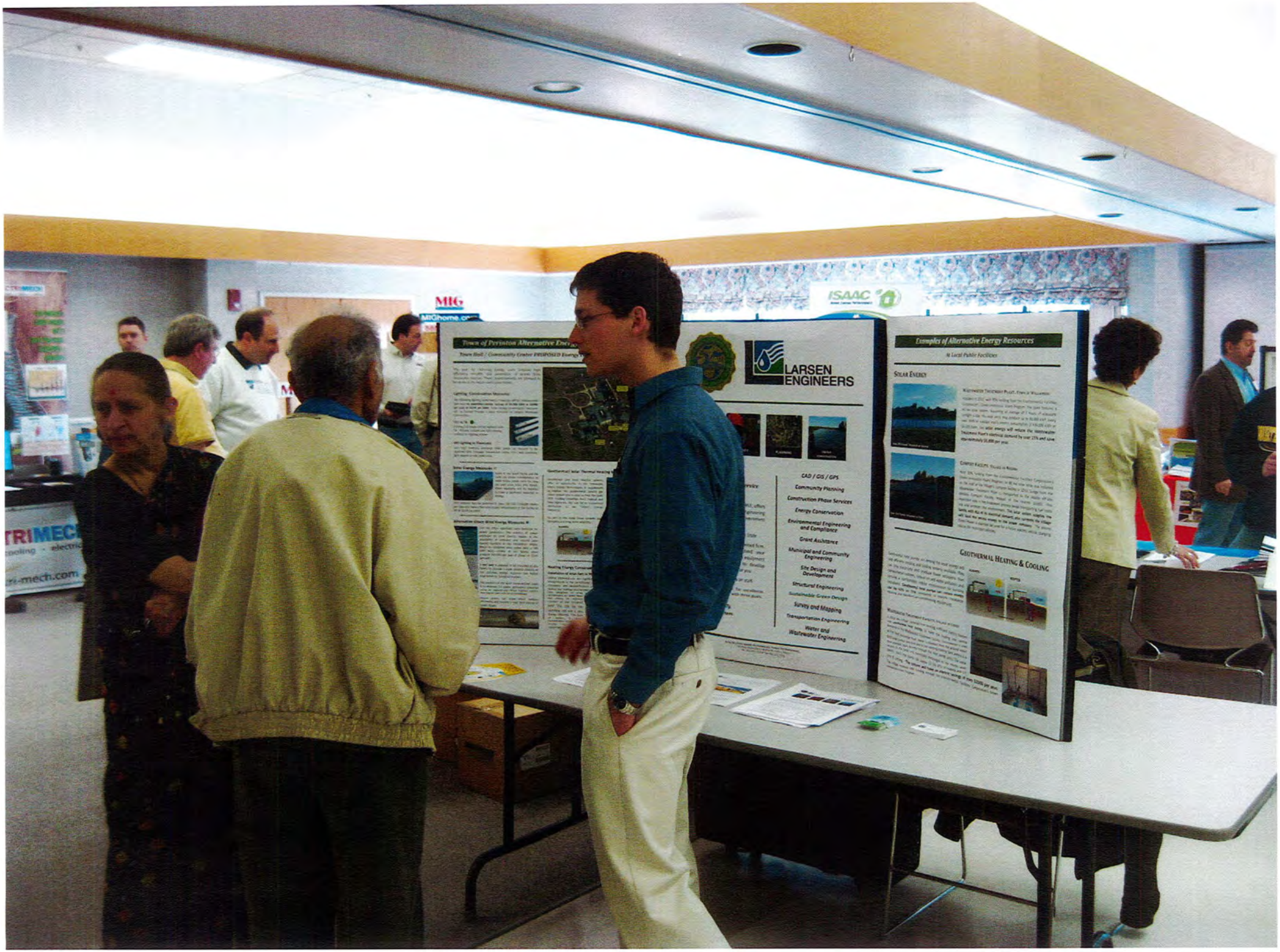
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Examples of Alternative Energy Resources
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Geothermal Heating & Cooling
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Energy Conservation
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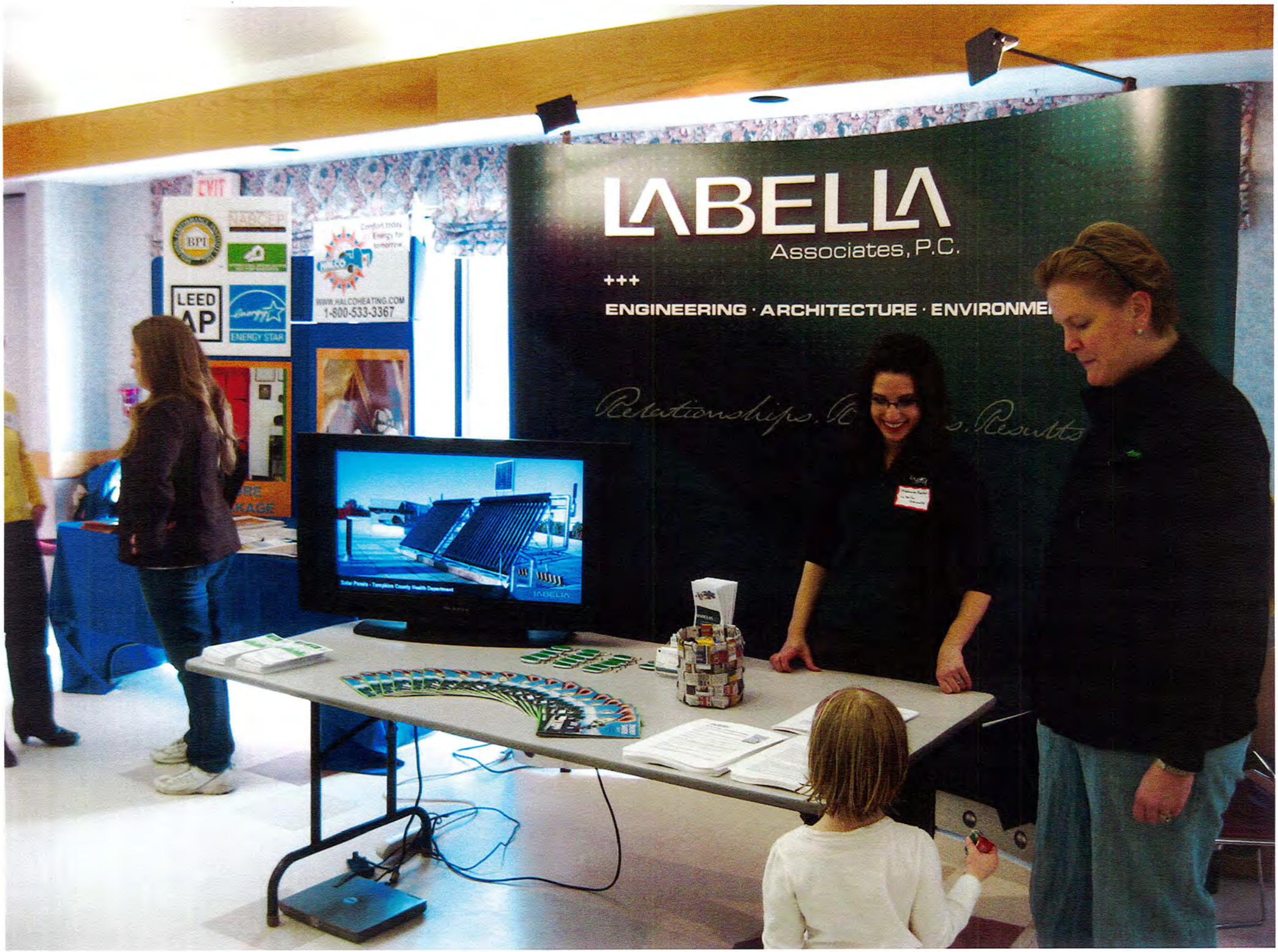
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0 - 200 mA
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Capacitors
Pedal 4 Power


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0 - 30 Amps
Volts X Amps = Watts
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0 - 200 mA
Fuse
Capacitors
Circuit Breaker
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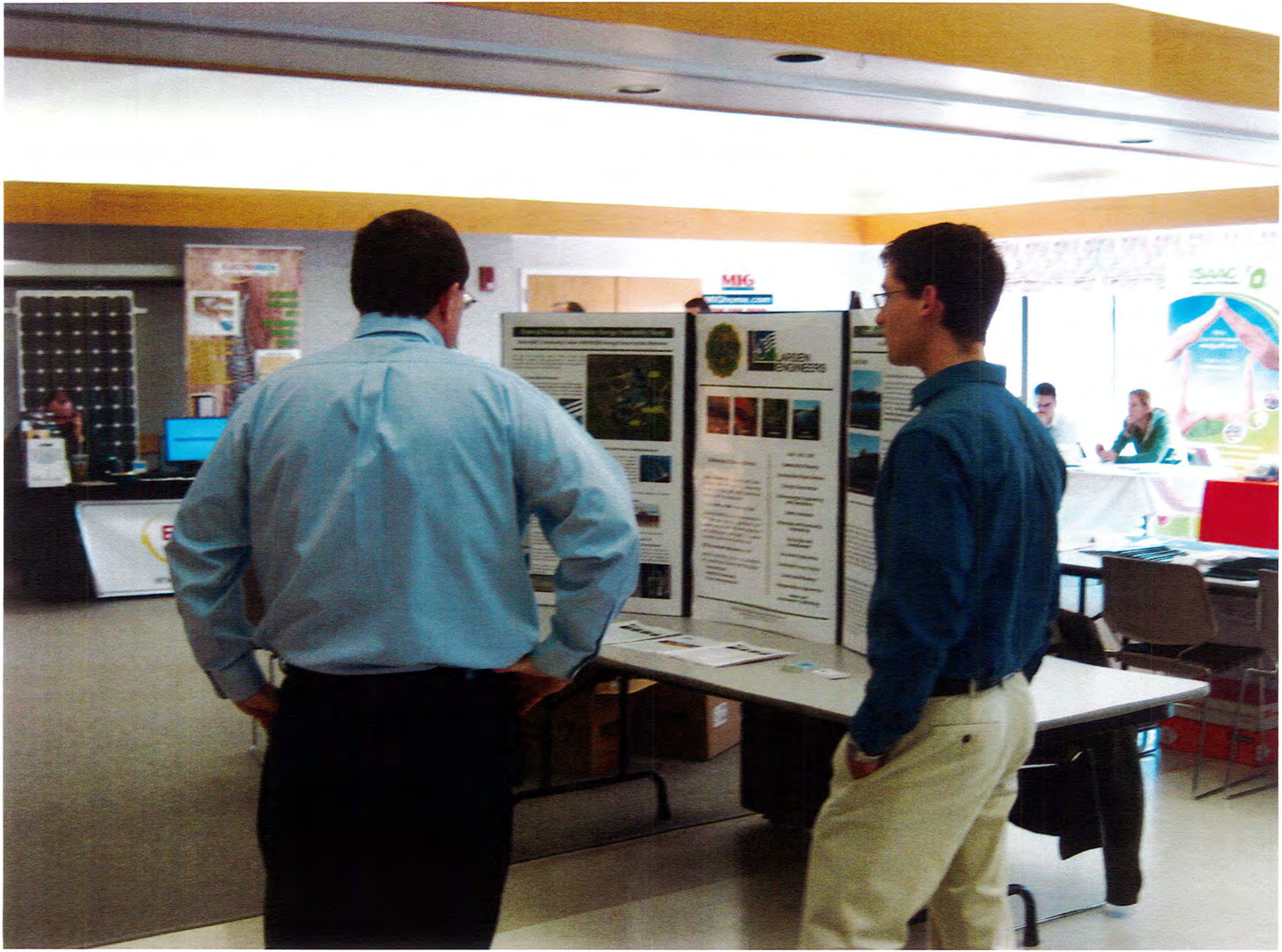
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TOWN OF PERINTON
COMMUNITY-WIDE STRATEGIC
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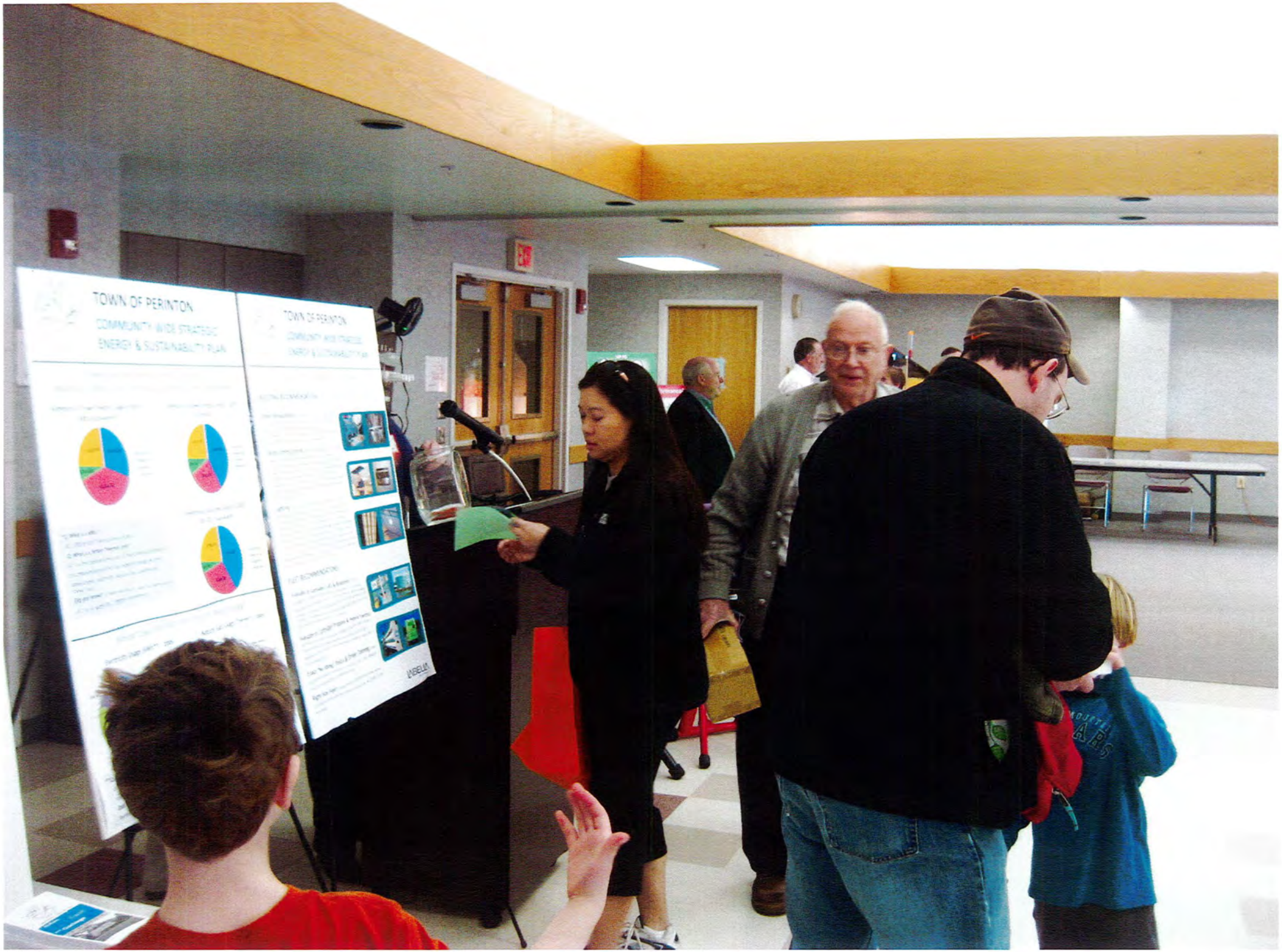
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