

EMISSIONS REDUCTIONS FROM CAPTURE OF WASTE HEAT AT THE GARVIN COMPRESSOR STATION



ELEMENT MARKETS

Document Prepared By

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Project Title	Waste Heat Capture Project at Natural Gas Pipeline in Garvin, Minnesota
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity uses waste heat from the exhaust generated by a natural gas compressor station to produce zero emissions electricity. Verified Carbon Units (VCUs) are generated through the displacement of existing resources on the grid. Construction of the project started in the first half of 2009. The project began operations October 21, 2009 and has been in continuous operation to date.

In the absence of this project, the waste heat generated at the compressor stations would dissipate into the atmosphere. With the implementation of this project, a major portion of the waste heat is recovered and used to produce an average of 5.5 MWs of electricity each year. The heat recovery generating station – referred to as a recovered energy generation (REG) unit – is located at compressor station #12 near Garvin, MN along the Northern Border Pipeline. The recovered heat energy heats a thermal oil, which is then transferred and used to vaporize a fluid that expands to drive the turbine, which in turn drives a generator. The facility delivers electricity to the Western Area Power Administration (WAPA) – Upper Great Plains East (UGPE) Integrated System (IS). This power control area is part of the Midwest Reliability Organization (MRO) NERC region.

Basin Electric Power Cooperative (BEPC) developed this project on a voluntary basis in anticipation of potential GHG and renewable legislation. This project was not required to meet any state renewable portfolio requirements. In addition, the monetization of the green attributes from this project was part of the justification of the economics of the project to BEPC as they have more cost effective alternatives to obtain energy from grid connected resources, absent the value of the green attributes.

The project achieved total net GHG emission reductions of 31,845 tCO₂e in the period from January 1 – December 31, 2014

1.2 Sectoral Scope and Project Type

As a grid-connected, zero emissions waste heat recovery project at a compressor station, the project activity is principally categorized under Sectoral Scope 4: Manufacturing industries. This project is not a grouped project.

1.3 Project Proponent

Organization name	Basin Electric Power Cooperative
Contact person	Zane Zuther
Title	Planning Analyst
Address	1717 East Interstate Avenue Bismarck, North Dakota 58503-0564
Telephone	701-557-5638
Email	zzzuther@bepc.com

Organization name	Basin Electric Power Cooperative
Contact person	David Raatz
Title	Manager of Marketing and Power Supply
Address	1717 East Interstate Avenue Bismarck, North Dakota 58503-0564
Telephone	701-223-0441
Email	draatz@bepc.com

Organization name	Ormat Recovered Energy Generation II (OREG II – subsidiary of Ormat Technologies Inc.)
Contact person	Eric Sponsler
Title	Plant Manager
Address	12805 370 th Avenue Wetonka, SD 57481
Telephone	605-225-1055
Email	esponsler@ormat.com

1.4 Other Entities Involved in the Project

Organization name	Element Markets, LLC
Role in the project	Consultant and authorized representative for BEPC
Contact person	Ken Nelson
Title	Authorized Agent
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Telephone	281-207-7208
Email	knelson@elementmarkets.com

1.5 Project Start Date

The date of first generation for the Garvin project is October 21, 2009.

1.6 Project Crediting Period

The project crediting period for the projects started January 1, 2010, and will conclude December 31, 2014, for a total of 5 years. This verification covers the periods from January 1, 2014–December 31, 2014.

1.7 Project Location

The compressor station is located approximately one mile southeast of Garvin, MN in Lyon County.

Garvin, MN – Latitude: 44.2° Longitude: -95.8° The compressor station is located approximately one mile southeast of Garvin, MN in Lyon County.

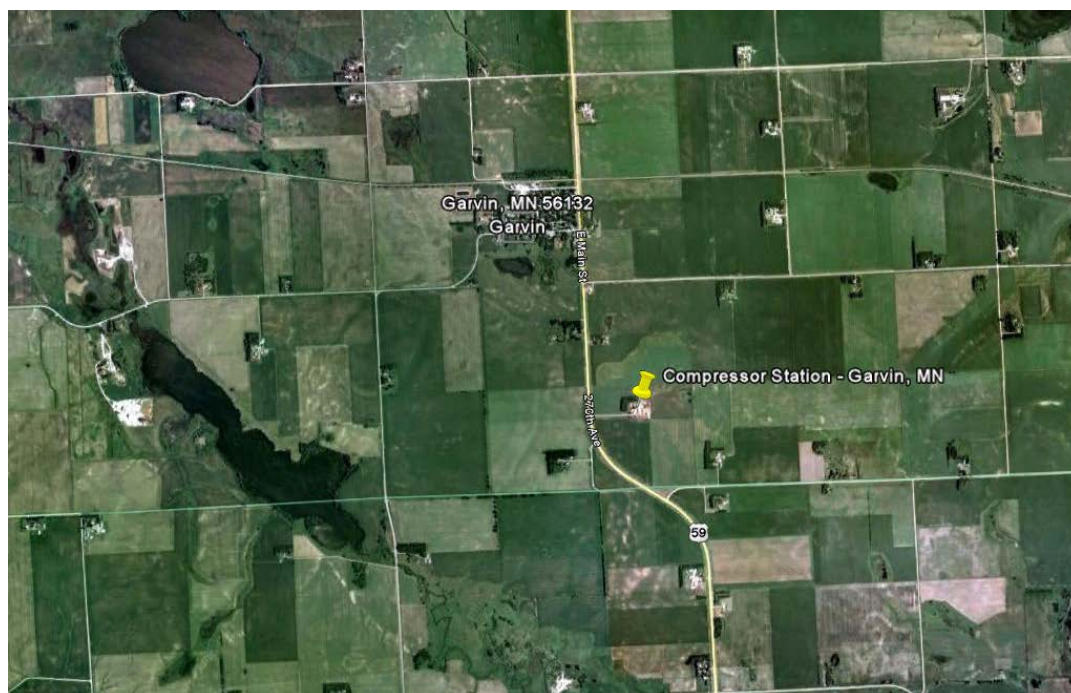


Figure 1 Map of Project location

1.8 Title and Reference of Methodology

1.8.1 Title

AMS III.Q: Waste Energy Recovery (Gas / Heat / Pressure) projects

1.8.2 Reference

http://cdm.unfccc.int/filestorage/R/W/8/RW84DSJ1MY7KQZBLECHV2603IFXTP5/EB60_repan22_%20AMS-III%20Q_ver04.pdf?t=ek58bHNwYmdifDB95nIUkZtbZMtBalZccVMF

1.8.3 Version

Version 4.0

1.8.4 Tools used

- Tool for the demonstration and assessment of additionality - version 5.2
- Tool to calculate the emission factor for an electricity system - version 2.2.0
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption - Version 1

1.9 Other Programs

The facility is not subject to any emissions trading programs or binding limits. Credits from these projects will not be used to meet compliance for another emissions trading program or to meet binding limits on GHG emissions.

The project is eligible to receive voluntary Renewable Energy Credits (RECs). It is currently registered in MRETS (the Midwest Renewable Energy Tracking System), a tracking registry to record the generation of renewable energy MWhs. BEPC does not plan to generate RECs for environmental attributes that are claimed as VCUs. The facility will remain in MRETS for reporting purposes only. RECs associated with the projects will be retired in MRETS so that VCUs may be issued in accordance with the mechanism described below.

A third party, WAPA, reports the number of MWhs generated each month to MRETS, which assigns unique serial numbers for each MWh. For the creation of VCUs, the MWhs for which VCUs are being claimed will be retired in the system and the reason for doing this (VCU creation) will be documented in the system. The retirement of these credits and subsequent identification of the reason will ensure that those RECs will not be double sold, and that VCUs can be created with confidence

The project has neither applied for nor been denied acceptance under any other GHG program.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The Garvin waste heat project has been operating since October 21, 2009. The project experienced normal operations in 2014. There were no disruptions to normal operations experienced at the compressor station.

A Nexus revenue meter measures the amount of power generated on a continuous basis; data is aggregated hourly and is reported in a MV90 report with 8760 separate data points for the number of kWhs generated each hour. The Western Area Power Administration (WAPA) reads this meter on a monthly basis and reports the number of megawatt hours (MWh) generated to the Midwest Renewable Energy Tracking System (MRETS), which then issues Renewable Energy Credits (RECs) to the project's account. As noted in the project description, the project's registration in MRETS is being used for reporting purposes only – all certificates for which VCUs are being generated will be retired.

Per the project description, both the MV90 data and the corresponding MRETS generation records are being provided to corroborate the number of MWh generated. Please note that at times, there can be a small difference between the value reported in the MV90 report and the value in MRETS. For the period between January 1 – December 31, 2014, the difference between the annual MRETS value and the MV90 value is extremely small 0.425%.

The small difference between the MV90 data and M-RETS occurs due to the way WAPA reads the meters for the projects. WAPA's standard procedure is to use the Stop meter reading and subtract the Start meter reading to come up with the monthly reading. This reading is then multiplied by the meter's multiplier to come up with monthly kWhs. The Start and Stop times occur at midnight of the beginning of each month. The MV90 hourly data is a reading for each hour multiplied by the meter multiplier. Therefore when summing up the hourly meter reads and comparing to a start and stop time meter read a variance will occur to sampling.

The project generated a total of 37,877 MWhs during the period from January 1 – December 31, 2014.

2.2 Deviations

2.2.1 Methodology Deviations

As discussed in the Project Description, the following Methodology Deviations are applied during each verification period, including the current monitoring period.

We do not monitor certain parameters which are not pertinent to the calculation of emissions reductions. These include:

- The gross amount of energy contained in the waste heat or the amount of waste heat.
- Temperature and Pressure

Since emissions reductions are calculated based on net energy delivered to grid, the above parameters are not pertinent to the GHG reduction calculations performed. In addition, in regards to waste heat metering, the gross adjustment factor is being calculated on an ex-ante basis, hence it is not necessary to monitor the gross generation on a forward basis.

Accordingly, the deviations only relate to the criteria and procedures for monitoring and measurement; and do not negatively impact the conservativeness of the quantification of GHG emission reductions.

2.2.2 Project Description Deviations

No project description deviations were applied during this monitoring period.

No project description deviations were applied during previous reporting periods.

2.3 Grouped Project

Garvin Waste Heat Capture Project is a stand-alone project, and is not a grouped project

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	f_{WCM}
Data unit:	Ratio
Description:	Fraction of total electricity generated by the project activity using only waste energy (as opposed to waste energy and fossil fuels).
Source of data:	Default Factors
Value applied:	1
Justification of choice of data or description of measurement methods and procedures applied	Since the electricity generation is purely from the generation of waste energy, this fraction is 1.
Purpose of Data:	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	$EF_{elec,i,y}$
Data unit:	Metric tons / MWhr
Description:	The CO ₂ emissions factor for the grid i displaced due to the project activity, during the year y in metric tons CO ₂ /MWh, as calculated by the combined operating margin (CM), which is a weighted average of the Simple Operating Margin and Build Margin.
Source of data:	Calculated based on tool for calculating emissions intensity of the grid; Sources include EIA 923/860 databases, EIA fuel emissions factors
Value applied:	0.8422
Justification of choice of data or description of measurement methods and procedures applied	$w1 * \text{Simple OM} + w2 * \text{Build Margin}$, where $w1 = 0.75$ and $w2 = 0.25$
Purpose of Data	Calculation of baseline emissions
Any comment:	The ex-ante option is chosen

Data Unit / Parameter:	$EF_{grid,OMsimple,y}$
Data unit:	Metric tons / MWh
Description:	Simple Operating Margin CO ₂ emissions factor in year y
Source of data:	Calculated based on Tool for calculating emissions intensity of the grid; Sources include EIA 923/860 databases, EIA fuel emissions factors
Value applied:	0.98542
Justification of choice of data or description of measurement methods and procedures applied	Calculated based in tool for calculating emissions intensity of the grid. For detailed calculations see Section 3 of the Project Description .
Purpose of Data	Calculation of baseline emissions
Any comment:	The ex-ante option is chosen

Data Unit / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated by power unit m in year y (m includes all power units except low cost must run power units)
Source of data:	EIA 923/860 databases
Value applied:	Varies by unit
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data:	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	For simple operating margin - $EF_{EL,m,y}$
Data unit:	Metric tons / MWh
Description:	CO ₂ emissions factor of power unit m in year y (tCO ₂ / MWh)
Source of data:	EIA 923/860 databases
Value applied:	Varies by unit
Justification of choice of data or description of measurement methods and procedures applied	Calculated using EIA 923 / EIA 860 databases and EIA Fuel emissions factors
Purpose of Data	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	$FC_{i,m,y}$ and $NCV_{i,y}$
Data unit:	MMBtus
Description:	Amount of fossil fuel type i consumed by power unit m in year y (mass or unit volume) and the Net Calorific Value (energy content) of fossil fuel type i in year y
Source of data:	EIA 923/860 databases and EIA Fuel Emissions Factors
Value applied:	Varies by unit
Justification of choice of data or description of measurement methods and procedures applied	The EIA 923 database provides the product of these two factors and provides the MMBtus consumed for electricity generation for each plant in the grid.
Purpose of Data	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	$EF_{CO_2,i,y}$
Data unit:	Kg CO ₂ e/MMBtu
Description:	CO ₂ emissions factor of fossil fuel type i in year y
Source of data:	EIA 923/860 databases and EIA Fuel Emissions Factors
Value applied:	Varies by fuel type
Justification of choice of	EIA fuel emissions factors are default values that have been used to prepare GHG inventories.

data or description of measurement methods and procedures applied	
Purpose of Data	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	EF _{grid,BM,y}
Data unit:	Metric Tons / MWh
Description:	CO2 emissions factor of fossil fuel type i in year y
Source of data:	Calculated using Option A2 for simple OM, but including all units as defined in the methodology. EIA 923/860 databases and EIA Fuel Emissions Factors
Value applied:	0.4126
Justification of choice of data or description of measurement methods and procedures applied	For detailed calculations see Section 3 of the Project Description
Purpose of Data	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	For Build Margin - EF _{EL,m,y}
Data unit:	Metric tons / MWh
Description:	CO2 emissions factor of power unit m in year y (tCO2 / MWh)
Source of data:	EIA 923/860 databases
Value applied:	Varies by unit
Justification of choice of data or description of measurement methods and procedures applied	Calculated using EIA 923 / EIA 860 databases and EIA Fuel emissions factors, based on Option A2 as described under the Simple OM found in Section 3 of the Project Description .
Purpose of Data	Calculation of baseline emissions
Any comment:	This factor uses the power generation efficiency factor and the CO2 emissions factor of fossil fuel type l in year y.

Data Unit / Parameter:	For Build Margin - n _{m,y}
Data unit:	MMBtus / MWh
Description:	Average net energy conversion efficiency of power unit m in year y
Source of data:	Default table, Annex 1
Value applied:	Varies by unit
Justification of choice of data or description of measurement methods and procedures applied	This is required by the Tool for the option chosen.
Purpose of Data	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	$TDL_{i,y}$
Data unit:	Default Factor
Description:	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data:	Tool to calculate baseline, project and/or leakage emissions
Value applied:	20%
Justification of choice of data or description of measurement methods and procedures applied	Default Factor
Purpose of Data	Calculation of project emissions
Any comment:	N/A

Data Unit / Parameter:	$CF_{\text{historical, Garvin}}$
Data unit:	Percentage
Description:	Ratio of mean daily horsepower hours generated over maximum theoretical horsepower hours feasible at the Garvin compressor station
Source of data:	Mean daily horsepower hours are based on BEPC's historical data collected over 32 months at the compressor station. Maximum theoretical horsepower hours is based on the conservative assumption that the Northern Border Pipeline has a 40,000 hp turbine in place at Garvin. This information is derived from the Gas Technology Institute's report about the BEPC and OREG waste heat projects.
Value applied:	0.674609
Justification of choice of data or description of measurement methods and procedures applied	This measure captures the historical capacity factor that measures how much energy was available at each compressor station. It is based on data which was used to assess the technical feasibility of the project at the Garvin Site.
Purpose of data	Calculation of baseline emissions
Any comment:	N/A

Data Unit / Parameter:	Gross Adjustment Factor
Data unit:	Percentage
Description:	Median of historical monthly data of percentage by which gross generation exceeds net generation at Compressor Station #12.
Source of data:	OREG II readings at CS12 since its start date – historical data. OREG II data includes gross generation, net generation and parasitic load.
Value applied:	12.75%
Justification of choice of data or description of measurement methods and procedures applied	This measure captures the historical capacity factor that measures how much energy was available at each compressor station. It is based on data which was used to assess the technical feasibility of the project at the Garvin Site.
Purpose of Data	Calculation of baseline emissions
Any comment:	N/A

3.2 Data and Parameters Monitored

Data Unit / Parameter:	EG _{i,j,2014}
Data unit:	MWh
Description:	The quantity of electricity supplied to the recipient (in this case the grid) by the generator that in the absence of project activity would have been sourced from i (MRO) grid in MWh in year 2014.
Source of data:	Project activity revenue meter at the Garvin substation - a Nexus 1252-120-D-INP2 manufactured by Electro Industries, Serial No. 39827837.
Description of measurement methods and procedures to be applied:	Electricity generation is measured continuously and recorded monthly.
Frequency of monitoring/recording:	Monthly
Value Monitored:	EG _{i,j,2014} : 37,877 MWhs
Monitoring equipment:	Project activity revenue meter at the Garvin substation - a Nexus 1252-120-D-INP2 manufactured by Electro Industries, Serial No. 39827837 owned by East River Electric Cooperative. East River Electric Cooperative owns and calibrates the meter per the interconnection Agreement.
QA/QC procedures to be applied:	The meter is tested every year, normally during the last quarter of the calendar year. This meter does not lend itself to be easily field calibrated, so it has been East River's practice that if the meter is found to be out of calibration they will simply replace the meter. This meter was last tested on 12/9/2014, and found to be operating within acceptable parameters. An attestation for 2014 is provided stating that no meter calibrations were conducted during CY 2014.
Purpose of the data	Calculation of baseline emissions
Calculation method:	Meter readings
Any comment:	N/A

Data Unit / Parameter:	CF _{actual, Garvin, 2014}
Data unit:	Percentage
Description:	Total Generation in MWh * 1.1275 / (7.5 * 8760)
Source of data:	Project activity revenue meter at the Garvin substation - a Nexus 1252-120-D-INP2 manufactured by Electro Industries, Serial No. 39827837 owned by East River Electric Cooperative.
Description of measurement methods and procedures to be applied:	MV90 generation data is archived electronically. Electricity generation is measured continuously and recorded monthly.
Frequency of monitoring/recording:	An annual calculation will be made based on total electricity generated at the site
Value applied:	CF _{actual, Garvin, 2014} : 65.00%
Monitoring equipment:	Project activity revenue meter at the Garvin substation - a Nexus 1252-120-D-INP2 manufactured by Electro Industries, Serial No. 39827837 owned by East River Electric Cooperative. East River Electric Cooperative owns and calibrates the meter per the interconnection Agreement.
QA/QC procedures to be applied:	The meter is tested every year, normally during the last quarter of the calendar year. This meter does not lend itself to be easily field calibrated, so it has been East River's practice that if the meter is

	found to be out of calibration they will simply replace the meter. This meter was last tested on 12/9/2014 and found to be operating within acceptable parameters. An attestation for 2014 is provided stating that no meter calibrations were conducted during CY 2014.
Purpose of the data	Calculation of baseline emissions
Calculation method:	Meter readings and formula above
Any comment:	N/A

Data Unit / Parameter:	$f_{cap, Garvin, 2014}$
Data unit:	Ratio
Description:	$f_{cap, Garvin, 2014} = \min \{1, 0.674609 / CF_{actual, Garvin, 2014}\}$
Source of data:	$CF_{historical, Garvin}$ is calculated to be 0.674609 based on the average versus theoretical maximum daily horsepower hours at the compressor station. $CF_{actual, Garvin}$ will be based on the gross amount of electricity generated and delivered to the grid in 2014, which is calculated as the net amount of electricity delivered to the grid times the gross generation adjustment factor.
Description of measurement methods and procedures to be applied:	MV90 generation data is archived electronically. Electricity generation is measured continuously and recorded monthly.
Frequency of monitoring/recording:	An annual calculation will be made based on total electricity generated at the site
Value applied:	$f_{cap, Garvin, 2014} = 1$
Monitoring equipment:	Project activity revenue meter at the Garvin substation - a Nexus 1252-120-D-INP2 manufactured by Electro Industries, Serial No. 39827837 owned by East River Electric Cooperative. East River Electric Cooperative owns and calibrates the meter per the interconnection Agreement.
QA/QC procedures to be applied:	The meter is tested every year, normally during the last quarter of the calendar year. This meter does not lend itself to be easily field calibrated, so it has been East River's practice that if the meter is found to be out of calibration they will simply replace the meter. This meter was last tested on 12/12/2014, and found to be operating within acceptable parameters. An attestation for 2014 is provided stating that no meter calibrations were conducted during CY 2014.
Purpose of the data	Calculation of baseline emissions
Calculation method:	Meter readings and formula above
Any comment:	N/A

Data Unit / Parameter:	$EC_{PJ, i, 2014}$
Data unit:	MWh
Description:	Quantity of electricity consumed by the project electricity consumption source j in year 2014 (MWh/yr)
Source of data:	Project activity revenue meters at the Garvin substation
Description of measurement methods and procedures to be applied:	Station services consumption will be derived from billing statements provided monthly by Lyon Lincoln Cooperative in whose service territory this project is located, and to whose distribution lines the project interconnects
Frequency of monitoring/recording:	Monthly
Value applied:	$EC_{PJ, i, 2014} = 54.666 \text{ MWh}$

Monitoring equipment:	Lyon Lincoln Invoices
QA/QC procedures to be applied:	Copies of Monthly Invoices submitted by Lyon Lincoln Electric Cooperative
Purpose of the data	Calculation of project emissions
Calculation method:	Not calculated, provided in meter data
Any comment:	N/A

Data Unit / Parameter:	PE _{EC,2014}
Data unit:	Metric Tons
Description:	Project emissions from electricity consumption in year 2014 (tCO ₂ / yr)
Source of data:	Project activity revenue meters at the Garvin substation
Description of measurement methods and procedures to be applied:	Station services consumption will be derived from billing statements provided monthly by Lyon Lincoln Cooperative in whose service territory this project is located, and to whose distribution lines the project interconnects After MWh consumed is obtained, the parameter will be calculated using the following formula: $PE_{EC,y} = \sum EC_{PJ,i,y} * EF_{EL,i,y} * (1 + TDL_{i,y})$
Frequency of monitoring/recording:	Monthly
Value applied:	PE _{EC,2014} = 55.248
Monitoring equipment:	Lyon Lincoln Invoices
QA/QC procedures to be applied:	Copies of Monthly Invoices submitted by Lyon Lincoln Electric Cooperative
Purpose of the data	Calculation of project emissions
Calculation method:	Meter readings as detailed on the invoice
Any comment:	N/A

3.3 Monitoring Plan

3.3.1 Relationship of the parties involved

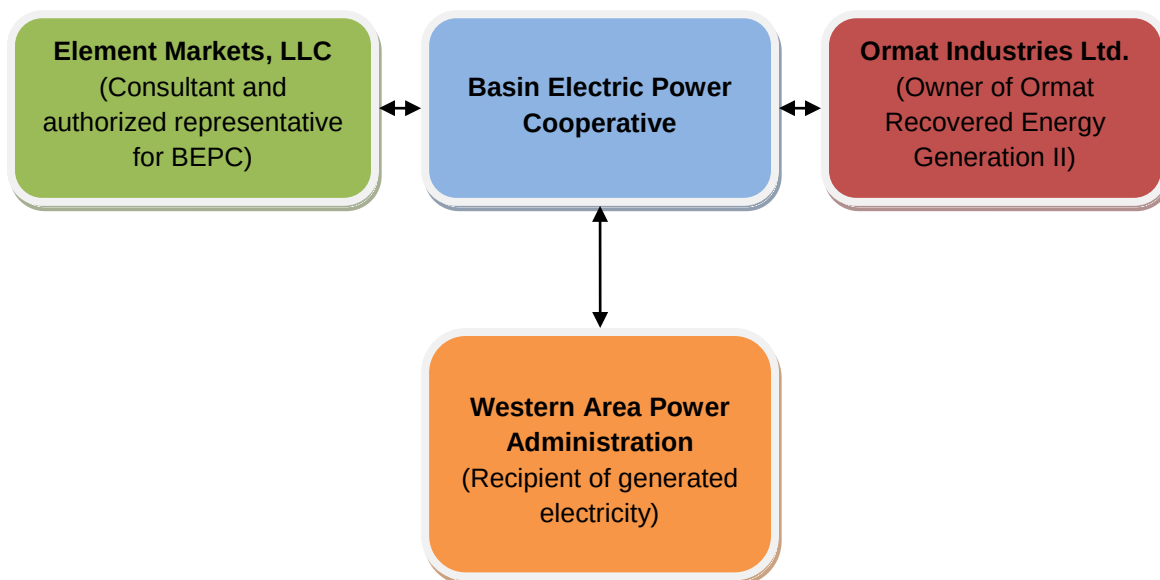


Figure 2 Relationship of parties involved in the project

Basin Electric Power Cooperative: A wholesale electric generation and transmission cooperative based in North Dakota. BEPC built the interconnection infrastructure used to provide energy to the grid by the Garvin site. BEPC has entered a power purchase agreement (PPA) with the owner and operator of the recovered energy generation (REG) units, Ormat Technologies, through Ormat's subsidiary OREG II.

Element Markets, LLC: a renewable energy development and environmental credit marketing company based in Houston, Texas. Element Markets, LLC (Element Markets or EM) is the consultant and authorized representative for BEPC and is undertaking the verification and validation of the VCS project on behalf of BEPC.

Ormat Industries Ltd.: Owner of Ormat Recovered Energy Generation II (OREG II) – the company which built the waste heat project and oversees facility operations.

Western Area Power Administration: Recipient of all electricity generated by the project. WAPA is taking monthly readings and reporting electricity generation in MRETS.

For contact information of the parties involved in the project, see section 1.4 Other Entities Involved in the Project.

3.3.2 Data Monitoring

- A Nexus 1252-120-D-INP2 meter records power generated on a continuous basis.
- Production is then aggregated at an hourly interval so that an 8,760 hourly production shape is available for each year.

- Data monitoring takes place on a monthly basis when WAPA reads the meters and submits data to the Midwest Renewable Energy Tracking System (M-RETS).
- This monthly data from M-RETS is what will be used to calculate the emissions reductions.
- Monitoring records will be retained for 7 years (two years past the project's crediting period of 5 years)

3.3.3 Metering Devices

- The revenue grade meter Nexus 1252-120-D-INP2 (manufactured by Electro Industries, Serial No. 39827837) is owned by East River Electric Cooperative, which owns and calibrates the meter per the interconnection Agreement. The meter is tested every year, normally during the last quarter of the calendar year. This meter does not lend itself to be easily field calibrated, so it has been East River's practice that if the meter is found to be out of calibration they will simply replace the meter. This meter was last tested on 12/9/2014 and found to be operating within acceptable parameters. An attestation for 2014 is provided stating that no meter calibrations were conducted during CY 2014.

3.3.4 Extraordinary Events:

No extraordinary events or unscheduled maintenance took place.

3.3.5 Retirement of RECs:

- As stated in the project description, since this project is registered in MRETS, renewable energy credits are being created for each MWhr generated. These credits have been retired.
- In addition, Basin has provided an attestation that these credits are not being used in any other GHG program.

3.3.6 Internal audit and handling of non-conformities

- All data used for establishing and verifying GHG emission reductions and removals is collected and processed by Element Markets with the help of the other project proponents.
- Data collection and processing is based on EM's internal QA/QC procedures which include preapproved data and documentation checklists as well as emission reduction calculation methodology.
- All verification data submittal is performed under the supervision of EM's senior management. Any errors or non-conformities discovered during internal audits or by third party verifiers are addressed in cooperation with the project proponents by EM's operations team.
- The final step of non-conformance resolution is review and (if needed) update of the appropriate sections of the QA/QC procedures.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

$$BE_{elec,2014} = f_{cap,2014} * f_{WCM} * EG_{i,j,2014} * EF_{Elec,i,j,2014}$$

Hence the Baseline Emissions are:

$$BE_{elec,2014} = 1 * 1 * 37,877 * 0.8422 = 31,900 \text{ metric tons}$$

4.2 Project Emissions

$$PE_{EC,2014} = EC_{PJ,j,2014} * EF_{EL,j,2014} * (1 + TDL_{j,2014})$$

Hence Project Emissions are:

$$PE_{EC,2014} = 54.666 * 0.8422 * (1+0.2) = 55.248 \text{ metric tons}$$

4.3 Leakage

No leakage is considered as the equipment being utilized in the project activity is not transferred from outside the boundary to the project activity. Ormat, the project developer, installed new, original equipment at this site to generate the emissions reductions, and has provided an attestation for the validation process to that effect. Hence, we do not consider leakage here.

4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2014	31,900	55.248	-	31,845
Total	31,900	55.248	-	31,845