Background

- **Combined cycles with 2x1 configuration or higher and steam turbines with multiple boilers can reflect their heat input curves in cost-based offers using multiple methods. The methods can be:**

  1. **One heat input curve of entire operating range, regardless of configuration.**

  2. **Multiple heat input curves, one per configuration.**

  3. **Pseudo heat input curve for combined cycles that choose to be modeled using the combined cycle pseudo model.**

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Problem/Opportunity Statement

- **The work is intended to include in Manual 15 the different methods available to combined cycles and specialized boilers to reflect their heat input.**

- **Activities:**

  1. **Review the current methods combined cycles and specialized boilers can use to reflect their heat input.**

  2. **Explore additional methods not currently used.**

  3. **Document methods in Manual 15.**

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Method 1: One Heat Input

- **Uses all the historical operating data (MW output, MMBtu input) to calculate a single heat input curve.**

- **The unit's cost-based offer is submitted using a single schedule regardless of configuration.**

- **Start heat input is based on starting the full configuration.**

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Method 2: Heat Input per Configuration

- **Uses all the historical operating data (MW output, MMBtu input) to calculate multiple heat input curves per configuration.**

- **The units can either:**

  - **Submit multiple cost-based offers, each one using the corresponding heat input curve and start heat input (preferred) or**

  - **Submit one cost-based offer but required to update the heat input curve and start heat input used when a certain configuration is being used.**

- **Start heat input is based on each configuration.**

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Method 3: Pseudo Model

- **Uses all the historical operating data (MW output, MMBtu input) to calculate multiple heat input curves per configuration.**
  - **The full configuration heat input is split among the pseudo units.**
  - **The X0 (no load heat) is divided by the number of pseudo units.**
  - **The X1 is kept the same.**
  - **The X2 is multiplied by the number of pseudo units.**

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Method 3: Pseudo Model

- **The unit's cost-based offer is submitted using a single schedule. The schedule must be based on the full configuration when all units are available.**
  - **It can also be based on the smaller number of configurations when entire unit is not fully available.**
- **Start heat input is equal to the full configuration divided by the number of pseudo units.**
  - **It can also be based on starting a smaller number of configurations when entire unit is not available.**

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Method 3 Example

Heat Input Curve Coefficient	Full Unit Heat Input Curve	Pseudo Unit Heat Input Curve
X0	800.00	400.00
X1	5.00	5.00
X2	0.0010	0.0020
Eco Max (MW)	500	250
Eco Max Heat Input (MMBtu)	3,550	1,775
Average Heat Rate (MMBtu/MWh)	7.10	7.10

Full Unit Inc. Heat Rates		Pseudo Unit Inc. Heat Rates	
MW	Inc. Heat Rate (MMBtu/MWh)	MW	Inc. Heat Rate (MMBtu/MWh)
0	5.00	0	5.00
50	5.10	25	5.10
100	5.20	50	5.20
150	5.30	75	5.30
200	5.40	100	5.40
250	5.50	125	5.50
300	5.60	150	5.60
350	5.70	175	5.70
400	5.80	200	5.80
450	5.90	225	5.90
500	6.00	250	6.00

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