Technical Support Document for Calculating Carbon Pollution Goals for Existing Power Plants in Territories and Areas of Indian Country

October 2014

CONTENTS

Acronyms and initialisms ii
Introduction 1
Affected electricity generating units on tribal lands 1
Overview 1
Data 2
BSER factors informing tribal lands' emission rate goals 3
Building block 1 – heat rate improvement at coal-fired power plants 3
Building block 2 – redispatch to lower-emitting NGCC EGUs 3
Building block 3 – renewables 4
Building block 4 – energy efficiency 4
Affected electricity generating units in U.S. territories 4
Overview 4
Data 7
BSER factors informing territories' emission rate goals 11
Building block 1 – heat rate improvement at coal-fired power plants 11
Building block 2 – redispatch to lower-emitting NGCC EGUs 11
Building block 3 – renewables 11
Building block 4 – energy efficiency 12
Appendix 1 – Tribal and Territory Unit-level Inventory 13
Appendix 2 – Goal Data and Computation 13
Appendix 3 – Cost Calculations 13
Appendix 4 – Summary of tribal and territory goals under the proposed Existing Source Performance Standard 14
Proposed and alternate goals with approach A 14
Co-proposed and alternate goals with approach B 14
Alternative goals 14
Appendix 5 – 2012 emission rate and building block application 15
Proposed goals 15

ACRONYMS AND INITIALISMS

BSER	best system of emission reduction
CC	combined cycle
CO_2	carbon dioxide
CT	combustion turbine
EGU	electric generating unit
GHG	greenhouse gas
GPA	Guam Power Authority
ICE	internal combustion engine
LNG	liquified natural gas
NGCC	natural gas combined cycle
PREPA	Puerto Rico Electric Power Authority
ST	steam turbine
VIWAPA	U.S. Virgin Islands Water and Power Authority

INTRODUCTION

In the June 2014 *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units* (hereafter referred to as "June 2014 proposed rule"), EPA proposed to establish carbon dioxide (CO_2) emission guidelines for existing electricity generating units (EGUs) in the 50 states of the U.S. The Agency also indicated that it would propose a supplemental rule that included CO_2 guidelines for existing EGUs in the territories and areas of Indian country (hereafter referred to as "tribal lands").

Based on the June 2014 proposed rule, the Agency identified the *best system of emission reduction* (BSER) that, taking into account the cost of achieving emission reductions and non-air quality health and environmental impact and energy requirements, the Administrator determines has been adequately demonstrated. Based on its evaluation of adequately-demonstrated greenhouse gas (GHG) abatement measures, the Agency listed four categories, or "building blocks," that are technically viable and broadly applicable, and can provide cost-effective reductions in CO_2 emissions from existing EGUs. These "building blocks" include:

1. Reducing the CO_2 intensity of generation at individual affected EGUs through heat rate improvements;
2. Reducing emissions from the most CO_2-intensive affected EGUs in the amount that results from substituting generation at those EGUs with generation from less CO_2-intenstive affected EGUs (e.g., natural gas combined cycle (NGCC) EGUs);
3. Reducing emissions from affected EGUs in the amount that results from substituting generation at those EGUs with expanded generation at low- or zero-CO_2 EGUs; and,
4. Reducing emissions from affected EGUs in the amount that results from the use of demand-side energy efficiency that reduces the amount of generation required.

The Agency believes that for purposes of Clean Air Act section 111(d), as applied to the power sector, the BSER encompasses all four "building blocks."

This Technical Support Document (TSD) describes how the Agency applied the BSER from the June 2014 proposed rule to affected EGUs on tribal lands and in territories.

AFFECTED ELECTRICITY GENERATING UNITS ON TRIBAL LANDS

Overview

There are four power plants with 12 affected EGUs on tribal lands (see Table 1). Three plants combust coal and one plant has two NGCC EGUs. The EGUs on tribal lands operate as part of an integrated electricity grid and supply the majority of their electricity generation to customers outside the tribal lands.

The Agency did not find any information about grid-connected renewable energy generation in 2012 on tribal lands with affected EGUs and, therefore, assumed no existing renewable energy sources.

Table 1: Potentially affected EGUs on tribal lands

Tribe	ORIS	Plant name	Unit	Fuel	Unit type	Capacity (MW)
Navajo	2442	Four Corners	1	coal	steam turbine	190
Navajo	2442	Four Corners	2	coal	steam turbine	190
Navajo	2442	Four Corners	3	coal	steam turbine	253
Navajo	2442	Four Corners	4	coal	steam turbine	818
Navajo	2442	Four Corners	5	coal	steam turbine	818
Navajo	4941	Navajo Generating Station	NAV1	coal	steam turbine	803
Navajo	4941	Navajo Generating Station	NAV2	coal	steam turbine	803
Navajo	4941	Navajo Generating Station	NAV3	coal	steam turbine	803
Ute	7790	Bonanza	1	coal	steam turbine	500
Fort Mojave	55177	South Point Energy Center	A	gas	NGCC	236
Fort Mojave	55177	South Point Energy Center	B	gas	NGCC	236
Fort Mojave	55177	South Point Energy Center	ST1	gas	NGCC	236

Data

The 2012 CO_2 emissions and electricity generation data for the EGUs listed in Table 1 are taken from the document titled, *2012 Unit-level Data Using the eGRID Methodology*.[1] Information about the source of these data and the methodologies used to compile the data set is described in *Description of 2012 Unit-Level Data Using the eGRID Methodology*.[2]

The information available to the Agency indicates there was no generation from utility-scale, grid-connected renewable energy in 2012 in the three tribal lands with affected EGUs. This was based on a review of information from EIA, DOE's Office of Indian Energy Policy and Programs, and tribal utility authorities serving tribal lands with affected EGUs.

Data required for the calculation of building block 4 goals for tribal lands and their sources are:

- 2012 electricity sales (MWh): Form EIA-861[3]
- 2012 energy efficiency incremental effects – total (MWh): Form EIA-861[4]
- Projected annual electricity sales by region (2012-2040): AEO2013 Reference Case[5]

These data are inputs to the supporting technical files to this TSD:

- Option 1A: Building block 4 proposed goal based on each tribe/territory ramping up to 1.5% incremental savings with costs calculated using a 3% discount rate;
- Option 1B: Building block 4 proposed goal based on each tribe/territory ramping up to 1.5% incremental savings with costs calculated using a 7% discount rate;

[1] Available in the docket EPA-HQ-OAR-2013-0602 at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0602-0254.

[2] [2] Available in the docket EPA-HQ-OAR-2013-0602 at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0602-0257.

[3] Available at http://www.eia.gov/electricity/data/eia861/ (see "retail sales" workbook).

[4] Available at http://www.eia.gov/electricity/data/eia861/ (see "dsm" workbook).

[5] Available at http://www.eia.gov/forecasts/archive/aeo13/.

- Option 2A: Building block 4 alternative goal based on each tribe/territory ramping up to 1.0% incremental savings with costs calculated using a 3% discount rate; and
- Option 2B: Building block 4 alternative goal based on each tribe/territory ramping up to 1.0% incremental savings with costs calculated using a 7% discount rate.

Table 2 summarizes data on 2012 electricity sales for tribal lands by state and utility. None of the tribes reported energy efficiency data on their Form EIA-861 submittals for 2012. Projected annual electricity sales by region are included in the supporting technical files to this TSD.

Table 2: 2012 total electricity sales for tribal lands

Tribe	Utility number	Utility name	State	Total sales (MWh)
Ute	12866	Moon Lake Electric Assn Inc	UT	470,007
Navajo	13314	Navajo Tribal Utility Authority	AZ	548,934
Navajo	13314	Navajo Tribal Utility Authority	NM	117,010
Navajo	13314	Navajo Tribal Utility Authority	UT	10,070
Fort Mojave	58123	Aha Macav Power Service	AZ	47,788

BSER factors informing tribal lands' emission rate goals

The methodology for calculating tribal lands' emission rate goals generally applies the same approach to determining BSER as described in the *Goal Computation TSD* from the June 2014 proposed rule. Information about the BSER measures can be found in the *GHG Abatement Measures* TSD.[6] The *GHG Abatement Measures* TSD describes the categories of emission reduction measures (building blocks) used in determining the emission rate goals.

Building block 1 – heat rate improvement at coal-fired power plants

Using the data discussed above, the Agency applied a 6% heat rate improvement to the EGUs at the Four Corners, Navajo Generating Station, and Bonanza coal-fired power plants. To calculate the alternative goal, the Agency applied a 4% heat rate improvement to the EGUs. The results from building block 1 are presented in Table 3.

Table 3: Adjusted average coal CO_2 emission rate for coal-fired EGUs

Tribe	6% HRI Coal CO_2 rate (lbs/MWh)	4% HRI Coal CO_2 rate (lbs/MWh)
Navajo	1,993	2,036
Ute	2,016	2,059

Building block 2 – redispatch to lower-emitting NGCC EGUs

Because none of the tribal lands have both coal-fired EGUs and NGCC EGUs, the analysis does not include redispatch to less CO_2-intenstive affected EGUs.

[6] Available in the docket EPA-HQ-OAR-2013-0602 at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0602-0437.

Building block 3 – renewables

The analysis of renewable energy for building block 3 used the proposed methodology from the June 2014 proposed rule. Because EPA did not find any information about utility-scale, grid-connected renewable energy net generation on tribal lands with affected EGUs in 2012, the renewables targets are zero, and, therefore, result in no change to the goals for these areas.

EPA did not propose renewable energy targets for goal calculations based on the co-proposed methodology for the U.S. territories or the alternative approach used in the June 2014 proposed rule as discussed in the preamble. However, EPA considered using the renewable energy technical potential estimates for tribal lands[7,8] as well as using the lowest renewable energy percentage target (as derived in the alternative approach upon which EPA solicited comment for states) of any state in which that area of Indian country is located. Because these co-proposed methodology and alternative approach are based on a state or territory's total net electricity generation and not retail sales (i.e., consumption), applying these methodologies to tribal lands – where sales are only 2% - 16% of generation – yields large renewable energy goals relative to retail sales.

Building block 4 – energy efficiency

The analysis of energy efficiency for building block 4 used the proposed methodology from the June 2014 proposed rule.

AFFECTED ELECTRICITY GENERATING UNITS IN U.S. TERRITORIES

Overview

The territories of Guam, Puerto Rico, and the US Virgin Islands have coal-, oil-, and/or gas-fired EGUs that may be affected by this proposal. Data from these EGUs were analyzed to establish territorial goals using the BSER described above.

The Guam Power Authority (GPA) owns and manages the territory's electricity grid. The majority of electricity on Guam is generated from No. 6 heavy fuel oil with a small amount from No. 2 distillate oil, both of which are shipped to the territory by tanker.[9] There are nine fossil-fired EGUs in Guam equal to or greater than 25 MW nameplate capacity (see Table 4). Excluding Guam's internal combustion engines (ICEs) and oil-fired combustion turbines (CTs),[10] there are four EGU heavy fuel oil-fired steam turbine (STs) EGUs that may be affected sources under the rule.

Guam is also pursuing renewable energy and energy efficiency. In 2008, Guam's legislature established a renewable energy goal of 8% of net electricity sales by December 31, 2020; 10% of net electricity sales by December 31, 2025; and 15% of net electricity sales by December 31, 2030.[11]

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[7] Doris et al (DOE), 2013. Geospatial Analysis of Renewable Energy Technical Potential on Tribal Lands. Available at http://www.nrel.gov/docs/fy13osti/56641.pdf.

[8] Lopez et al (NREL), 2012. U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis. Available at http://www.nrel.gov/docs/fy12osti/51946.pdf.

[9] EIA, 2013. Guam – Territory Energy Profile Analysis. Available at http://www.eia.gov/state/analysis.cfm?sid=gq.

[10] The June 2014 proposed rule does not include ICEs as affected sources, and CTs must combust natural gas for more than 90% of the CT's heat input. Since available data indicate Guam's CT did not combust natural gas, it has been excluded from the list of potentially affected units for purposes of this goal-setting analysis.

[11] NCSU, 2014. Guam – Renewable Energy Portfolio Goal. Available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=GU03R&ee=1.

Table 4: Guam fossil-fired EGUs equal to or greater than 25 MW capacity

Plant name (location)	Unit	Fuel	Unit type	Capacity (MW)	
Cabras	1	No. 6 oil	ST	60	*
Cabras	2	No. 6 oil	ST	60	*
Cabras	3	No. 6 oil	ICE	38	
Cabras	4	No. 6 oil	ICE	38	
Tanguisson	1	No. 6 oil	ST	25	*
Tanguisson	2	No. 6 oil	ST	25	*
PITI	7	distillate oil	CT	40	
PITI	8	No. 6 oil	ICE	40	
PITI	9	No. 6 oil	ICE	40	

Note: EGUs with asterisks were included in the goal calculation for Guam

The Puerto Rico Electric Power Authority (PREPA) owns and manages the territory's electricity grid. In 2012, approximately 65% of the electricity was generated from No. 6 heavy fuel oil and No. 2 distillate oil, 18% from liquified natural gas (LNG), 16% from coal, and 1% from hydro.[12] There are several fossil-fired EGUs in Puerto Rico equal to or greater than 25 MW nameplate capacity (see Table 5). Excluding oil-fired CTs and combined cycles (CCs),[13] there are 2 coal-fired ST EGUs, 2 NGCC EGUs, and 14 oil-fired ST EGUs that may be affected sources under the rule.

Puerto Rico is also pursuing renewable energy and energy efficiency. In 2010, Puerto Rico enacted a renewable energy portfolio standard of 15% of retail electricity sales in 2020, rising to 20% in 2035.[14]

Table 5: Puerto Rico fossil-fired EGUs equal to or greater than 25 MW capacity

Plant name (location)	Unit	Fuel	Unit type	Capacity (MW)	
AES (Guayama)	1	Coal	ST	227	*
AES (Guayama)	2	Coal	ST	227	*
Eco-electrica (Penuelas)	CT1	Gas	NGCC	568	*
Eco-electrica (Penuelas)	CT2	Gas	NGCC	568	*
PREPA Aguirre (Aguirre)	AG1	No. 6 oil	ST	450	*
PREPA Aguirre (Aguirre)	AG2	No. 6 oil	ST	450	*
PREPA Aguirre (Aguirre)	CC1	distillate oil	CC	296	
PREPA Aguirre (Aguirre)	CC2	distillate oil	CC	296	
PREPA Aguirre (Aguirre)	T1-1	distillate oil	CT	30	
PREPA Aguirre (Aguirre)	T1-2	distillate oil	CT	30	
PREPA Cambalache (Arecibo)	C1	distillate oil	CT	83	

[12] EIA, 2014. Puerto Rico Territory Energy Profile. Available at http://www.eia.gov/state/print.cfm?sid=RQ

[13] In the June 2014 proposed rule, affected CTs are defined as those that combust natural gas for more than 90% of the CT's heat input. Since available data indicate Puerto Rico's CTs did not combust natural gas, those units have been excluded from the list of potentially affected units.

[14] NCSU, 2014. Puerto Rico – Renewable Energy Portfolio Standard. Available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=PR07R&ee=1.

PREPA Cambalache (Arecibo)	C2	distillate oil	CT	83	
PREPA Cambalache (Arecibo)	C3	distillate oil	CT	83	
PREPA Daguao (Ceiba)	T1-1	distillate oil	CT	30	
PREPA Daguao (Ceiba)	T1-2	distillate oil	CT	30	
PREPA Jobos (Guayama)	T1-1	distillate oil	CT	227	
PREPA Jobos (Guayama)	T1-2	distillate oil	CT	227	
PREPA Mayaquez	GT5	distillate oil	CT	28	
PREPA Mayaquez	GT6	distillate oil	CT	28	
PREPA Mayaquez	GT7	distillate oil	CT	28	
PREPA Mayaquez	GT8	distillate oil	CT	28	
PREPA Palo Seco (Toa Baja)	PS1	No. 6 oil	ST	85	*
PREPA Palo Seco (Toa Baja)	PS2	No. 6 oil	ST	85	*
PREPA Palo Seco (Toa Baja)	PS3	No. 6 oil	ST	216	*
PREPA Palo Seco (Toa Baja)	PS4	No. 6 oil	ST	216	*
PREPA Palo Seco (Toa Baja)	GT1-1	distillate oil	CT	30	
PREPA Palo Seco (Toa Baja)	GT1-2	distillate oil	CT	30	
PREPA Palo Seco (Toa Baja)	GT2-1	distillate oil	CT	30	
PREPA Palo Seco (Toa Baja)	GT2-2	distillate oil	CT	30	
PREPA Palo Seco (Toa Baja)	GT3-1	distillate oil	CT	30	
PREPA Palo Seco (Toa Baja)	GT3-2	distillate oil	CT	30	
PREPA San Juan (San Juan)	SJ7	No. 6 oil	ST	100	*
PREPA San Juan (San Juan)	SJ8	No. 6 oil	ST	100	*
PREPA San Juan (San Juan)	SJ9	No. 6 oil	ST	100	*
PREPA San Juan (San Juan)	SJ10	No. 6 oil	ST	100	*
PREPA San Juan (San Juan)	CC5	distillate oil	CC	232	
PREPA San Juan (San Juan)	CC6	distillate oil	CC	232	
PREPA South Coast (Guiyanilla)	SC3	No. 6 oil	ST	85	*
PREPA South Coast (Guiyanilla)	SC4	No. 6 oil	ST	85	*
PREPA South Coast (Guiyanilla)	SC5	No. 6 oil	ST	410	*
PREPA South Coast (Guiyanilla)	SC6	No. 6 oil	ST	410	*
PREPA South Coast (Guiyanilla)	GT1	distillate oil	CT	45	
PREPA South Coast (Guiyanilla)	GT2	distillate oil	CT	45	
PREPA Vega Baja	GT1-1	distillate oil	CT	30	
PREPA Vega Baja	GT1-2	distillate oil	CT	30	
PREPA Yabucoa (Humacao)	GT1-1	distillate oil	CT	30	
PREPA Yabucoa (Humacao)	GT1-2	distillate oil	CT	30	

Note: EGUs with asterisks were included in the goal calculation for Puerto Rico

The U.S. Virgin Islands Water and Power Authority (VIWAPA), an independent government agency, manages the territory's two separate electricity grids. There are several fossil-fired EGUs in the U.S. Virgin Islands, but most are less than 25 MW nameplate capacity. The Agency found information about 3 fossil-fired EGUs equal to or greater than 25 MW (see Table 6). Excluding the oil-fired combustion turbine (CT) EGU,[15] there is 1 coal-fired ST EGU that has not operated in more than 20 years and 1 oil-fired ST EGU that

[15] In the June 2014 proposed rule, affected CTs are defined as those that combust natural gas for more than 90% of the CT's heat input. Since available data indicate the U.S. Virgin Island's CT did not combust natural gas, that unit has been excluded from the list of potentially affected units.

has not operated since 2011. Because there are no 2012 data for the analysis and because there is no indication that VIWAPA will return these units to operation, the analysis does not include a goal calculation for the U.S. Virgin Islands.

Table 6: Virgin Island fossil-fired EGUs equal to or greater than 25 MW capacity

Plant name (location)	Unit	Fuel	Unit type	Capacity (MW)	
Krum Bay	13	No. 6 oil	ST	35	
Krum Bay	23	Distillate oil	CT	39	
St. Croix Renaissance	10	Coal	ST	25	

Data

Potentially-affected EGUs in the U.S. territories do not report comprehensive information to the Agency or the Energy Information Administration (EIA). Therefore, the Agency compiled data from a variety of sources, including:

- EPA's Greenhouse Gas Reporting Program[16]
- Puerto Rico Electric Power Authority (PREPA)
- U.S. Virgin Islands Power and Water Authority (VIWAPA)
- Guam Power Authority (GPA)
- EIA's form EIA-861

The territory goals are described as a CO_2 emission rate (lb of CO_2 per MWh of net electricity generation). However, the Agency did not have comprehensive unit-level data available on both CO_2 emissions and net electricity generation. For Guam, the Agency received unit-level net generation and fuel consumption data from GPA. For Puerto Rico, the Agency had unit-level CO_2 emission data reported by the power companies to the EPA's Greenhouse Gas Reporting Program. Therefore, two different methodologies were used to calculate CO_2 emissions (Guam) and net electricity generation (Puerto Rico).

For Guam, GPA provided information about unit-level net generation and fuel consumption. The Agency used the information to calculate unit-level CO_2 emissions using the following formula:

$$CO2_{2012} = OIL_{2012} \times EF$$

Where:

$CO2_{2012}$ is the 2012 annual CO_2 emissions in metric tons;

OIL_{2012} is the 2012 annual oil consumption in gallons; and

EF is an emission factor of 0.01127 metric tons of CO_2/gallon of No. 6 oil.[17]

For Puerto Rico, CO_2 emission data for 2012 were available at the unit level, but information was not available for unit-level net electricity generation in 2012. The Agency estimated 2012 net electricity

[16] Information about EPA's Greenhouse Gas Reporting Program is available on the program's website at http://ghgdata.epa.gov/ghgp.

[17] Emission factors from 40CFR Part 98 Subpart C, Table C-1. Available at http://www.ecfr.gov/cgi-bin/text-idx?SID=0769576af3d3e7d0e7c4556a2611dc4c&node=ap40.21.98_138.1&rgn=div9.

generation by multiplying each unit's ratio of maximum net electricity generation to maximum CO_2 emissions by the unit's reported CO_2 emissions in 2012. The calculation is:

$$MWh_{2012} = \left(\frac{MWh_{max}}{CO2_{max}}\right) \times CO2_{2012}$$

Where:

MWh_{2012} is the annual net electricity output produced by the EGU in MWh;

MWh_{max} is the maximum potential annual net electricity output produced by the EGU in MWh – calculated as nameplate capacity in MW X 8,784 hours[18] X a net:gross conversion factor (see Table 7);

$CO2_{2012}$ is the 2012 annual CO_2 emissions in metric tons reported to the EPA's Greenhouse Gas Reporting Program; and

$CO2_{max}$ is the maximum potential CO_2 emissions in metric tons – calculated as:

$$CO2_{max} = \frac{\left(F_c \times U_f \times MW_{CO2} \times HI_{max}\right)}{2205\ (\frac{lb}{metric\ ton})}$$

Where:

F_c is a carbon-based F-factor in standard cubic feet (scf) CO_2/mmBtu (see Table 8);

U_f is a conversion factor equal to 1/385 scf CO_2/lb-mole at 14.7 psia and 68° F;

MW_{CO2} is the molecular weight of CO_2, 44 lb/lb-mol; and

HI_{max} is the maximum potential annual heat input in mmBtu – calculated as:

$$HI_{max} = C \times \frac{1}{\eta_{pm}} \times 8{,}784h \times K$$

Where:

C is the nameplate capacity of the unit in MW;

η_{pm} is the electricity generating efficiency of the prime mover-fuel combination in percent[19] – calculated as 3.412 mmBtu/MWh[20] ÷ heat rate in mmBtu/MWh for the prime mover-fuel combination (see Table 9)[21]; and

K is a constant equal to 3.412 mmBtu/MWh, the energy value of 1 MWh.

[18] The number of possible operating hours in 2012.

[19] For information about calculating power plant efficiency, see EIA, Frequently Asked Questions: What is the efficiency of different types of power plants? Available at http://www.eia.gov/tools/faqs/faq.cfm?id=107&t=3.

[20] One MWh of electricity is equal to 3.412 mmBtu of energy.

[21] Heat rates are based on 2012 data from EIA, Electric Power Annual, Table 8.2: Average tested heat rates by prime mover and energy source 2007-2012. Available at http://www.eia.gov/electricity/annual/html/epa_08_02.html.

Table 7: Net:gross electricity generation factor (2012)

EGU type	Net:gross ratio
Coal ST	.9360
Oil ST	.9352
Natural gas CC	.9728

Table 8: Carbon-based F-factors (scf/mmBtu)

Fuel type	F_c
Coal (bituminous)	1800
Oil	1420
Natural gas	1040

Source: 40CFR Part 75 App. G §2.3

Table 9: Electric generating efficiency by prime mover type and fuel (2012)

EGU type	Heat rate (mmBtu/MWh)
Coal ST	10.107
Oil ST	10.359
Natural gas CC	7.615

Source: EIA, Electric Power Annual, Table 8.2: Average tested heat rates by prime mover and energy source 2007-2012. Available at http://www.eia.gov/electricity/annual/html/epa_08_02.html.

The unit-level data for Guam and Puerto Rico are in the supporting technical files to this TSD [see Excel workbook titled "Appendix 1, 2, & 3 – Tribal and Territory Unit-level Inventory, Goal Data and Computation, and Cost Calculations"].

For renewable energy, the available information indicate that generation from utility-scale, grid-connected renewable energy on Guam and Puerto Rico in 2012 was limited to hydroelectric energy in Puerto Rico (see Table 10). The total estimated annual technical potential (MWh) for solar PV and wind in Puerto Rico were developed using datasets for 40 km solar[22] and 70m wind[23] and methodologies generally consistent with the NREL report, "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis."[24] More specific information related to the methodologies for developing the datasets are available for 40 km solar[25] and 70m wind.[26] Other data sources include:

[22] National Renewable Energy Lab (NREL), 2003. Caribbean 40km Tilt Equals Latitude. Available at www.nrel.gov/gis/data/GIS_Data_Technology_Specific/International/Solar/Low_Resolution/Caribbean_40km_Tilt_Equals_Latitude.zip.

[23] National Renewable Energy Lab (NREL), 2009. Annual average modeled wind speed (m/s) for Puerto Rico and the Virgin Islands at a 70 meter hub height. Available at http://en.openei.org/datasets/dataset/annual-average-modeled-wind-speed-m-s-for-puerto-rico-and-the-virgin-islands-at-a-70-meter-hub-hei.

[24] Lopez, et al, 2012. U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis. Available at http://www.nrel.gov/docs/fy12osti/51946.pdf.

[25] Campbell-Howe & Wilkins-Crowder (eds), 1999. Proceedings of the Solar 99 Conference. Available at http://www.nrel.gov/gis/pdfs/proceedings_solar99.pdf.

[26] Elliot & Schwartz, 2005. Development and Validation of High-Resolution State Wind Resource Maps for the United States. Available at http://www.nrel.gov/docs/fy05osti/38127.pdf.

- Net generation by utility: Form EIA-861[27]
- Existing generation: EIA territorial profiles[28]

Table 10: Renewable energy net generation (MWh)

Territory	Renewables	2011 (MWh)	2012 (MWh)
Guam	Hydro	0	0
	Non-hydro	0	NA
Puerto Rico	Hydro	149,000	148,000
	Non-hydro	0	NA

Source: EIA, International Energy Statistics, Total Renewable Electricity Net Generation.

Data required for the calculation of building block 4 goals for territories and their sources are:

- 2012 electricity sales (MWh): Form EIA-861[29]
- 2012 energy efficiency incremental effects – total (MWh): Form EIA-861[30]

These data are inputs to the supporting technical files to this TSD:

- Option 1A: Building block 4 proposed goal based on each tribe/territory ramping up to 1.5% incremental savings with costs calculated using a 3% discount rate;
- Option 1B: Building block 4 proposed goal based on each tribe/territory ramping up to 1.5% incremental savings with costs calculated using a 7% discount rate;
- Option 2A: Building block 4 alternative goal based on each tribe/territory ramping up to 1.0% incremental savings with costs calculated using a 3% discount rate; and
- Option 2B: Building block 4 alternative goal based on each tribe/territory ramping up to 1.0% incremental savings with costs calculated using a 7% discount rate.

Table 11 summarizes data on 2012 electricity sales for the territories. None of the territories reported energy efficiency data on their Form EIA-861 submittals for 2012. Unlike the tribes and states, electricity sales projections are not available from the 2013 AEO reference case. EPA is not aware of another source for this information and, thus, is holding sales constant at their 2012 levels through the analysis period.

Table 11: 2012 total electricity sales for territories

Territory	Utility Number	Utility Name	Total Sales (MWh)
Guam	40428	Guam Power Authority	1,563,475
Puerto Rico	15497	Puerto Rico Electric Power Authority	18,150,330

[27] Available at http://www.eia.gov/electricity/data/eia861/ (see "operational data" workbook)
[28] Available at - http://www.eia.gov/state/analysis.cfm?sid=GQ and http://www.eia.gov/state/analysis.cfm?sid=RQ
[29] Available at http://www.eia.gov/electricity/data/eia861/ (see "retail sales").
[30] Available at http://www.eia.gov/electricity/data/eia861/ (see "dsm").

BSER factors informing territories' emission rate goals

As discussed in the section on BSER factors informing tribal lands' emission rate goals, the methodology for calculating emission rate goals generally applies the same approach to determining BSER as described in the *Goal Computation TSD* from the June 2014 proposed rule.

Building block 1 – heat rate improvement at coal-fired power plants

Using the data discussed above, the Agency applied a 6% heat rate improvement to the coal-fired EGUs in Puerto Rico. The Agency assumes that a 6% heat rate improvement at the facility with the coal-fired EGUs will directly translate to a 6% reduction in the net CO_2 emission rate. To calculate the alternative goal, the Agency applied a 4% heat rate improvement to the EGUs. The results from building block 1 are presented in Table 12.

Table 12: Adjusted average coal CO_2 emission rate for coal-fired EGUs

Territory	6% HRI Coal CO_2 rate (lbs/MWh)	4% HRI Coal CO_2 rate (lbs/MWh)
Puerto Rico	2,083	2,127

Building block 2 – redispatch to lower-emitting NGCC EGUs

In 2012, Puerto Rico had a one facility with two NGCC EGUs. Based on the Agency's calculations described above, the facility operated at approximately a 37% capacity factor. The *GHG Abatement Measures TSD*[31], suggests that the average availability of an NGCC is significantly greater than 70%. Because the NGCC EGUs in Puerto Rico use imported LNG, the Agency reviewed the capacity of the existing LNG port and gasifiers to ensure they would not constrain the ability of the EGUs to achieve a 70% capacity factor. Based on data available to the Agency, we believe the port has sufficient importing and processing capacity to supply LNG for the NGCCs to achieve a 70% capacity factor which offsets generation at both coal-fired ST EGUs and oil-fired ST EGUs.

Building block 3 – renewables

Because neither Guam nor Puerto Rico have utility-scale, grid-connected, non-hydroelectric renewable energy generation for 2012, the analysis of renewable energy using the proposed methodology from the June 2014 proposed rule resulted in no renewable energy targets, and, therefore, no change to the goals for these areas.

The second co-proposal option includes an adjustment to the proposed methodology that changes the amount of renewable energy in 2017 to be consistent with the lowest amount among the 50 states in 2012, which is 0.37% of the 2012 total electricity generation. EPA then applies the 9% annual growth factor through 2029. The 9% annual growth factor is based on Hawaii's historical growth in renewable energy generation between 2002 and 2012.

For Puerto Rico's renewable energy target based on the alternative approach, the Agency used estimates provided by DOE for wind and utility-scale solar PV (urban and rural) from available wind and solar resource data for the region. The wind resource data used are 70m hub height wind speed estimates

[31] See footnote 6.

modeled by AWS Truepower and NREL in 2008. The solar resource data used was produced by the NREL Climatological Solar Radiation model in 2007.

Consistent with the June 2014 proposed rule, the Agency also includes renewable energy targets for Puerto Rico with the inclusion of 2012 hydroelectric generation. These data are presented in the technical files to this TSD:

- Data file – Supplemental Proposed RE Method; and
- Data file – Supplemental Alternative RE Approach.

Building block 4 – energy efficiency

The analysis of energy efficiency for building block 4 used the proposed methodology from the June 2014 proposed rule.

APPENDIX 1 – TRIBAL AND TERRITORY UNIT-LEVEL INVENTORY

See "App 1 – Info", "App 1 – Guam", "App 1 – PR", and "App 1 – Tribes" worksheets in Excel workbook titled "Appendix 1, 2, & 3 – Tribal and Territory Unit-level Inventory, Goal Data and Computation, and Cost Calculations"

APPENDIX 2 – GOAL DATA AND COMPUTATION

See "App 2 – Goals option 1" and "App 2 – Goals option 2" worksheets in Excel workbook titled "Appendix 1, 2, & 3 – Tribal and Territory Unit-level Inventory, Goal Data and Computation, and Cost Calculations"

APPENDIX 3 – COST CALCULATIONS

See "App 3 – Cost info" and "App 3 – Cost analysis" worksheets in Excel workbook titled "Appendix 1, 2, & 3 – Tribal and Territory Unit-level Inventory, Goal Data and Computation, and Cost Calculations"

APPENDIX 4 – SUMMARY OF TRIBAL AND TERRITORY GOALS UNDER THE PROPOSED EXISTING SOURCE PERFORMANCE STANDARD

Proposed and alternate goals with approach A

The proposed goals and alternative goals are based on no non-hydro, grid-connected renewable energy in 2012.

Figure 4 - 1: Proposed goals (option 1) and alternate goals (option 2) with approach A for building block 3

Territory or tribal lands	Option 1 Interim goal (2020-2029)	Option 1 Final goal (2030 and after)	Option 2 Interim goal (2020-2024)	Option 2 Final goal (2025 and after)
Guam	1,733	1,586	1,854	1,794
Puerto Rico	1,470	1,413	1,542	1,521
Fort Mojave	856	855	857	857
Navajo	1,991	1,989	2,035	2,034
Ute	2,000	1,988	2,052	2,048

Co-proposed and alternate goals with approach B

The co-proposed goals and alternate co-proposed goals are based on the lowest amount of renewable energy among the 50 states in 2012 – 0.37%.

Figure 4 - 2: Co-proposed and alternate co-proposed goals with approach B for building block 3

Territory or tribal lands	Option 1 Interim goal (2020-2029)	Option 1 Final goal (2030 and after)	Option 2 Interim goal (2020-2024)	Option 2 Final goal (2025 and after)
Guam	1,708	1,556	1,831	1,768
Puerto Rico	1,459	1,399	1,533	1,510

Alternative goals

The alternative goals are based on the renewable energy technical potential.

Figure 4 - 3: Alternative goals using technical potential for building block 3

Territory or tribal lands	Interim goal (2020-2029)	Final goal (2030 and after)
Guam	1,733	1,586
Puerto Rico	1,452	1,397

APPENDIX 5 – 2012 EMISSION RATE AND BUILDING BLOCK APPLICATION

Proposed goals

The proposed goals (option 1 approach A) are based on no non-hydro, grid-connected renewable energy in 2012.

Territory or tribal lands	2012 fossil rate	Building block 1	Building blocks 1 & 2	Building blocks 1, 2 & 3	Building blocks 1, 2, 3, & 4 (final goal)
Guam	1,948	1,948	1,948	1,948	1,586
Puerto Rico	1,901	1,678	1,546	1,546	1,413
Fort Mojave	858	858	858	858	855
Navajo	2,121	1,993	1,993	1,993	1,989
Ute	2,145	2,016	2,016	2,016	1,988