

# Energy Facility Siting Council

## 2018 Rulemaking Carbon Dioxide (CO<sub>2</sub>) Standards, Phase Two: Updates to CO<sub>2</sub> Standards

Rulemaking Advisory Committee (RAC)  
Meeting #3

May 15, 2018  
10 a.m. -12 p.m.

Jason Sierman, Energy Policy Analyst  
Blake Shelide, Facilities Engineer  
Lesley Jantarasami, Climate Policy Analyst



# Today's Agenda

## Review and hear input on:

- 1) Staff's preliminary findings for most efficient CCCT power plant operating in U.S.;
- 2) Staff's analysis of the 13 Principles under 345-024-0510; and
- 3) Staff's analysis of the fiscal impacts of this rulemaking project.

## Next steps

## Public input from non-RAC members

# Applicability of New Standards

New standards would be applicable to:

- Unbuilt fossil-fueled energy facilities receiving a site certificate after the effective date of the rulemaking.
- Unbuilt fossil-fueled energy facilities receiving an amendment to a site certificate to extend its construction deadlines after the effective date of the rulemaking.
- Built or unbuilt fossil-fueled energy facilities receiving an amendment to a site certificate after the effective date of the rulemaking that adds new CO<sub>2</sub> emitting equipment or alters the operation of existing CO<sub>2</sub> emitting equipment included in the original site certificate.
- Facilities with express terms and conditions in its site certificate that require the application of new CO<sub>2</sub> standards under certain scenarios.

# 3 Categories of CO<sub>2</sub> Standards

Standards regulate CO<sub>2</sub> emissions from 3 types of energy facilities:

## 1) Base Load Gas Plants Standard

- Base Load w/ Power Augmentation (i.e. Duct Firing)

## 2) Non-Base Load Power Plants Standard

- Regulates Power Augmentation Component

## 3) Nongenerating Energy Facilities Standard

# Review of Preliminary Findings

# Evaluation Process

|   | <b><u>Status</u></b>     |
|---|--------------------------|
| 1) Staff shares preliminary findings of search for most efficient natural gas-fired power plant operating in U.S. <ul style="list-style-type: none"><li>• Statutory authority to modify CO<sub>2</sub> standards, <i>see ORS 469.503(2)(a)</i></li></ul>  | <b><i>Complete</i></b>   |
| 2) Staff conducts preliminary analysis of 13 principles listed under ORS 469.503(2)(b) and OAR 345-024-0510.  | <b><i>Complete</i></b>   |
| 3) Staff asks RAC to vet preliminary findings, analysis of 13 principles and fiscal impact statement. <ul style="list-style-type: none"><li>• After receiving RAC input, staff may identify new or different heat rate than what staff initially identified.</li></ul>  | <b><i>In Process</i></b> |
| 4) Staff presents Council with a summary of staff's evaluation and a summary of the input received from the RAC. <ul style="list-style-type: none"><li>• Staff's presentation may include a recommendation that the existing CO<sub>2</sub> standards be modified, and recommendations as to what they should be modified to.</li></ul> | <b><i>Next Steps</i></b> |

# Efficiency, Heat Rate, and the Standards

|                 | A = 3,412 / B                             | B                      | C  | D = B x C  | E = D x 0.83  |
|-----------------|---|------------------------|--|--|---|
|                 | Efficiency<br>(energy out /<br>energy in) | Heat Rate<br>(BTU/kWh) | Conversion<br>Factor*<br>(lbs. CO <sub>2</sub> /BTU) | Emissions<br>Rate<br>(lbs. CO <sub>2</sub> /kWh) | -17% Reduction<br>Emissions Std.<br>(lbs. CO <sub>2</sub> /kWh) |
| Perfect World   | 100%                                      | 3,412                  | 0.000117   | 0.3992   | 0.331   |
| 1997 Statute    | 47%                                       | 7,200                  | 0.000117   | 0.8424   | 0.70  |
| 2000 Rulemaking | 49%                                       | 6,955                  | 0.000117   | 0.8137   | 0.675   |
| 2018 Rulemaking | ??  | ????                   | <b>0.000117</b>                                      | ????   | ????  |

\*Conversion factor of 117 lbs. CO<sub>2</sub> per MMBtu set in rule and statute. ORS 469.503(2)(e)(J) and OAR 345-001-0010(38)(c), 345-021-0010(1)(y)(N)(vii), and 345-024-0620(1).

# Heat Rate Research

- Staff recognized the difference between various measurements and statements of “heat rate”
- Variables include:
  - 1) Net vs. gross heat rate
  - 2) LHV (Lower Heating Value) vs. HHV (Higher Heating Value)
  - 3) Conditions (temperature, pressure, humidity)
  - 4) Capacity factor
  - 5) Manufacturer’s specified heat rate
  - 6) Field tested heat rate (commissioning, performance guarantee)
  - 7) Annual operating heat rate

# ISO Conditions

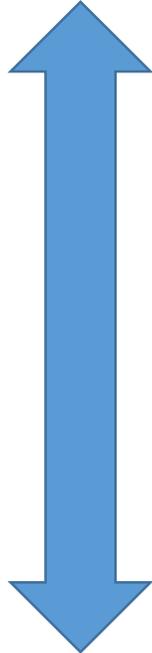
- Efficiency of a turbine is dependent on operating conditions.
- For like-to-like comparisons, it is necessary to specify standard conditions to which tested heat rates can be corrected.
- ISO conditions are specified in ISO-Standard 3977, and are generally:
  - 1) Temperature = 59°F (15°C)
  - 2) Pressure = 1 atm/14.7 psia
  - 3) Humidity = 60% RH
  - 4) Inlet/outlet pressure conditions
  - 5) 100% rated load
- Manufacturers provide correction factors for heat rates tested at non-ISO conditions.

# Heat Rate Research

- Many variables of the heat rate the Council must find are set in statute:
  - 1) Gross heat rate vs. Net heat rate
  - 2) LHV vs. HHV
  - 3) Conditions: ISO: Temp = 59°F, Press. = 1 atm/14.7 psia, Humidity = 60% RH
  - 4) Capacity factor: Base load (100% full power)
- Ambiguity about what type of heat rate the Council must find:
  - 1) Manufacturer's spec heat rate,
  - 2) Field tested heat rate, or
  - 3) Annual operating heat rate

# Same CCCT, Different Heat Rates

Heat rates from the same CCCT can be measured in different ways

| Type of Heat Rate  | Hypothetical Example | Efficiency  | EFSC Phase                                       |
|--|----------------------|---|--|
| <b>Manufacturer's Spec</b><br>(Generic gas turbine/steam turbine configurations)   | 5800                 |  <p>Highest</p> <p>Lowest</p> | Application<br>(Est. of funds for EFSC approval) |
| <b>Designed</b><br>(Project specific configuration)  | 5900                 |   | Construction<br>(Funds paid to TCT)              |
| <b>Field Tested</b><br>(Upon plant commissioning, part of performance guarantee, or similar. Follows test procedure and adjusted to ISO) | 6100                 |   | Operating<br>(Year 1 Heat Rate True Up)          |
| <b>Operating</b><br>(“Real” annual fuel consumption and net generation)  | 6400                 |   | n/a<br>(No Heat Rate True Up after Year 1)       |

# Heat Rate Research

- Statute specifies:
  - “Most efficient” CCCT plant that is “commercially demonstrated and operating in the United States”
  - Newly constructed plants are measured on a “new and clean basis”
  - Adjustment to ISO conditions

# Heat Rate Research

So when we look at the 3 main type of heat rate:

| Type of Heat Rate                    | Determination   | Rationale  |
|--------------------------------------|---|--|
| <b>Manufacturer's Spec Heat Rate</b> |    | <ul style="list-style-type: none"><li>• Not “commercially demonstrated and operating”</li><li>• Does not match type of heat rate used to determine a newly sited facility's required offsets for compliance</li></ul>  |
| <b>Field Tested Heat Rate</b>        |   | <ul style="list-style-type: none"><li>• Matches with category of field tested heat rate used to determine a newly sited facility's required offsets for compliance</li><li>• Also reasonable since it serves as a midpoint between other heat rates</li></ul>          |
| <b>Annual Operating Heat Rate</b>    |  | <ul style="list-style-type: none"><li>• Not adjusted to ISO conditions, this number simply represents average annual “real” conditions</li><li>• Does not match type of heat rate used to determine a newly sited facility's required offsets for compliance</li></ul> |

# Preliminary Findings

| Plant                            | Owner                                 | State     | Nominal Capacity (MW) | Tested Heat Rate (Btu/kWh) | Date of Test         |
|----------------------------------|---------------------------------------|-----------|-----------------------|----------------------------|----------------------|
| Port Everglades                  | Florida Power Light                   | FL        | 1,237                 | 6,238                      | n/a                  |
| Cape Canaveral                   | Florida Power Light                   | FL        | 1,210                 | 6,314                      | n/a                  |
| <b>Grand River Energy Center</b> | <b>Grand River Dam Authority</b>      | <b>OK</b> | <b>505</b>            | <b>6,333*</b>              | <b>July 6-7 2017</b> |
| Riviera Beach                    | Florida Power Light                   | FL        | 1,212                 | 6,393                      | n/a                  |
| Carty – Unit 1                   | Portland General Electric             | OR        | 397                   | 6,639                      | 11/11/16             |
| Cosumnes                         | Sacramento Municipal Utility District | CA        | 519                   | 6,718                      | 11/18/16             |

\*Confirmed by plant performance report. ODOE is working to ensure adjustment to ISO conditions.

# Preliminary Findings

## Grand River Energy Center

|   |                           |
|---|---------------------------|
| <b>Owner</b>  | Grand River Dam Authority |
| <b>Location</b>   | Chouteau, OK              |
| <b>First Year of Commercial Operation</b>   | 2017                      |
| <b>Approx. Cost</b>   | \$ 296 MM                 |
| <b>Turbine Make &amp; Model</b>   | Mitsubishi Hitachi 501J   |
| <b>Nominal Capacity</b>   | 505 MW                    |
| <b>Tested HHV Net Heat Rate (adjusted to ISO conditions)</b>  | <b>6,333* Btu/kWh</b>     |
| <a href="http://www.grda.com/electric/facilities/grand-river-energy-center/">http://www.grda.com/electric/facilities/grand-river-energy-center/</a> |                           |

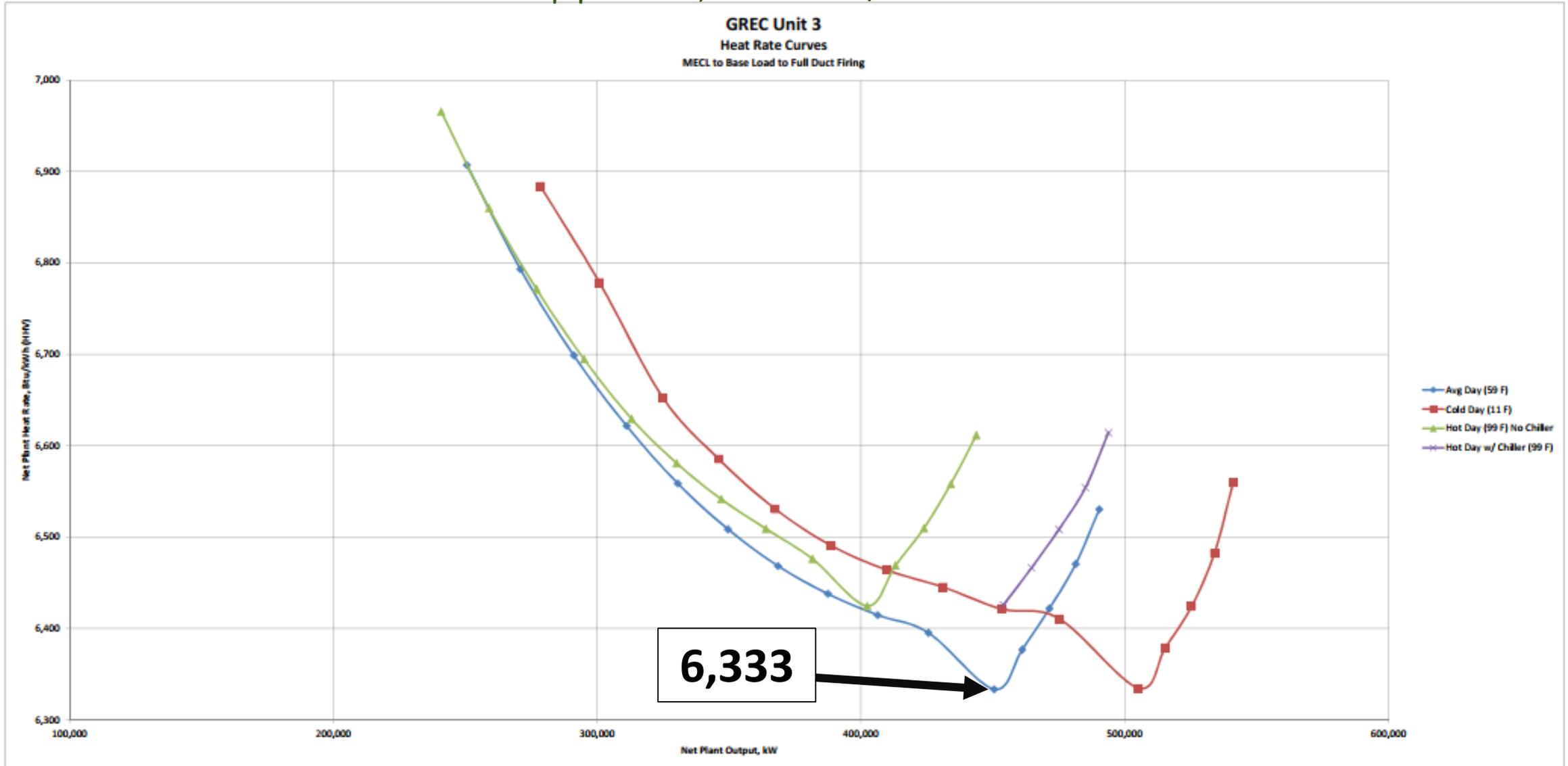


Photo courtesy of GRDA webpage (link in table).

\*Confirmed by plant performance report. ODOE is working to ensure adjustment to ISO conditions.

# Preliminary Findings

- Initial curve received to support 6,333 Btu/kWh HHV



# Preliminary Findings

- Results from GRDA's Grand River Energy Center - Unit 3 Final Performance Test Report, 10/25/2017:

| Parameter                     | Units       | Guarantee | Measured Test Results | Corrected Test Results | Margin | Pass / Fail |
|-------------------------------|-------------|-----------|-----------------------|------------------------|--------|-------------|
| Unfired Net Electrical Output | kW          | 449,960   | 444,232               | 450,521                | 561    | Pass        |
| Unfired Net Heat Rate         | Btu/kWh LHV | 5,723     | 5,800.1               | 5,714.4                | 8.6    | Pass        |

- Test results are reported as LHV and corrected to plant design conditions
- LHV test results convert to approximately **6,337 Btu/kWh HHV** (in line with previously provided HHV heat rate of 6,333 Btu/kWh)
- **Final step:** ODOE working with GRDA & MHPS to ensure correction back to ISO conditions. Plant design was at ISO temperature, but looking at small adjustments to other ISO parameters (humidity, pressure)

# Group Discussion of Preliminary Findings

# Review of 13 Principles Under 345-024-0510

# 13 Principles Under 345-024-0510

*In amending CO2 emissions standards, the Council shall consider and balance at least the following principles. In the rulemaking record, the Council shall include findings on these principles:*

- 1) Promote fuel efficiency;
- 2) Promote efficiency in the resource mix;
- 3) Reduce net carbon dioxide emissions;
- 4) Promote cogeneration that reduces net carbon dioxide emissions;
- 5) Promote innovative technologies and creative approaches to mitigating reducing or avoiding carbon dioxide emissions;
- 6) Minimize transaction costs;

# 13 Principles Under 345-024-0510

- 7) Include an alternative process that separates decisions on the form and implementation of offsets from the final decision on granting a site certificate;
- 8) Allow either the applicant or third parties to implement offsets;
- 9) **Be attainable and economically achievable for various types of power plants;**
- 10) Promote public participation in the selection and review of offsets;
- 11) Promote prompt implementation of offset projects;
- 12) Provide for monitoring and evaluation of the performance of offsets;
- 13) Promote reliability of the regional electric system.

# Group Discussion of 13 Principles Under 345-024-0510

# Review of Fiscal Impact Statement

# Fiscal Impact Statement

## ORS 183.333 - (paraphrased summary)

- (3) The agency shall seek the RAC's recommendations on whether the rule will have a fiscal impact, what the extent of that impact will be and whether the rule will have a significant adverse impact on small businesses.
- (4) An agency shall consider an advisory committee's recommendations provided under subsection (3) in preparing the statement of fiscal impact required by ORS 183.335(2)(b)(E).

# Fiscal Impact Statement

## ORS 183.335(2)(b)(E) - (paraphrased summary)

- A statement of fiscal impact identifying state agencies, units of local government and the public that may be economically affected by the adoption, amendment or repeal of the rule.
- An estimate of the economic impact on those identified as affected.
- In considering the economic effect of the proposed action on the public, the agency shall utilize available information to project any significant economic effect of that action on businesses which shall include a cost of compliance effect on small businesses affected.
- A housing cost impact statement.

# Group Discussion of Fiscal Impact Statement

# Next Steps

# Rulemaking Milestones

| Milestone  | Date                |
|--|---------------------|
| EFSC Approval and Appointment of a Rulemaking Advisory Committee (RAC)   | December 15, 2017   |
| RAC Meeting #1 - Teleconference w/ RAC   | January 24, 2018    |
| RAC Meeting #2 - ODOE office in Salem, OR  | March 21, 2018      |
| RAC Research Period – Add'l Input Deadline   | May 4, 2018         |
| EFSC Authorization to Issue Official Public Notice   | April 27, 2018      |
| <b>RAC Meeting #3 - ODOE office in Salem, OR</b> <ul style="list-style-type: none"><li>• <b>Discuss Add'l Input (Heat Rate, 13 Principles, Fiscal)</b></li></ul> | <b>May 15, 2018</b> |
| Official Public Notice Issued  | June or July        |
| EFSC Rulemaking Hearing  | July EFSC Meeting?  |

# Questions

# Public Input from Non-RAC Members