OFFICIAL PROCEEDINGS
CITY COUNCIL
ELECTRICAL ADVISORY COMMITTEE
CITY OF ESCANABA, MICHIGAN
Special Joint Meeting
Wednesday, August 10, 2016

Pursuit to a meeting notice posted August 5, 2016, the meeting was called to order by the Mayor Marc D. Tall at 4:00 p.m. in the Council Chambers of City Hall located at 410 Ludington Street.

Present: Mayor Marc D. Tall, Council Members, Patricia A. Baribeau, Ronald J. Beauchamp, Ralph B. Blasier (left at 5:15 p,m.), and Michael R. Sattem.

Absent: None.

Present: Electrical Advisory Committee (EAC) Members: Chairperson Tim Wilson (left at 5:22 p.m.), John Anthony, Glendon Brown, and John Mellinger.

Absent: Ann Bissell.

Also Present: City Manager James V. O'Toole, Electric Superintendent Mike Furmanski, Power System Engineering (PSE) Representatives Tom Butz, and members of the public and media.

ADJUSTMENTS TO THE AGENDA

Sattem moved, Blasier seconded, **CARRIED UNANIMOUSLY**, to approve the Joint City Council & Electrical Advisory Committee Agenda as submitted.

CONFLICT OF INTEREST – None

UNFINISHED BUSINESS – None

NEW BUSINESS

Update – Electric Department –General Operations.

Electric Superintendent Mike Furmanski provided an update on departmental operations and projects:

- Reviewed new water services;
- Received an Updated the bid and completion date for the new sub station.

Discussion – Future Power Purchases.

Electric Superintendent Mike Furmanski and PSE representative Tom Butz provided a power point presentation regarding various options available to the City regarding future power purchases. (See Attachment – A)

- A specific future power purchase offer was out there, but suggested the City should take time and compare what they are offering and what they will stand behind;
- Reviewed company profiles from NextERA, GLU;
- Looked at a range of decisions;
- No action was sought, but suggested inviting NextrERA, and GLU company representatives at a future joint meeting to listen to their proposals before and action was taken by the City.

Update – Solar Garden Project – Feasibility Study.

Electric Advisory Committee Member Glendon Brown provided Council and Administration an update on a proposed solar garden feasibility study. (See Attachment – B)

- Key remaining issues of proposal still needed to be answered:
- If Council approves proceeding, would come back to Council at key remaining issue 12;

Counsensus of Council for Electric Advisory Committee Member Brown and Electric Superintendend Furmanski to proceed further and report back to Council.

GENERAL PUBLIC COMMENT – None

COUNCIL/COMMITTEE, STAFF REPORTS – None

ADJOURNMENT

Hearing no further public comment, or further reports from the Electrical Advisory Committee or Council, the meeting adjourned at 5:53 p.m.

Respectfully submitted,

Robert S. Richards
City Clerk

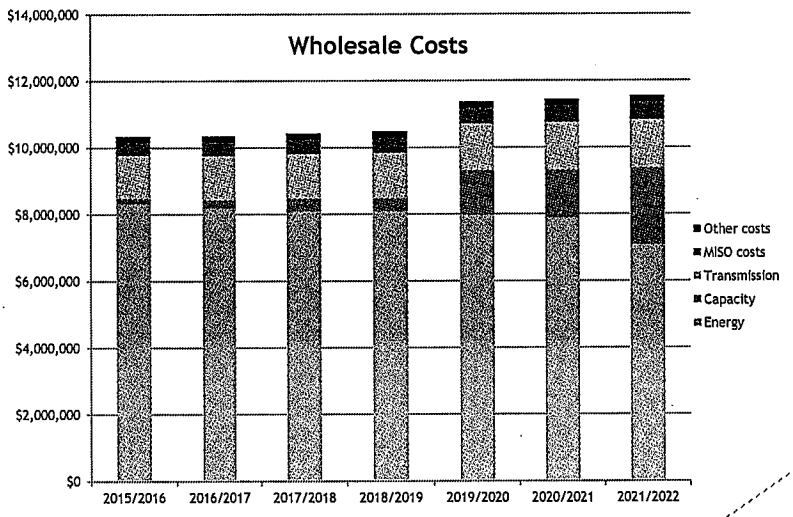
Approved: _____
Marc D. Tall, Mayor

Escanaba Power Supply Comparison

August 10, 2016

1

Wholesale power components

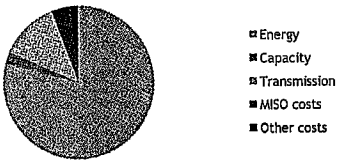


2

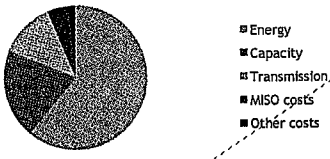
Energy and Capacity

- Energy
  - 79% of our current wholesale costs, could be 62% in 5 years
  - We have some control on this component
  - There are various options to purchase energy, which will be covered later
  - Future costs are expected to remain stable
- Capacity
  - We have limited control on this component
  - Future costs are expected to increase in near future
  - Currently 2.8% of wholesale costs, could be 20% in 5 years

Wholesale Total 16/17



Wholesale Total 21/22



3

Transmission, MISO & Other costs

- Transmission
  - Currently 12.7% of wholesale costs
  - Extremely limited control over this component
- MISO
  - Currently 4.1% of wholesale costs
  - No control over this component
- Other
  - Currently 1.4% of wholesale costs
  - SSR costs, Renewable Energy Credits are included here

4

History/current/future

- Since January 1, 2012 we have been buying energy on a full requirements basis from NextERA.
- The original contract was for 5 years at a price of $57.10/MWH
- Subsequent extensions have been for lower prices
- We have the following prices under contract:
  - Thru 12/31/2016 = $57.10
  - 1/1/17 - 12/31/19 = $55.51
  - 1/1/20 - 5/31/21 = $54.08
- We have purchased capacity from GLU since 2012
- We are contracted for capacity from GLU through May 31, 2019
- Recent and future capacity costs ($/kW-mo)
  - P/Y 2015 = $0.41
  - P/Y 2016 = $0.61
  - P/Y 2017 = $1.00
  - P/Y 2018 = $1.00
  - P/Y 2019 and beyond are expected to be $3.50 - $6.00

5

Energy Purchasing Options

- Open position
  - Pay the DA and RT prices for energy from the MISO Market
  - No price certainty
- Buy blocks of energy
  - Fixed price for a portion of load, balance actual load with MISO Market
- Full requirements - NextERA
  - Fixed price for all MWHs
- Not-to-exceed - GLU
  - A not-to-exceed price for all MWHs
- Power pool - GLU
  - Estimated price for all MWHs
  - Includes capacity

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2021/2022 Opportunities

- We have been in discussions with NextERA and Great Lakes Utilities (GLU) regarding energy for MISO planning year 21/22.
- Both parties have made offers
  - NextERA has offered an indicative price for full requirements
  - GLU has offered a not-to-exceed price for full requirements
  - GLU also has a power pool with 5 members
- Prices from each are very close

7

Company profile - NextERA

Investor owned utility

Excellent history with Escanaba

Strong Risk Management and Trading Expertise

Deep Levels of Staffing

National Footprint of Customers

Deep credit to withstand market swings, ie - Polar Vortex

Experience with Day Ahead load forecast for Escanaba

Experience dealing with Basis risk to Escanaba

Experience in DA Hedging - Block Size, Trading Hub

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Company profile - GLU

Municipal Joint Action Agency

Escanaba is 1 of 10 members

Issue RFPs annually for Energy and Capacity

Established Trading Expertise

Limited Levels of Staffing

WI and MI Customers

Adequate credit to withstand market swings, ie - Polar Vortex

Experience with Day Ahead load forecasting for their members

Experience dealing with Basis risk

Experience with DA Hedging, Block Size, Trading Hub, FTRs

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Range of Decisions

- Make a decision for an energy power supplier
- Make a Decision for 2021/2022 for energy
- More Detailed Comparisons
  - Historic Comparison of GLU prices and Nextera prices
  - Costs of Stabilization Fund and Credit Requirements
  - Trading methodologies
  - Load following methodologies
  - Compare GLU market based offering and spot capacity vs. power pool offering
  - Timeframe of price offerings

10

Attachment - B

Escanaba Solar Project

Update for August 10, 2016

Escanaba Solar Project
Estimated Installation Costs

1. For 250 KW to 1MW (DC) Capacity, the estimated installation costs range **from $1.67 to $1.84 per watt of DC** solar panel generation Capacity. The installation cost assumes:
   - No land purchase or lease cost
   - Cleared, flat and graded site
   - Driven post construction for mounting the racking system to support the solar panels
   - No security fence
   - Minimal utility distribution system connection costs (i.e., close proximity to existing distribution line of adequate Capacity)

2. The installed cost for an individual 315 watt solar panel will range from $526 to $580 for a 6.4' X 3.2' panel.

3. For a 1 MW (DC) Capacity system, 3,175 solar panels at 315 watts per panel, installation costs should range from $1.6 to $1.8 million.

4. For comparison, a small private residential solar system (e.g., less than 5 KW (DC) Capacity), 16 solar panels (315 watts per panel), the installed cost is approximately $3.75 per watt DC Capacity.

5. Buying in bulk clearly offers major cost savings

6. Solar generation equipment costs are continuing to decline.

Escanaba Solar Project
Site Location Requirements & Desirable Attributes

- **Unrestricted sun exposure, no tree or building shading for more than 50+years**
- **Flat or gently sloped site requiring minimal improvements beyond bush removal and grading**
- **Close proximity to existing City electric distribution lines with adequate capacity**
- **Limited access to reduce vandalism concerns; 1 solar panel costs ~ $530**
- **Access to clean water to clean solar panel surfaces, e.g., annual cleaning**
- **Visibility for economic promotion**
- **Ground suitable for low cost installation, e.g., driven post in sand for vertical support**
- **Set backs for aesthetics, FAA regulations, highway ROW, no underground utilities, etc.**
- **Approximately 5 to 6 acres required for 1 MW (DC) solar project**
- **Project economics cannot support significant:**
  - **Land purchase or lease costs**
  - **Major Site preparation costs**

Escanaba Solar Project

25 year Levelized Cost of Solar Generation

1. Using the Escanaba Airport weather station data, the National Renewable Energy Laboratory (i.e., NREL) website calculator estimates the annual electricity production at 1.26 kWh per watt (DC) of solar generation Capacity. This annual production estimate assumes:

- No shading
- Panels oriented to face due south
- Panels tilted at 45° orientation
- 0.84 conversion efficiency for DC to AC (98% inverter efficiency assumed)

2. With no degradation of Photovoltaic (PV) generation, 1 watt (DC) of solar PV Capacity will produce 31.43 kWh over 25 years.

3. Assuming a more realistic 0.5% loss of generation Capacity per year, after the first year of installation, 1 watt (DC) of solar PV Capacity will produce 29.61 kWh over 25 years.

4. With the estimated cumulative kWh's of generation over 25 years, 29.61 kWh, one can calculate a Levelized Cost of Generation over this same 25 year period. For example, with an Installed cost of $1.80/watt (DC) Capacity,

$1.80 / 29.61 kWh = $0.0608/kWh

yields a 25 year Levelized Cost of $0.0608/kWh for solar generation in Escanaba.

5. An accurate 25 year Levelized Cost analysis should include Annual Operation and Maintenance (O&M) costs in addition to the Initial Installation cost. The following types of O&M costs should be expected:

- **Mowing grass and weeds in areas under and surrounding the solar panel racks**
- **Monitoring the performance of the solar generation facility components, such as individual panels and inverters**
- **Cleaning exterior surface of the panels if necessary, e.g., bird droppings or accumulated dust**
- **Replacement of defective components beyond the equipment warranty, e.g. inverters typically have a 10 year warranty**

6. A February, 2016 NREL publication indicated the O & M costs averaged $0.016/watt of Capacity per year for large utility scale solar generation projects (i.e., 1 to 10 MW). Using this O & M cost estimate, the annual O & M cost for a 1 MW facility could be up to $16,000 per year.

7. Assuming a 0.5% loss of generation Capacity per year, the average O & M cost per kWh of solar generation is $0.01351/kWh.

$0.016/watt/yr X 25 years	=	$0.01351/kWh
29.61 kWh/ watt		

8. Combining the initial Installation cost with the annual average O&M cost, the 25 year Levelized Total Energy Cost can be estimated as shown in the next Table.

Summary of 25 Year Levelized Cost of Solar Generation

	25 Year Levelized Total Cost, $/kWh		
Installation Cost, $/watt	Installation Cost	Average O & M Cost	Total Cost
1.67	.0564	.0135	.0699
1.84	.0621	.0135	.0757

With Energy Optimization Rebate ($75 per 315 watt Solar Panel)

1.432	.0484	.0135	.0619
1.602	.0541	.0135	.0676

With 30% Investment Tax Credit

1.169	.0395	.0135	.0530
1.288	.0435	.0135	.0570

With 30% Investment Tax Credit & Energy Optimization Rebate

0.931	0.314	.0135	.0449
1.050	.0350	.0135	.0490

Small, private Residential System (e.g., 5 KW Capacity)
$3.75 Installation Cost and 30% ITC and EO Rebate

3.75	.1266	-	.1266
2.387	.0806	-	.0806

Current Escanaba Electric Energy Rates:

Customer Type	Energy Rate, $/kWh
Residential	.09570
Commercial	.08925
Municipal	.09303
City Street Lighting	.11456
Large Power	.05996 plus $8.97 per kW per month demand charge

9. Clearly the estimated 25 year Levelized Total costs for solar generation are less than the current residential, commercial and municipal energy rates. With the 30% Investment Tax Credit and $75 Energy Optimization Rebates, the 25 Year Levelized costs are substantially less than the current Escanaba energy rates.

10. Purchasing the solar generation Capacity essentially stabilizes your electric energy costs for 25+ years. In addition, the useful life of a well-designed, quality solar generation system is expected to be more than 25 years, lowering the levelized costs further.

11. A large scale Solar Project offers significant 25 Year Levelized cost savings over a small private solar system.

Value of Solar or Avoided Costs with Solar Generation Within the Escanaba Electric Distribution System

For each kWh of grid tied solar generation within the Escanaba electric distribution system, the following components of electricity costs are avoided:

1. Avoided Energy Costs

- **Each kWh of local solar generation eliminates the purchase of one kWh of energy from NextEra, the City's current contract energy supplier.**

- **The City has a firm contract for energy pricing through the fiscal year 2020-2021.**

- **Beyond 2021, energy costs are expected to initially decline.**

MISO Planning Year (June 1 – May 31)					
	2016-17	2017-18	2018-19	2019-20	2020-21
Energy Cost, $/kWh	.0563	.0555	.0555	.0555	.0541

- **For 2016-17, Energy Cost accounts for approximately 60% of the overall Electric Department budget.**

2. Avoided Capacity Costs

- **Escanaba is required by MISO to have local generation or purchase generation Capacity that meets the annual peak loads plus excess Capacity Reserves of at least 14%.**

- **With the shutdown and sale of Escanaba's 50+ year old 25 MW Capacity coal fired power plant, Escanaba has been purchasing all it's generation Capacity requirements.**

- **In 2016-17, Escanaba purchased 32 MW of Capacity which includes the Reserve Capacity requirements.**

- **Escanaba's current Capacity contract costs and forecasted costs are summarized below:**

Attachment - B

Fiscal Year					
	2016-17	2017-18	2018-19	2019-20	2020-21
Capacity Cost, $/kW Month	0.61	1.00	1.00	3.50 *(1)*	3.75 *(1)*
$/MW Year	7,320	12,000	12,000	42,000	45,000
Years for Capacity payment to fund 1 MW of new Natural Gas Combined Cycle Capacity *(2)*	150	92	92	26	24

(1) Current estimate

(2) Utility scale (e.g., 500 MW) Natural Gas Combined Cycle plant estimated construction cost $1.1 million per MW Capacity.

- **For 2016-17, the cost of Capacity is less than 2% of the overall Electric Department budget.**

- **Clearly, the current Capacity pricing, $0.61/kW Month, does not support the construction of new generation Capacity.**

- **Capacity pricing will need to increase to at least $3.50 to $4 per kW Month to provide rational market support for new generation Capacity construction.**

- **Currently, MISO estimates $7.50/kW Month for new construction.**

- An analysis of the recent City load data (2013-2015) found:
  - All monthly peak loads occur between 10AM and 4PM EST
  - All monthly peaks occur at a time when local solar generation could reduce peak loads.
  - In the last 10 years, all of the annual peak loads occurred in the months of June through September. 60% of the annual peak loads were in July.

- In December 2015, MISO developed a Preliminary Capacity Policy for utility scale solar generation (greater than 100 KW Capacity).

- A conservative 50% Capacity Factor is to be used for the first 3 years of operation.

- After 3 years of summer month actual performance data is collected, the Solar Capacity Factor can be adjusted to reflect actual performance.

- The Capacity of solar panels is typically rated in DC watts. In a well designed solar system, the AC Capacity is 84% of the DC Capacity: 1 watt (DC) = 0.84 watts (AC)

- The Avoided Capacity cost per KWH of solar generation is summarized in the table below:

	Fiscal Year				
	2016-17	2017-18	2018-19	2019-20	2020-21
Capacity Cost, $/kW Month	.061	1.00	1.00	3.50 *(1)*	3.75 *(1)*
Avoided Capacity Cost in $/kWh of Solar Generation (50% Capacity Factor)	0.0028	.0046	.0046	.0161	.0172

(1) Current Estimate

3. Avoided Transmission Costs

- **Escanaba's electricity Transmission cost is based on the monthly load (i.e., coincident load) at the time of the ATC Peak Load.**
- **In other words, Escanaba's electricity Transmission cost is based on its contribution to the overall monthly ATC Peak Load.**
- **For 2016-17, Transmission cost is approximately 10% of the overall Electric Department budget.**
- **Historical analysis of the 2013-2015 ATC time of monthly overall Peak Load data shows:**

- Monthly load peaks always occur on a weekday
- Time of day of the monthly peaks is very repeatable
- For January thru March and October thru December, the monthly peaks occur after sunset in Escanaba, between 7 and 9 PM EST.
- For six months, half of each year, from April thru September, the monthly load peaks occur before sunset, so that local solar generation could reduce the city's coincident loads at the time of the ATC Peak Loads.

- **The Avoided Transmission cost per kWh of solar generation is summarized in the table:**

	Fiscal Year				
	2016-17	2017-18	2018-19	2019-20	2020-21
ATC Transmission Cost, $/kW (Coincident Load) per Month	5.23 *(1)*	5.48 *(1)*	5.62 *(1)*	5.78 *(1)*	5.94 *(2)*
Avoided Transmission Cost, $/kWh of Solar Generation (50% Capacity Factor)	.0105	.0110	.0113	.0117	.0120

(1) ATC rate forecast

(2) Extrapolated estimate

4. Total Avoided Costs

The total estimated avoided cost (i.e., Energy, Capacity and Transmission), per kWh of solar generation within the Escanaba electric distribution system is summarized below:

	Fiscal Year				
	2016-17	2017-18	2018-19	2019-20	2020-21
Avoided Cost per kWh of solar generation, $/kWh					
Energy	.0563	.0555	.0555	.0555	.0541
Capacity	.0028	.0046	.0046	.0161 *(1)*	.0172 *(1)*
Transmission	.0105	.0110	.0113	.0117	.0120
Total (50% Capacity Factor)	.0696	.0711	.0714	.0833	.0833
Total (75% Capacity Factor)	.0762	.0789	.0794	.0972	.0979
Total (100% Capacity Factor)	.0829	.0867	.0873	.1111	.1125

(1) Current Estimate

- **Future avoided cost will be very dependent upon:**
  - **Cost of Capacity for 2019-20 and beyond**
  - **Actual Capacity Factor experienced for the Escanaba solar generation**

- **By the Fiscal Year 2019-20, the Escanaba 25 Year Levelized Cost of Solar Generation is estimated to be less than the Avoided Cost, even without the benefits of the Federal ITC or EO Rebate.**

- **In 2016-17, with the Federal ITC and EO Rebate, the Escanaba 25 Year Levelized Cost of Solar Generation is significantly less than the Avoided Cost, providing the savings to justify the solar generation investment.**

Escanaba Solar Project
Net Metering Rates & Example Residential Bill Calculation

1. Future Net Metering Policy

It is recommended that Avoided Cost of Solar Generation minus the O & M cost, serve as the foundation for the City of Escanaba's future solar generation Net Metering Policy (i.e., the basis for revenue from solar generation).

- **Participants in a proposed Escanaba Solar Project would receive a minimum of $.0561 ($.0696-.0135) in revenue or credit for every kWh of solar based generation in 2016-2017. (see Table on page 15)**
- **In 2019-2020, the revenue or credit for solar based generation is forecasted to rise to $.0698 ($.0833 - .0135).**
- **<u>The Avoided Cost based Net Metering Policy would be fair to both Escanaba Solar Project participants and non-participants</u>.**

- **The rate for the Net Metering Policy will be adjusted annually, to reflect the actual Energy, Capacity and Transmission avoided costs.**

- **Capacity Factor adjustments would be made after 3 years of operation, in accordance with the MISO policy.**

- **For a private solar generation facility, (e.g., for solar panels on your roof or on your property), the O & M cost for the Escanaba Solar Project will not be deducted from the avoided cost credit.**

Example Residential Monthly Electric Bill Calculation

	Resident with NO Solar Panels	Resident with 15 315 watt Solar Panels in Escanaba Solar Project
Monthly Electricity Usage, kWh	500	500
Monthly Electricity Generated from 15 Solar Panels, kWh	-	496
Monthly Electric Meter Charge, $	$8.38	$8.38
Energy Charge, 500 kWh x $0.0957	$47.85	$47.85
Revenue From Solar Panel Generation Avoided Cost: 496 kWh x ($0.0696-.0135)	-	- $27.83
Total Electric Charges before Sales Tax, $	$56.23	$28.40
Sales Tax, $	$2.25	$1.14
Total Monthly Electric Bill, $	$58.48	$29.54
Monthly Savings with 15 Solar Panels		$28.94

Solar Generation Investment Payback Analysis

1. Assumptions

- 315 Watt (DC) per individual solar panel
- $553 total installed cost per panel (average $1.67 to $1.84 per watt installation cost)
- Annual generation for first year of generation
  315 watts/panel X 1.26 kWh/watt = 396.90 kWh/panel
- 0.5% annual degradation in generation Capacity
- $478 installed cost per panel with only $75 Energy Optimization Rebate
- $387 installed cost per panel with only 30% Investment Tax Credit
- $312 installed cost per panel with both EO Rebate and ITC
- Solar generation revenue or credit = Avoided Cost – O & M Cost
- Conservative 50% Capacity Factor used for solar generation calculation
- After 2020-2021, the Avoided Cost is assumed to remain constant, not continue to increase

2. Payback Analysis Results:

Final Installed Cost per Solar Panel	Years to Payback Initial Investment	
	50% Capacity Factor	75% Capacity Factor
$312 with both $75 per panel EO Rebate and 30% Investment Tax Credit	11 - 12	10 - 11
$387 with only 30% Investment Tax Credit	14 - 15	12 - 13
$478 with only $75 Energy Optimization Rebate	17 - 18	15 - 16
$553 with no E O Rebate or ITC	20 - 21	17 - 18

3. Potential Factors to Accelerate Payback Period

- Solar generation Capacity Factor higher than the fixed 50% required for first 3 years
- Avoided Costs increase beyond the estimates for 2020-2021

4. Other Key Findings

- The 30% ITC is critical to attract Residential and Commercial customer investment in the Escanaba Solar Project

Key Remaining Issues

1. EAC support and Council approval to continue Escanaba Solar Project study
2. Find suitable site location(s), meeting requirements and desirable attributes
3. Conduct test soil borings to confirm proposed site can utilize driven post style solar panel racking system (Finalized Installation Cost).
4. Determine Capacity costs for 2020-21 and beyond. Confirm proposed MISO utility scale solar generation capacity policy has been adopted.
5. Continue to investigate transmission cost savings. There is some confusion as to whether or not distributed generation can be used to reduce transmission charges.
6. Determine if the Escanaba Electric Department purchase of solar generation Capacity is eligible for the Energy Optimization rebate. (25 Year Levelized Cost and Payback Analysis)
7. Start logging solar generation data to quantify Capacity Factor (critical for accurate avoided cost and payback analysis). Airport weather station may have data.
8. Continue to investigate contract terms and language necessary for City residents and businesses participating in the Escanaba Solar Project, to qualify for the 30% Federal Investment Tax Credit. (30% ITC through 2019, 26% in 2020, and 22% in 2021)

9. **Explore extended warranty costs on solar inverters to reduce the solar project O & M costs (e.g., 50%)**

10. **Revise 25 Year Levelized cost, Avoided cost and Payback Analysis.**

11. **Finalize new proposed Net Metering Policy based on Avoided Cost or Value of Solar.**

12. **Develop draft contract language and terms for Residential and Commercial customers to purchase installed solar panels in the Escanaba Solar Project.**

13. **Prepare brochures and other publicity materials to explain the Escanaba Solar Project to Escanaba citizens and businesses. Meet with Escanaba groups to explain the Project.**

14. **Survey resident and business community interest in the Project.**

15. **Monitor potential impact of any new Michigan energy legislation on the Escanaba Solar Project economics and feasibility.**

16. **Define the data requirements and electric billing software changes necessary to implement the Escanaba Solar Project.**

17. **Develop Project equipment specifications (e.g., solar panel specifications, inverter minimum efficiency, minimum DC wiring loss, etc.)**

18. **Draft RFP for proposed Escanaba Solar Project.**