Public Comment Webinar

Mexico Boiler Efficiency Project Protocol

CLIMATE
ACTION
RESERVE

July 20th, 2016

This protocol development effort has been supported by generous funding from our partners:

Recommendations and other opinions in this slide deck, however, do not necessarily reflect the opinion of project partners, but rather, are subject to further change pending further workgroup discussion.

Agenda

- Welcome & Review of Agenda
- Eligible Project Activities
- Eligibility Issues
- GHG Assessment Boundary: Sources, Sinks, & Reservoirs
- Quantification
- Monitoring, Reporting, & Verification (MRV)
- Next Steps
- Questions?

PROJECT LIFECYCLE

CLIMATE ACTION RESERVE

PLANNING	• Feasibility assessment • Review project definition, eligible project equipment & activities, as well as other eligibility criteria
SUBMITTAL, LISTING & IMPLEMENTATION	• Open a Reserve account • Submit a Project Submittal Form to “List” the project • Implement Project Activity
MONITORING & QUANTIFICATION	• Collect data; perform ongoing QA/QC • Complete quantification and monitoring plan
VERIFICATION	• Contract with approved verification body (VB) • VB conducts desk review and site visit
REGISTRATION	• Reserve staff review and approve verification report • CRTs issued to account holder
SALES	• CRTs may be transferred to the buyers account

REPEAT

PROJECT DEFINITION & ELIGIBLE PROJECT ACTIVITIES (SECTION 2)

Project Definition (Section 2.2)

The GHG reduction project is defined as the implementation of eligible project activities at an eligible boiler or group of eligible boilers, located at a single facility or project site.

- Eligible boiler equipment is defined in Section 2.2.1
  - Boilers must have a rated capacity of 9.8 MW (33.5 MMBtu/h) or greater to be eligible under this protocol
  - A boiler is defined as a closed vessel or arrangement of vessels and tubes and a heat source, in which water is heated to produce steam to drive turbines or engines, generate power, or drive other industrial process applications (Full definition in Section 2.2.1)
- Eligible project activities are defined in Section 2.2.2

Eligible Project Activities (Section 2.2.2)

- Retrofitting existing boilers
  - Eligible
- Installing new high-efficiency boilers
  - Eligible but with some restrictions

- Fuel switching
  - Allowable to take place simultaneous to project
  - However, not an eligible project activity (will not receive CRTs)

Eligible Project Activities (Section 2.2.2)

Retrofitting existing boilers.

The project retrofits an existing boiler, installing one or more new efficiency improvement technologies to the existing boiler.

Eligible Project Activities (Section 2.2.2)

Installing new high-efficiency boilers. The project installs a new boiler that demonstrates greater efficiency than conventional alternatives.

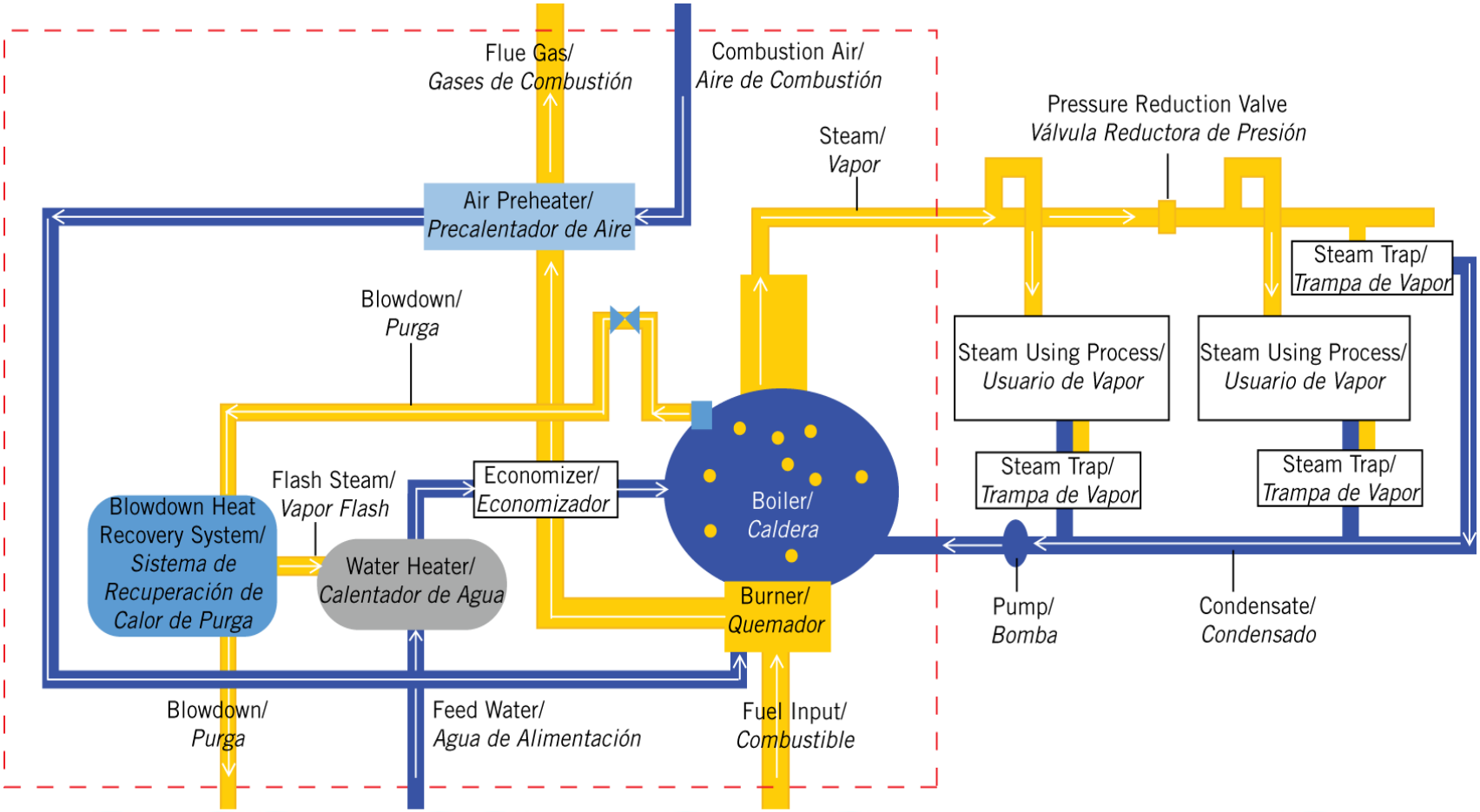
- Existing boiler (that is replaced):
  - Must not exceed 35 years of age (discussed in section 3.4.1 re PST)
    - Older boilers still eligible as retrofit project
  - May be retired or dismantled and sold for parts
  - May not be used to facilitate a capacity expansion at the project site or facility. Must demonstrate to verifier

Eligible Project Activities (Section 2.2.2)

Fuel switching.

- Allowable to take place simultaneous to other eligible project activities
- However, not an eligible project activity (will not receive CRTs)
- Assumption that numerous factors in Mexico are already driving desire to switch fuels
- In quantification of emission reductions, baseline higher heating value must be used for both Project and Baseline

Project Boundary Diagram (Figure 2.1)



ELIGIBILITY RULES
(SECTION 3)

Eligibility Rules (Section 3)

3.1 Location = in Mexico

3.2 Start Date

- Defined as the date the boiler with improved efficiency and the associated steam generation system becomes operational (i.e., resumes or enters operation and begins generating outputs such as steam) following an initial start-up period of up to 6 months
- Project start date is selected by the project developer within the 6 month start-up period after the date in which the system consumes energy for the first time after the implementation of the project

Eligibility Rules (Section 3)

3.3 Crediting Period

- Projects get a single 10 year crediting period

3.4.2 Legal Requirement Test

- Project activities may not be legally required
- Research performed by the Reserve and summarized in Appendix B confirms this

3.5 Regulatory Compliance

- Projects must be in compliance with all laws at all times during the reporting period

PERFORMANCE STANDARD

(SECTION 3.4.1)

Performance Standard (Section 3.4.1)

- Projects pass the Performance Standard Test (PST) by meeting a performance threshold, i.e. a standard of performance applicable to all boiler efficiency projects that screens out non-additional projects
- The performance threshold represents a level of energy efficiency that is beyond business-as-usual compared to existing boilers
- The performance standard is designed to be part of the eligibility criteria of the protocol: if a project meets the performance standard, it is automatically considered additional and eligible (so long as other eligibility criteria are met)

Performance Standard (Section 3.4.1) How do we develop one?

- Instead of project-specific assessments of additionality, the Reserve evaluates significant amounts of data on common practice or Business-As-Usual (BAU) practices in a given sector, up front, to develop these performance standards
- Standards are specified such that the incentives created by the carbon market are likely to have played a critical role in decisions to implement projects that meet the performance standard
- In its analysis, the Reserve considers financial, economic, social, and technological drivers or barriers that may affect decisions to undertake a particular project activity
- Access to data is critical for the success of this process and has been an ongoing challenge to overcome for this protocol

DATA ANALYSIS

Data Analysis: Developing the PST

Existing steam boiler data Mexico:

- No public / official data on boiler efficiency
- Dated / limited previous surveys

Engaged in primary data gathering

- Confidentiality
- No standard industry for record keeping
- Limited time / budget
- Need representative sample

Data Analysis: Developing the PST

Boiler data request:

- Nominal capacity
- Year built / installed
- Most recent assessed efficiency
- Generated steam spec's
- Type of fuel
- Fuel consumption (last three years)
- Heat recovery equipment

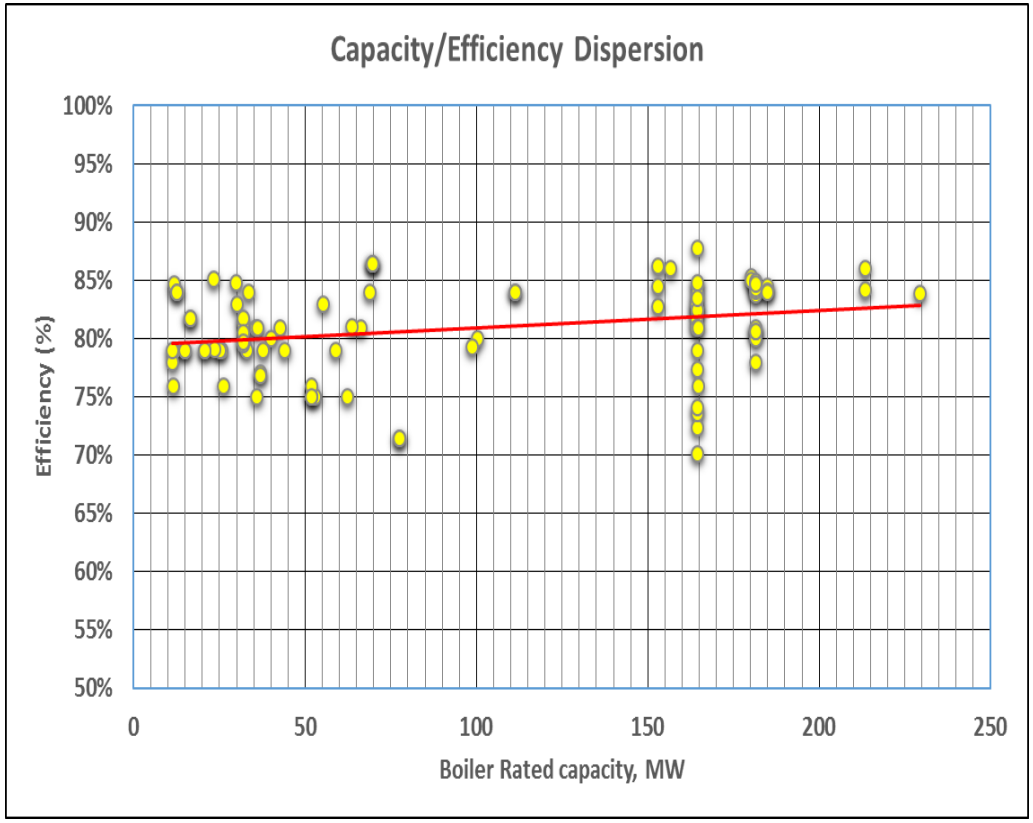
Data Analysis: Summary of Results

Data analysis overall results:

- Data from 125 boilers/29 companies
  - Capacities: 1.4 – 229.4 MW
- Data from 115 boilers within the eligible capacity ranges
- Efficiency data from 107 eligible boilers
  - However efficiencies of biomass-fueled boilers are excluded from this analysis, reducing the number of boilers analyzed to 96
- Multiple analyses were performed examining efficiencies by fuel type, capacity, inclusion of specific energy efficiency technology, etc. The following results are specific to these 96 eligible boilers burning conventional fuels

Data Analysis: Developing the PST

- Efficiency ranges 69.2% to 87.2%
- Trend line: higher capacity = higher efficiency
- Total population estimate: 2900 boilers
- Total sample: 96 boilers
- Confidence interval of 9.84 at 95% confidence level



Data Analysis: Summary of Results

Data quality note:

- Data from operation and maintenance internal records
- It is estimated all but efficiency data have very low uncertainty levels
- Efficiency data coming from direct gas analysis devices measurements / maintenance records when performed by service companies
- Estimated uncertainty for efficiency measurements y 2%
- Efficiency reported values deemed as conservative

Data Analysis: Summary of Results

Data analysis (boiler age):

- Boiler ages for the sample range from < 1 to 69 years
- Average boiler age for sample = 30 years
- No standard age of retirement or legally required retirement age exists for boilers in Mexico

Data Analysis: Summary of Results

Data analysis (boiler age):

- Assumption that boilers equal to or greater than 35 years old will be replaced under business as usual. Therefore they should not get credits for doing so
  - Conservative assumption to minimize non-additional crediting
  - This assumption is applied as a maximum age for existing boilers that would be replaced in the “new boiler” project type
  - There is no maximum age for a boiler applying for crediting of a retrofit project

Performance Standard (Section 3.4.1)

Performance Standard for all projects: Applied to the existing boiler once the project activities have been implemented.

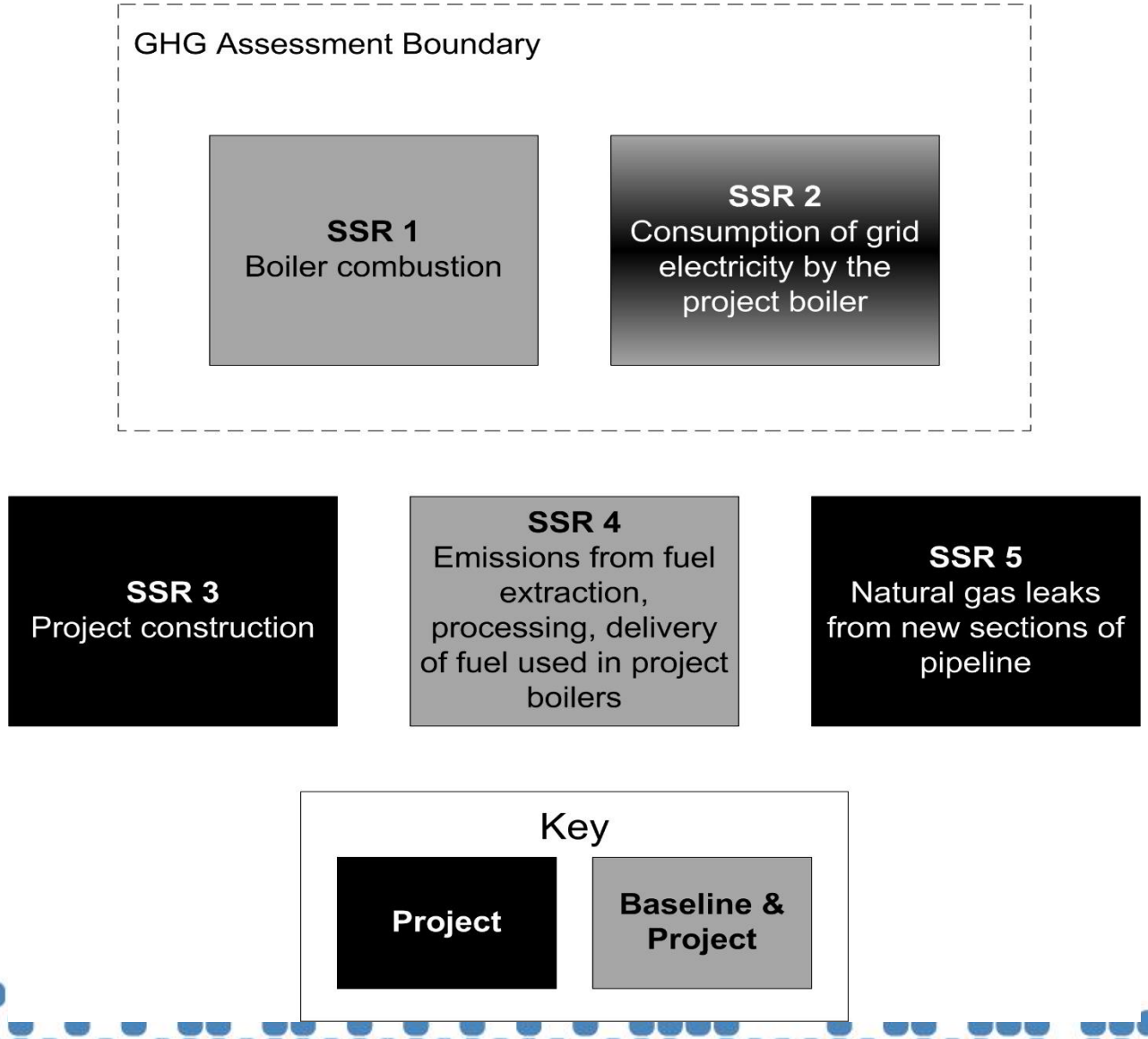
Boiler Capacity	Performance Threshold
Boilers 9.8 to 100 MW (33.5 –341.4 MMBtu/h)	80.5%
Boilers 100 MW or greater (>341.4 MMBtu/h)	82%

Additional Performance Standard for new boiler projects: Maximum age of existing boiler (to-be-replaced) = 35 years

THE GHG ASSESSMENT BOUNDARY

(SECTION 4)

GHG Assessment Boundary Diagram (Fig. 4.1)



NOTE:
In final protocol, SSR 2 will be more clearly designated as an SSR that is:

Required if GHGs increase

OR

Optional if GHGs decrease

Description of all Sources, Sinks, and Reservoirs (Table 4.1)

SSR	Source Description	GHG	Included (I) or Excluded (E)	Baseline (B) or Project (P)	Justification/Explanation
1 Boiler combustion	Emissions from fuel combustion at boiler + subcomponents	CO_2	I	B, P	CO_2 - Primary emission reductions opportunity for the project activities CH_4/N_2O – Conservative to exclude
		CH_4	E		
		N_2O	E		
2 Consumption of grid electricity by the project boiler	Indirect emissions from grid electricity consumption	CO_2	I (when GHGs increase) O (when GHGs decrease)	B, P	Expected to make up a small portion of total emissions from a single boiler, in most cases. Must quantify if there is an increase.
3 Project construction	Project construction & decommissioning	CO_2 CH_4 N_2O	E	P	Negligible – therefore excluded
4 Emissions from fuel extraction, processing, delivery of fuel used in project boilers	Facilities where fuel used undergoes extraction, processing and delivery	CO_2 CH_4 N_2O	E	B, P	Negligible – therefore excluded
5 Natural gas leaks from new sections of pipeline	Natural gas leaks from NG pipeline installed for the project	CH_4	E	P	NG switch not credited – therefore excluded

QUANTIFICATION OF EMISSIONS & EMISSION REDUCTIONS (SECTION 5)

Quantification (Section 5)

- Organized as a step-by-step inductive procedure to guide required calculations
- Basic equation driving development of proposed quantification method:

$$ER = BE - PE$$

Where:

ER = Emission reductions

BE = Baseline emissions

PE = Project emissions

Quantification (Section 5)

- Emissions generation mechanisms
- Baseline hypothesis
- Outstanding methodological references
  - Codes and Standards (e.g., ASME PTC 4, BS 845)
  - Similar methodologies (e.g., CDM)
  - Available tools (e.g. CONUEE boiler efficiency tool)
- Key issues worth noting:
  - Mechanism to allow for fuel switch without crediting:
    - If fuel switch to lower carbon intensity fuel, Baseline Higher Heating Value (HHV) is used for both Baseline and Project scenario
  - Options for calculating boiler fuel efficiency: Indirect method vs. direct method
  - Electricity emissions (Optional, unless emissions increase)

$ER = BE - PE$
Equation 5.1
Emission reductions

Methodological Flow

Calculations flow

Baseline Emissions

BE
Equation 5.2
Total baseline GHG emissions

FE_B
Equation 5.3
Fuel emissions

$FE_{B,i}$
Equation 5.4
Fuel energy input from fuel i

η_B
Equation 5.5
Boiler fuel efficiency (direct method)

or

η_B
Equation 5.8
Boiler fuel efficiency (indirect method)

BEO
Equation 5.6
Boiler energy absorbed by steam output streams

BEL
Equation 5.9
Boiler energy losses

BEI
Equation 5.7
Boiler energy supplied by fuel streams

BEC
Equation 5.10
Boiler energy credits

EE_B
Equation 5.11
Electricity emissions

PC_B
Equation 5.12
Electric power consumption

ECI_B
Equation 5.13
Electric power consumption index

ECI_y
Equation 5.14
Electric power consumption index for reporting period y

Project Emissions

PE
Equation 5.15
Total project GHG emissions

$FE_{P,y}$
Equation 5.16
Fuel emissions for project year y

$FE_{P,i,y}$
Equation 5.17
Fuel energy input from fuel i for project year y

$\eta_{P,y}$
Equation 5.18
Boiler fuel efficiency for project year y (direct method)

or

$\eta_{P,y}$
Equation 5.21
Boiler fuel efficiency for reporting period y (indirect method)

PEO_y
Equation 5.19
Boiler energy absorbed by steam output streams in reporting period y

PEL_y
Equation 5.22
Boiler energy losses in reporting period y

PEI_y
Equation 5.20
Boiler energy supplied by fuel streams in reporting period y

PEC_y
Equation 5.23
Boiler energy credits in reporting period y

$EE_{P,y}$
Equation 5.24
Electricity emissions

Quantification (Section 5)

Direct vs. Indirect methods to calculate boiler fuel efficiency

Equation 5.5. Calculating Baseline Boiler Fuel Efficiency (Direct / Input-Output Method)

$$\eta_B = \frac{BEO}{BEI} \times 100$$

Where,

			Units
η_B	=	Baseline boiler fuel efficiency	%
BEO	=	Baseline boiler energy absorbed by steam output streams (as calculated in Equation 5.6)	TJ
BEI	=	Baseline boiler energy supplied by fuel streams (as calculated in Equation 5.7)	TJ

Equation 5.8. Calculating Baseline Boiler Fuel Efficiency (Indirect / Energy Balance Method)

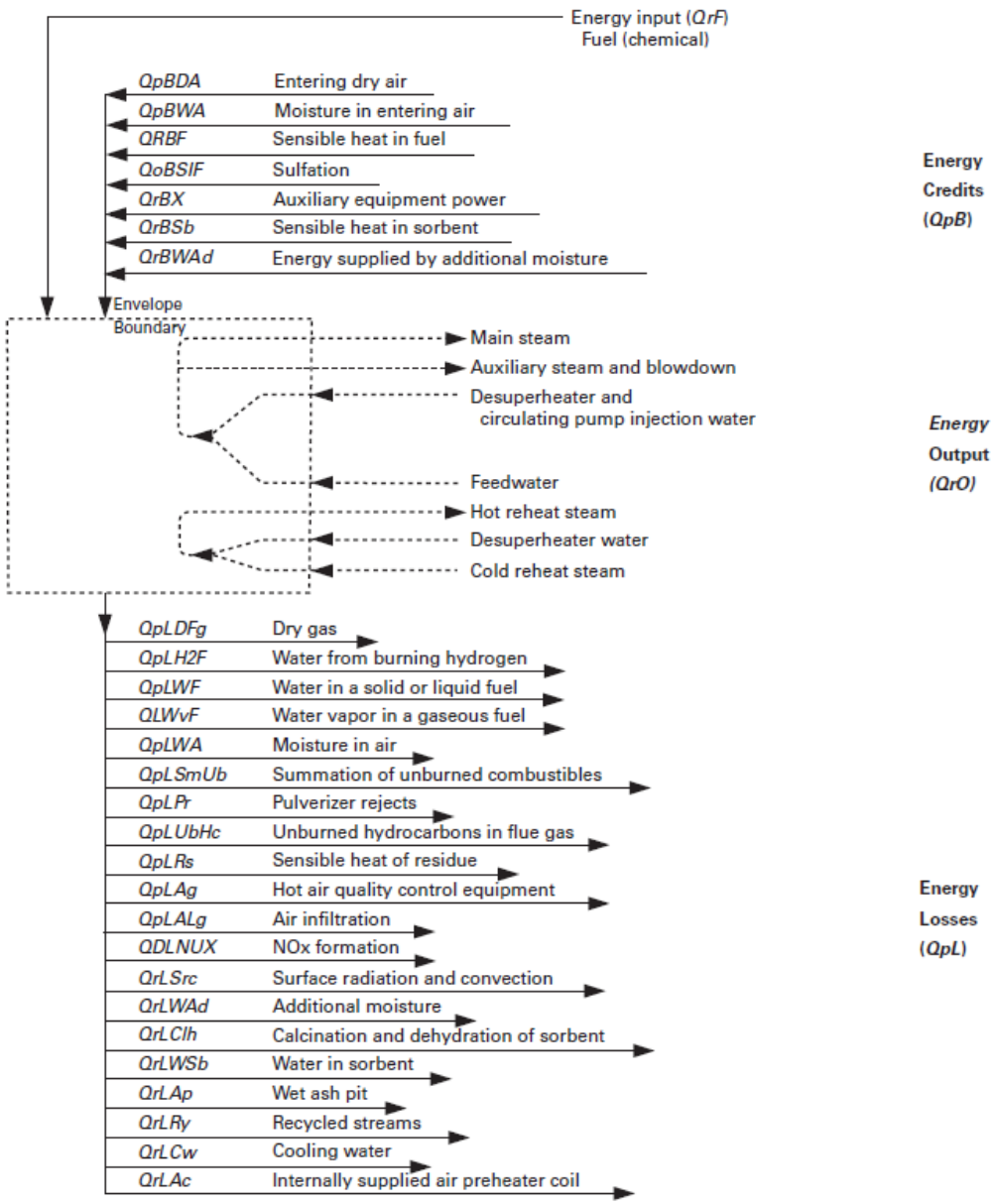
$$\eta_B = \frac{(BEI - BEL + BEC)}{BEI} \times 100$$

Where,

			Units
η_B	=	Baseline boiler fuel efficiency	%
BEI	=	Baseline boiler energy supplied by fuel streams (as calculated in Equation 5.7)	TJ
BEL	=	Baseline boiler energy losses (as calculated in Equation 5.9)	TJ
BEC	=	Baseline boiler energy credits (as calculated in Equation 5.10)	TJ

Quantification (Section 5)

Basic boiler energy balance:



Energy Balance:

OUTPUT = INPUT - LOSSES + CREDITS

QrO = QrF - QrL + QrB

QpL = 100 × (*QrL* / *QrF*), %

QpB = 100 × (*QrB* / *QrF*), %

Fuel efficiency (%) = *EF* (%) = 100 × *Output–Input* = 100 - *QpL* + *QpB*

Quantification (Section 5)

Boiler efficiency approach choice:

Efficiency Approach	Advantages	Disadvantages
Direct (Input-Output) Method	• Direct measurement of primary parameters • Fewer measurements and calculations • No unmeasurable losses estimation required	• Uncertainty highly affected by primary parameter measurement accuracy • Does not allow for efficiency corrections • No identification of loss sources
Indirect (Energy Balance) Method	• Accurate measurement of primary parameters • Reduced uncertainty • Errors in secondary data minimal • Identification of loss sources • Allows for efficiency corrections	• Incremented monitoring requirements • Some unmeasurable losses must be estimated • Does not yield automatic capacity/output data

CONUEE Boiler Efficiency Tool

- CONUEE developed a tool intended for general industry use in 2002
- Tool is a simplified version of ASME PTC 4.1
- Currently being updated and complemented (joint effort)
  - Based on ASME PTC 4-2013
  - More featured calculations, suitable for all kinds of boiler systems
  - Choice of direct / indirect method
  - Includes default values and reference data and HV calculation tool
  - User-friendly platform to be developed

Quantification (Section 5)

Electricity Emissions calculation considerations:

- **Required**: All projects must account for material increases in grid electricity consumption due to project
  - No quantification necessary if can demonstrate to verifier that no material increase expected
- **Optional**: PDs may include accounting for project reduction of grid electricity consumption
  - If quantifying a reduction, must include monitoring in Baseline & Project

MONITORING, REPORTING & VERIFICATION REQUIREMENTS

(SECTIONS 6, 7 & 8)

Monitoring Requirements (Section 6)

- Much depends on data available to Project Developers – as well as tools and methods for quantification
- Need Monitoring Plan – outlining all monitoring / reporting activities required for project
  - Specifies how data will be collected & recorded; how frequently
  - Quality Assurance/Quality Control (QA/QC) provisions for equipment
    - Frequency of instrument maintenance – calibration – qualifications of persons working on/with such equipment

Monitoring Requirements (Section 6)

Critical parameters to be measured dependent on efficiency determination approach:

- Direct method:
  - Steam flow, pressure and temperature
  - Fuel flow and Heating Value
- Indirect method:
  - Flue gas analysis and temperature

Monitoring Requirements (Section 6)

Key Considerations

- Accuracy vs. cost, defaults vs. measuring
- Measurement practicality
- Recorded and supplier information
- Monitoring frequency
- Data substitution management

Reporting (Section 7)

Reporting requirements standardized for consistency / transparency

- Emission reductions must be reported and verified annually at minimum
- Record keeping of data: Project developers are required to maintain records for verification purposes (but much this data does not need to be reported to the Reserve, just with the verifier)
  - Must keep all primary data – not just monthly summaries
  - Copies of all permits – correspondence with regulators, etc.
  - Fuel / electricity use records, etc.
- Standard reporting documentation used at project submittal and each reporting period when seeking issuance of credits
- Joint project reporting & verification allowed where multiple projects are located at a single project site or facility. Provides economies of scale

Verification (Section 8)

Provides guidance for the verifier and project developer on best practices for how to verify the boiler efficiency project

- Guidelines for verifying eligibility criteria, quantification, records, monitoring plan, and where a verifier may use professional judgement
- Site visit requirements
- Guidelines for joint verifications (verification of multiple projects at a single site – economies of scale
- Currently, verifiers required to be accredited with ANSI and the Reserve. (In future, may expand to allow verifiers accredited with EMA (not just ANSI))
- Verification requirements must balance high cost / highly accurate measurements that might provide “absolute” assurance vs. sufficient evidence to verify to “reasonable” level of assurance
  - Are there tools or methods that might reduce cost / improve efficiency?
  - Use of CONUEE Tool, for example, might ease verification

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REPEAT

Protocol Development Timeline

Milestone/Task	Timeline
Deadline for all public comments	August 1, 2016, 5 pm PDT
Reserve responds to public comments and finalizes protocol for presentation to Reserve Board	August 15, 2016
Protocol Presented to Reserve Board for Adoption	October 19, 2016

Next Steps

- Please provide written comments on the draft protocol no later than August 1st at 5pm PDT.
  - The Reserve will respond to all public comments, and both the comments and the Reserve's response will be made available to the general public
- We are planning to finalize the protocol for consideration by the Reserve Board of Directors by August 15.
  - Changes made will be based on public stakeholder and WG comments
- Projects may be submitted once the Board of Directors adopts the Protocol (which is anticipated at their meeting October 19)

Questions?

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Thank you!! Gracias!!

http://www.climateactionreserve.org/how/protocols/mexico-boiler-efficiency