Using Publicly Available Heat Rate Data

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EPRI Heat Rate Meeting

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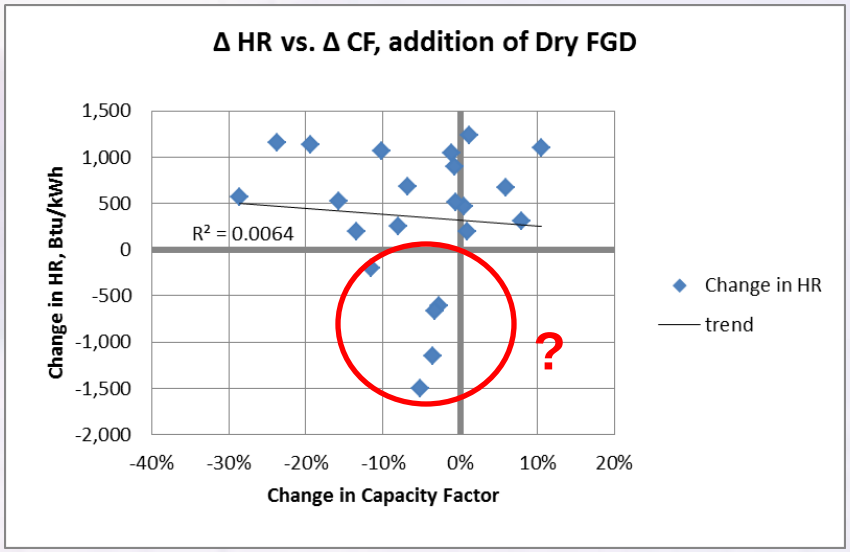
Public Sources of Heat Rate data

- EPA's National Electric Energy Data System (NEEDS)
  - Net heat rate uses heat rates developed by EIA from 3 year periods for Annual Energy Outlook examining fuel use and generation data
- Energy Information Administration (EIA) Form 923
  - Reported fuel use and generation data
- EPA's Air Markets Program Data (AMPD)
  - Heat input determined from exhaust parameters, gross generation reported
- EPA's eGRID (developed from AMPD)
- FERC Form 1 data (self reported)

NEEDS

- Examined effects of capacity, capacity factor, fuel, age, steam cycle and if scrubber was installed – results presented in 2014 MEGA Symposium
  - Most trends as expected
    - Capacity, age, steam cycle
  - Some unexpected
    - Likely due to noise in data



EPA's AMPD and EIA Form 923 Study

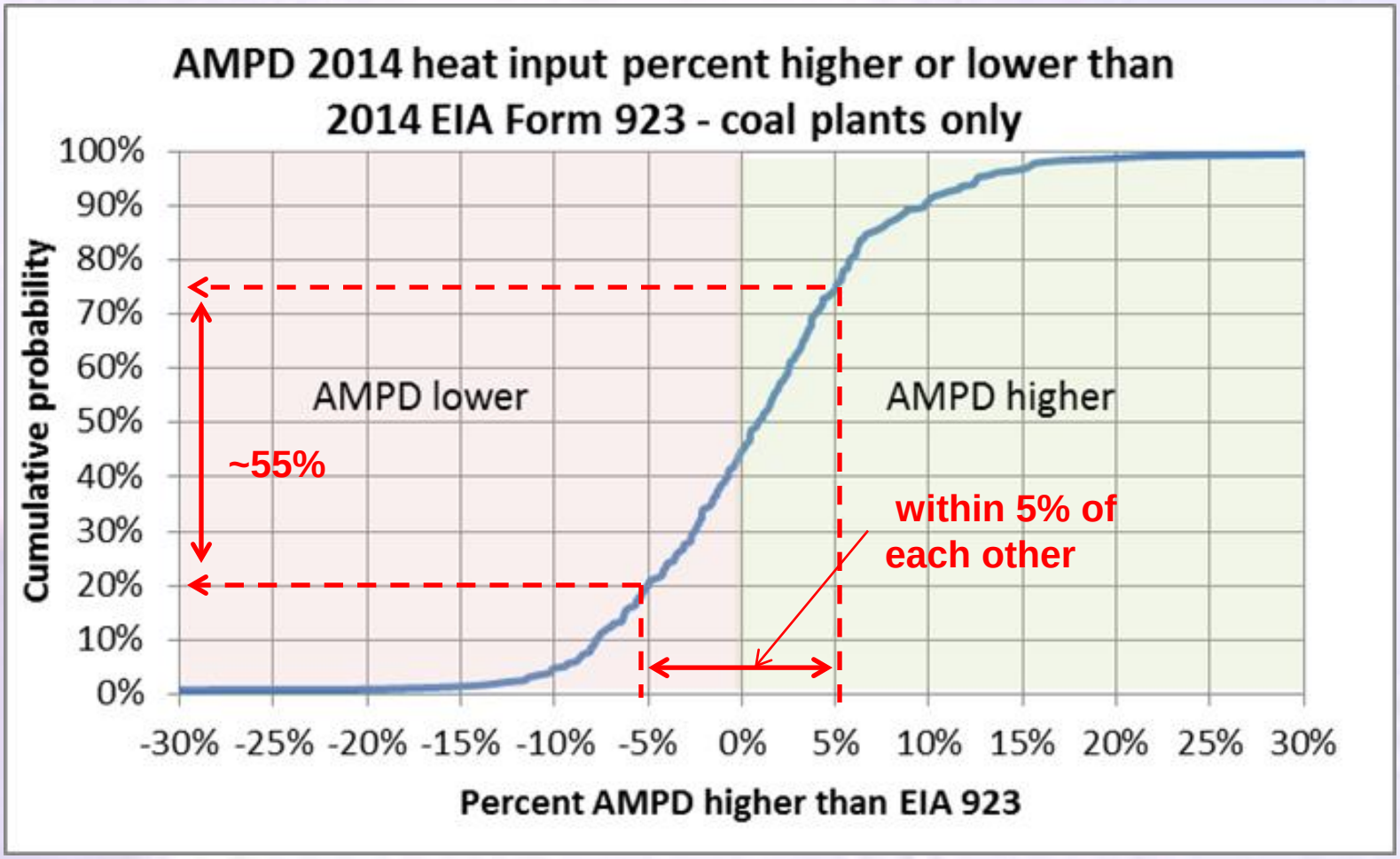
(also see paper in 2016 MEGA Symposium)

- Compare heat input data from EIA Form 923 and EPA's AMPD for coal plants and determine degree of consistency/inconsistency
- Examine the stability of the F factor relationship (flow versus heat input) with different coals and the potential impact on "apparent" potential improvement in heat rate when performing heat rate variability analysis

Form 923 versus AMPD comparison

- Compared annual 2014 AMPD emissions data and EIA Form 923 data for electric utility boilers
  - AMPD is from CEMS
  - EIA Form 923 from reported fuel use
- Compared total annual heat input for 232 *plants* that only have boilers with coal as primary fuel (no CTs or combined cycle on site)
- Also examined data for *units* with lowest CO_2 emission rate based upon AMPD and compared against EIA

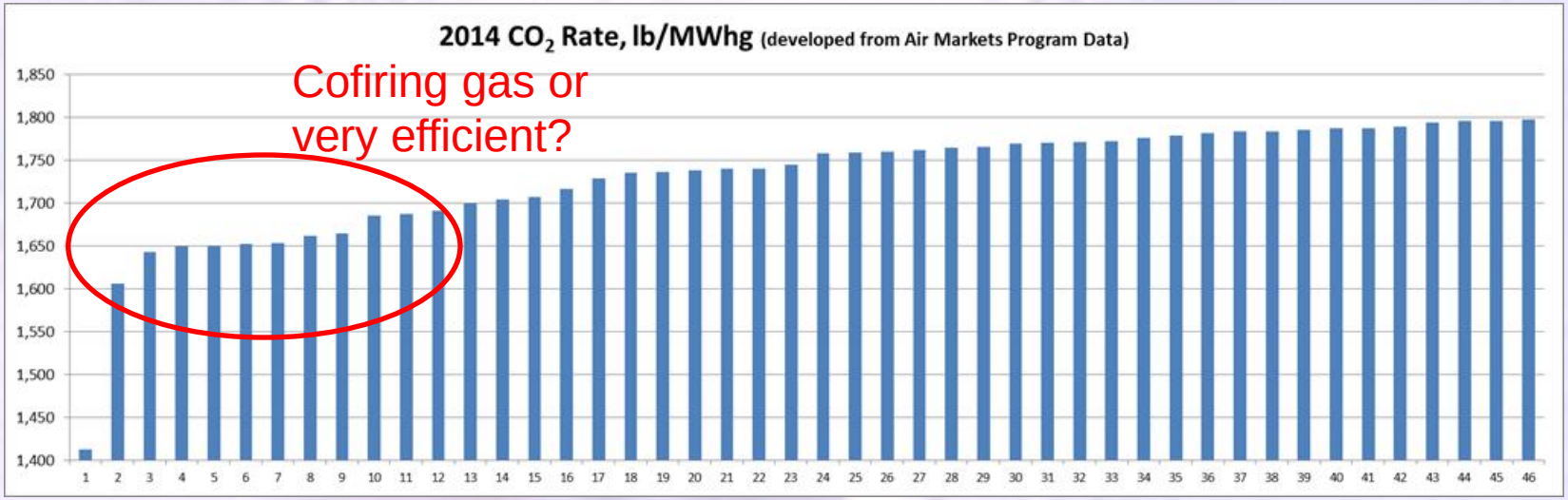
Comparison of heat input – AMPD versus EIA Form 923

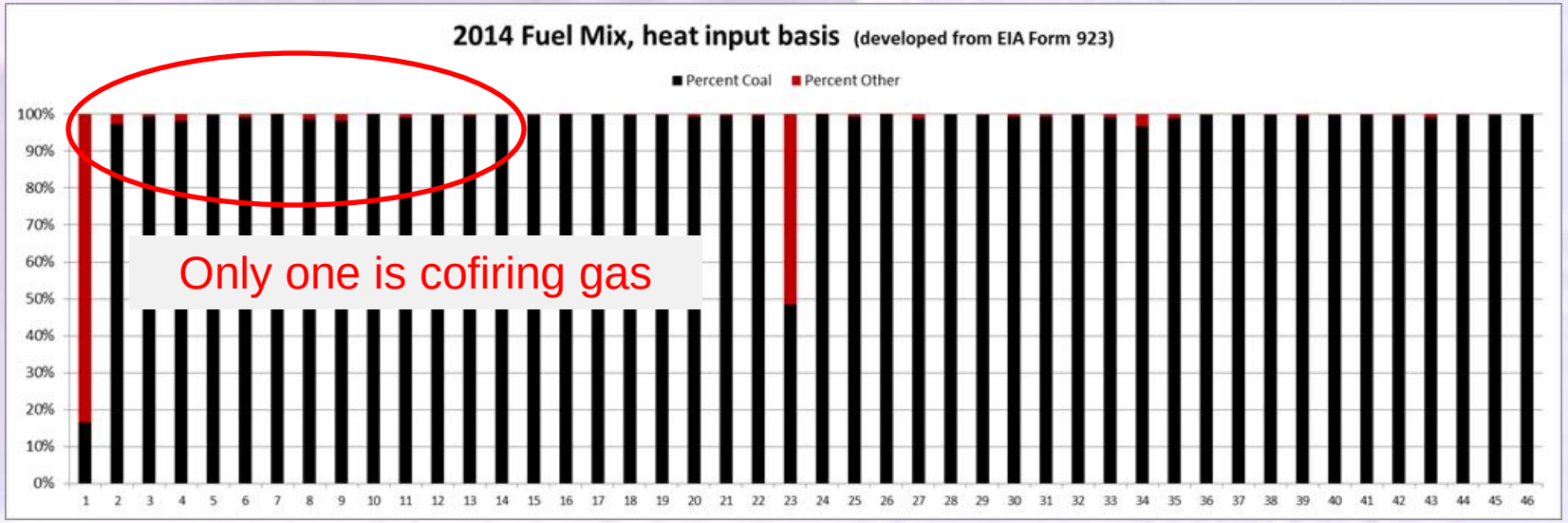


Examination of specific units

- Examined units that appeared to have low CO_2 emission rates (lb/MWhr) based upon AMPD
- Compared to EIA Form 923 heat input from fuel use

CO_2 Rate and Fuel for lowest emitting units





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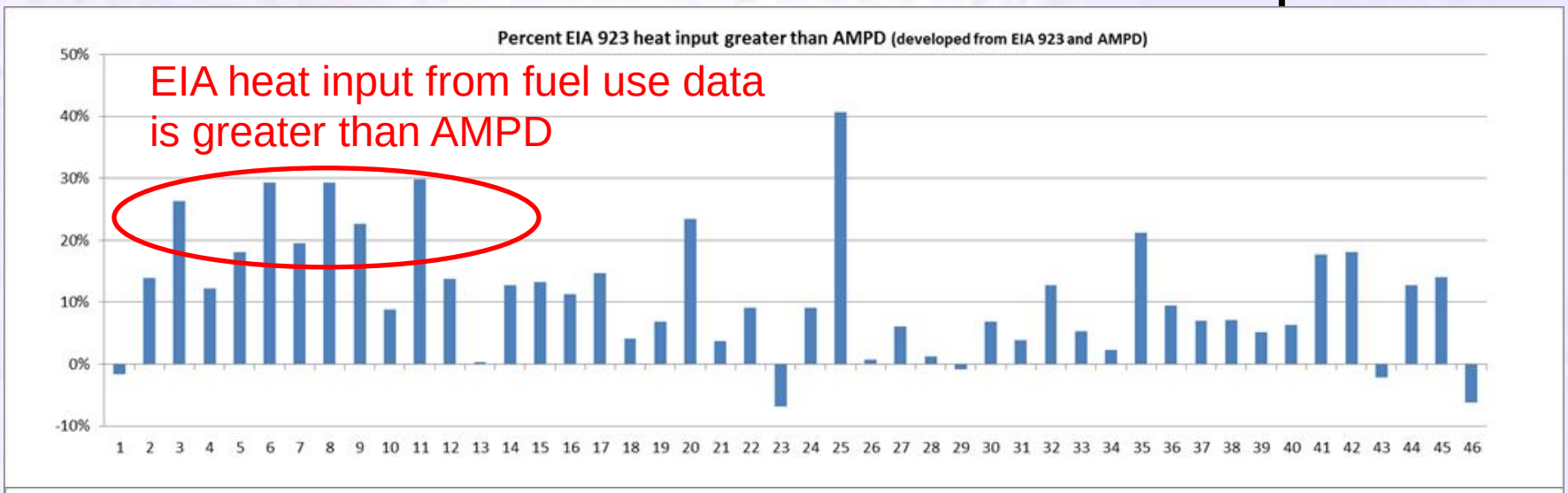
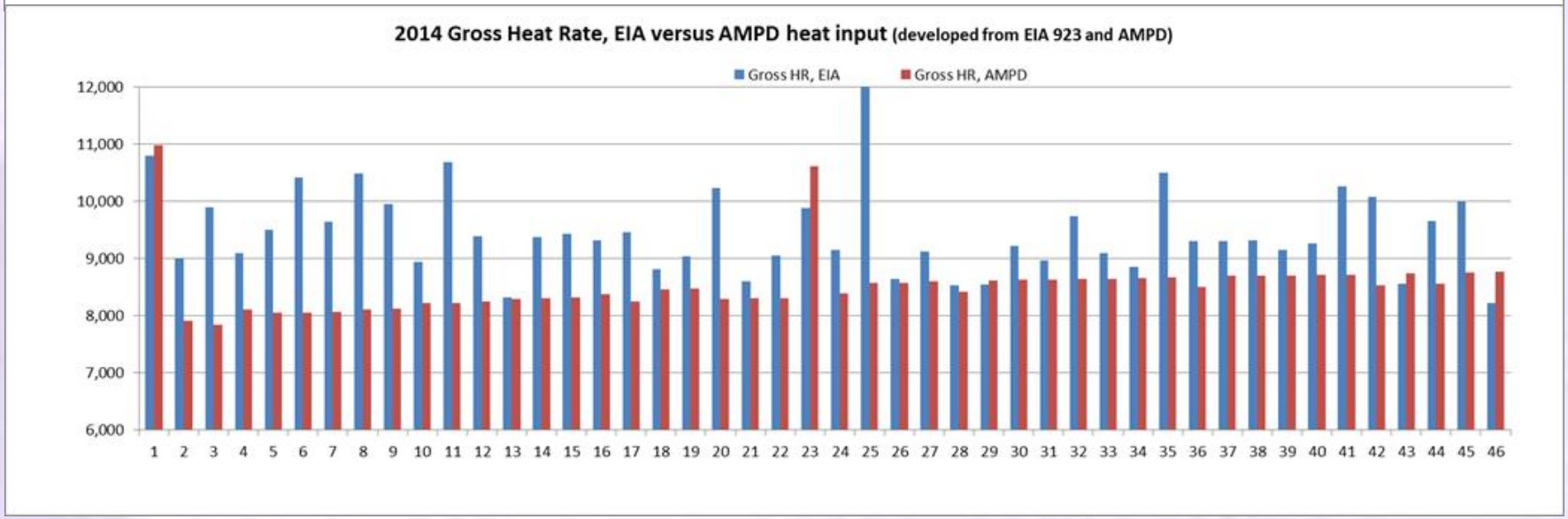
EIA Form 923 versus AMPD Heat Input





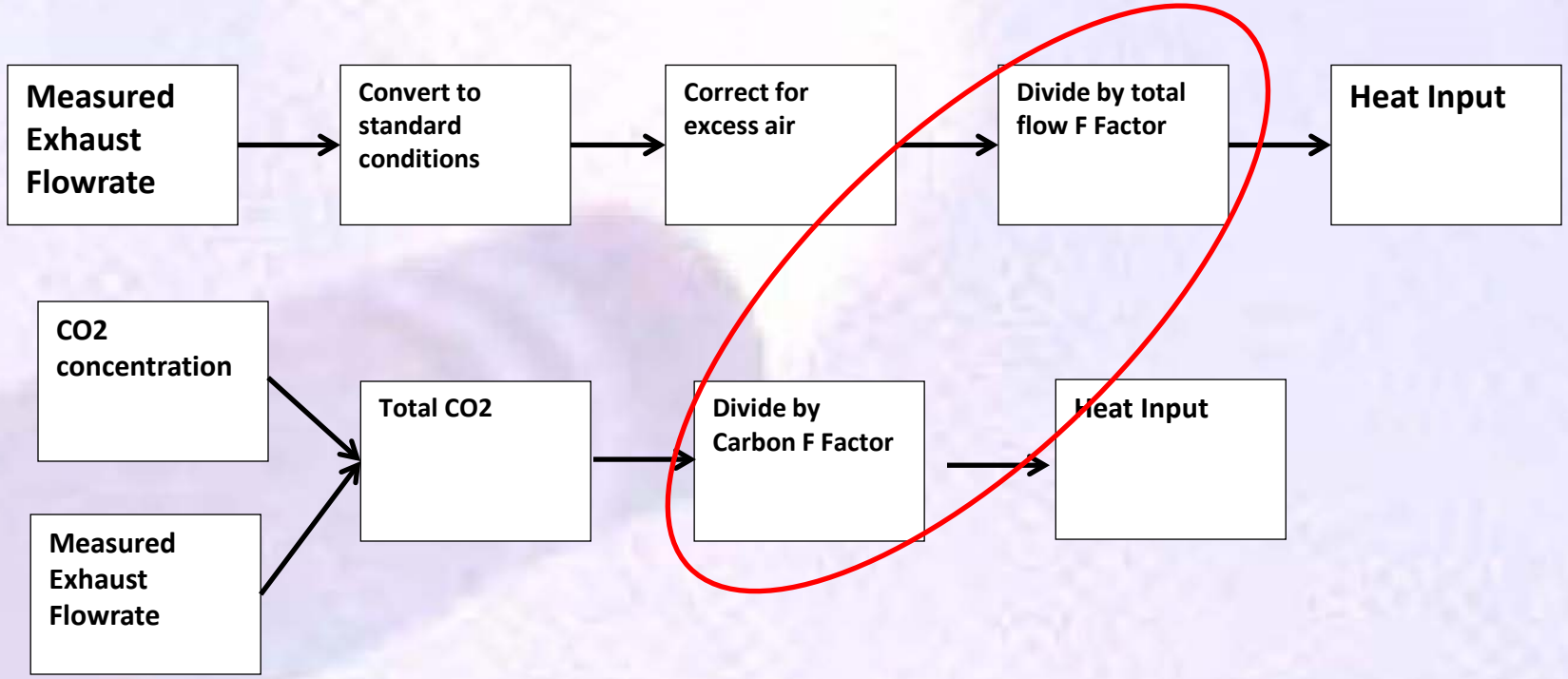
Conclusions – AMPD versus EIA

- Significant differences between heat input from AMPD data and EIA Form 923 fuel data
  - AMPD is based upon measured stack parameters while EIA Form 923 is based upon fuel use
- Sampling of lowest apparent CO_2 emitters found individual discrepancies
  - In these cases the EIA Form 923 data seemed more believable

AMPD ***Inference*** of heat input from measured stack parameters

Heat input is assumed to be proportional to flowrate or CO2

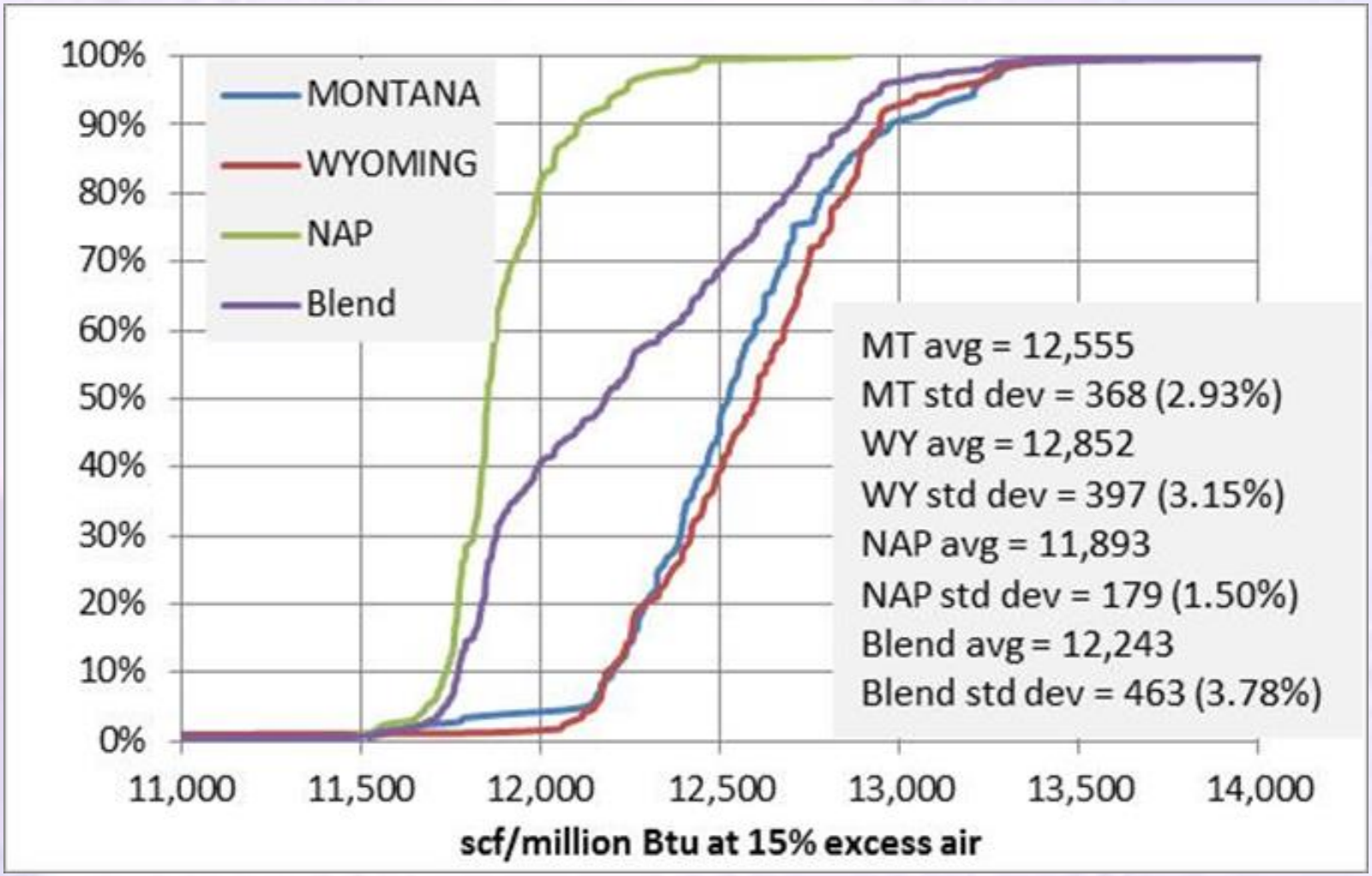
How stable is the "F factor" relationship?



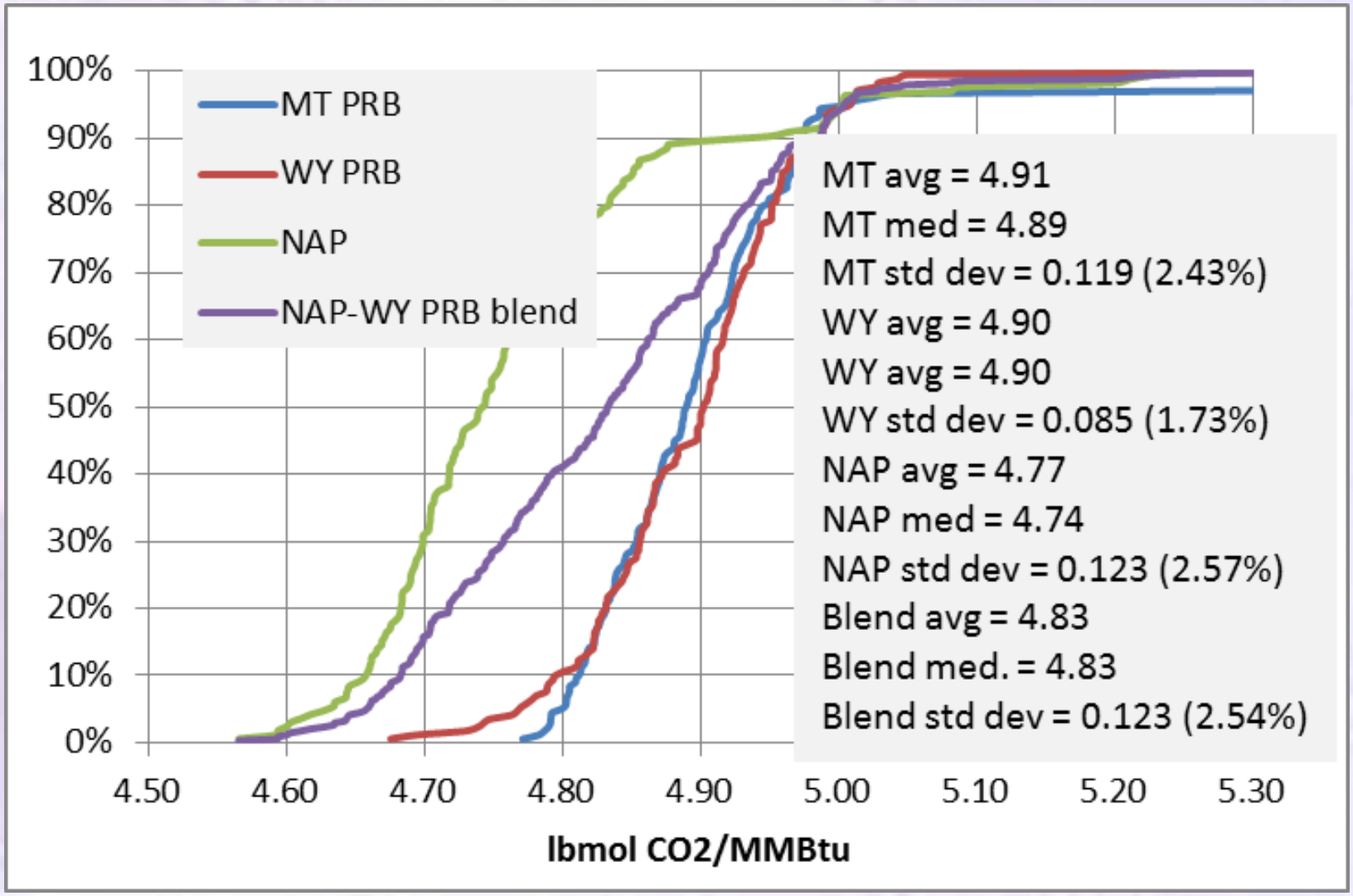
Examination of the stability in F factor relationship for different coals

- F factor used in CEMS determined from EPA Method 19
- The actual relationship between flowrate and heat input is a function of coal characteristics.
- Used fuel data from USGS Coal Quality database
- For different coals performed calculations to determine exhaust flowrate per million Btu and lbmol CO_2 per million Btu
- Examined variability in relationship and potential impact on heat rate variability analysis
- **Assume "perfect" flow and CO_2 measurement**

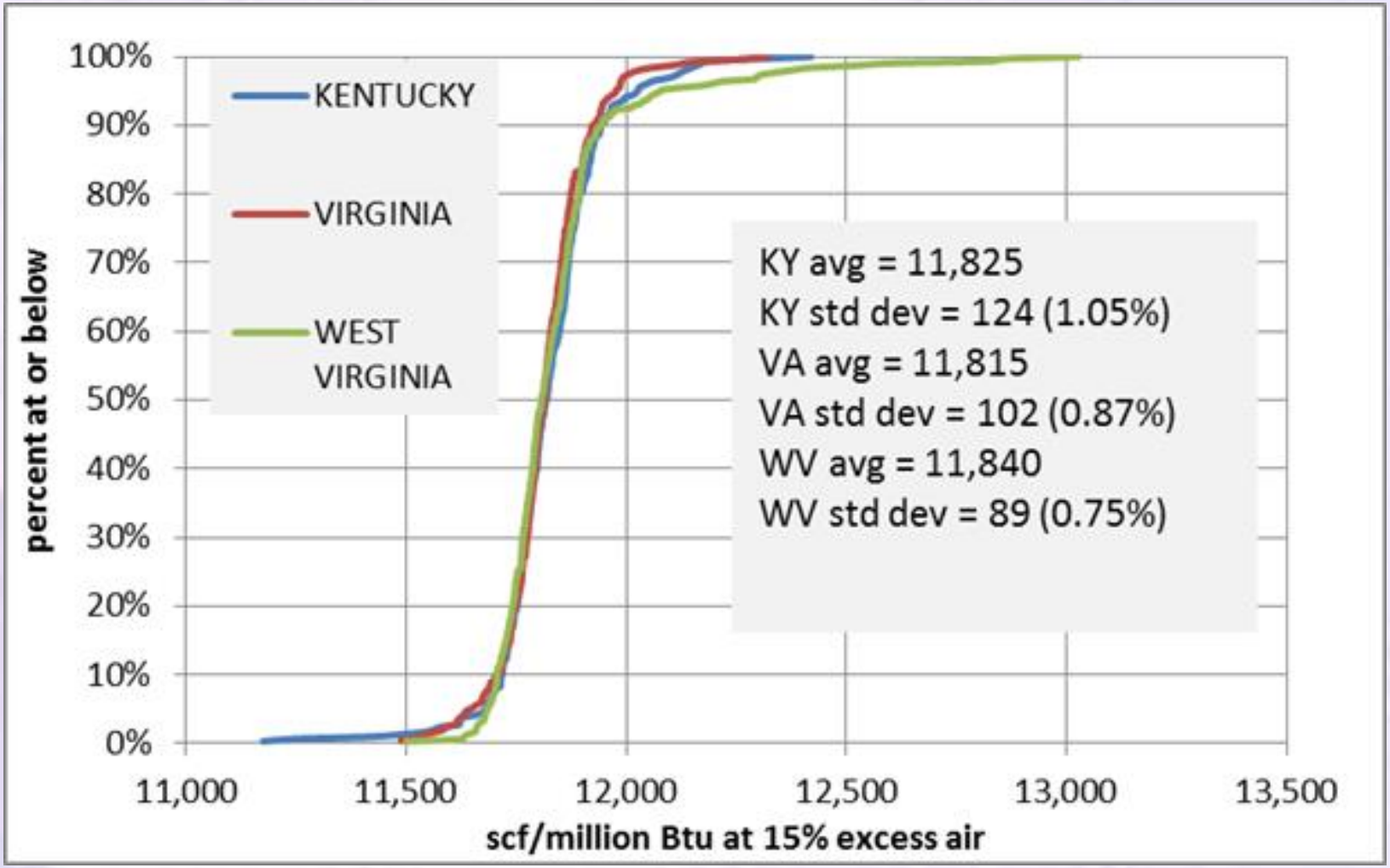
Cumulative probability of exhaust flow to heat input at 15% excess air for Montana PRB, Wyoming PRB, Northern Appalachian (NAP) coals and 50/50 blend of WY PRB and NAP



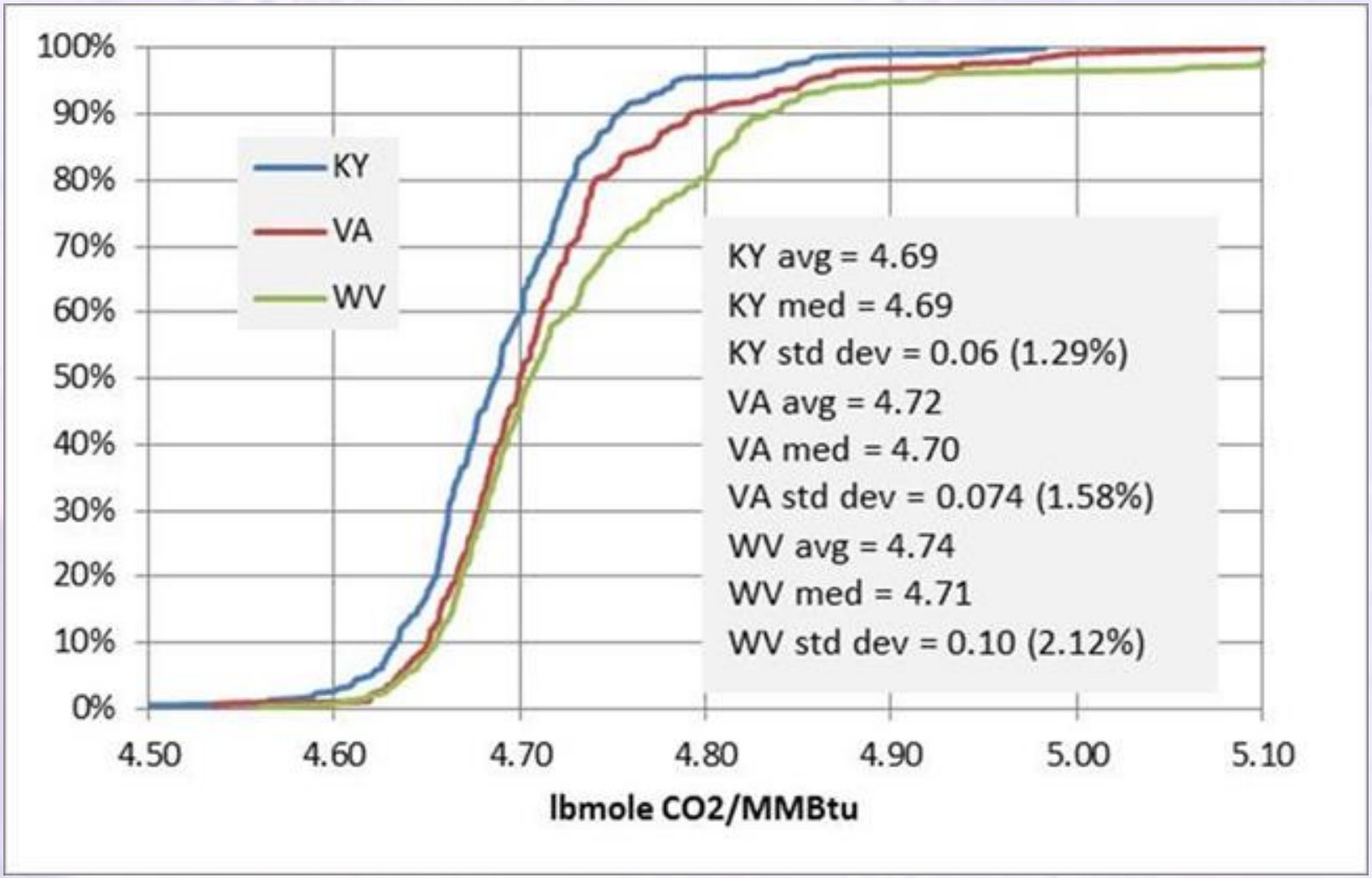
Cumulative probability of lbmol CO_2 to heat input for Montana PRB and Wyoming PRB



Cumulative probability of exhaust flow to heat input at 15% excess air for Kentucky, Virginia and West Virginia Central Appalachian coals



Cumulative probability of lbmol CO_2 to heat input for Central Appalachian coal



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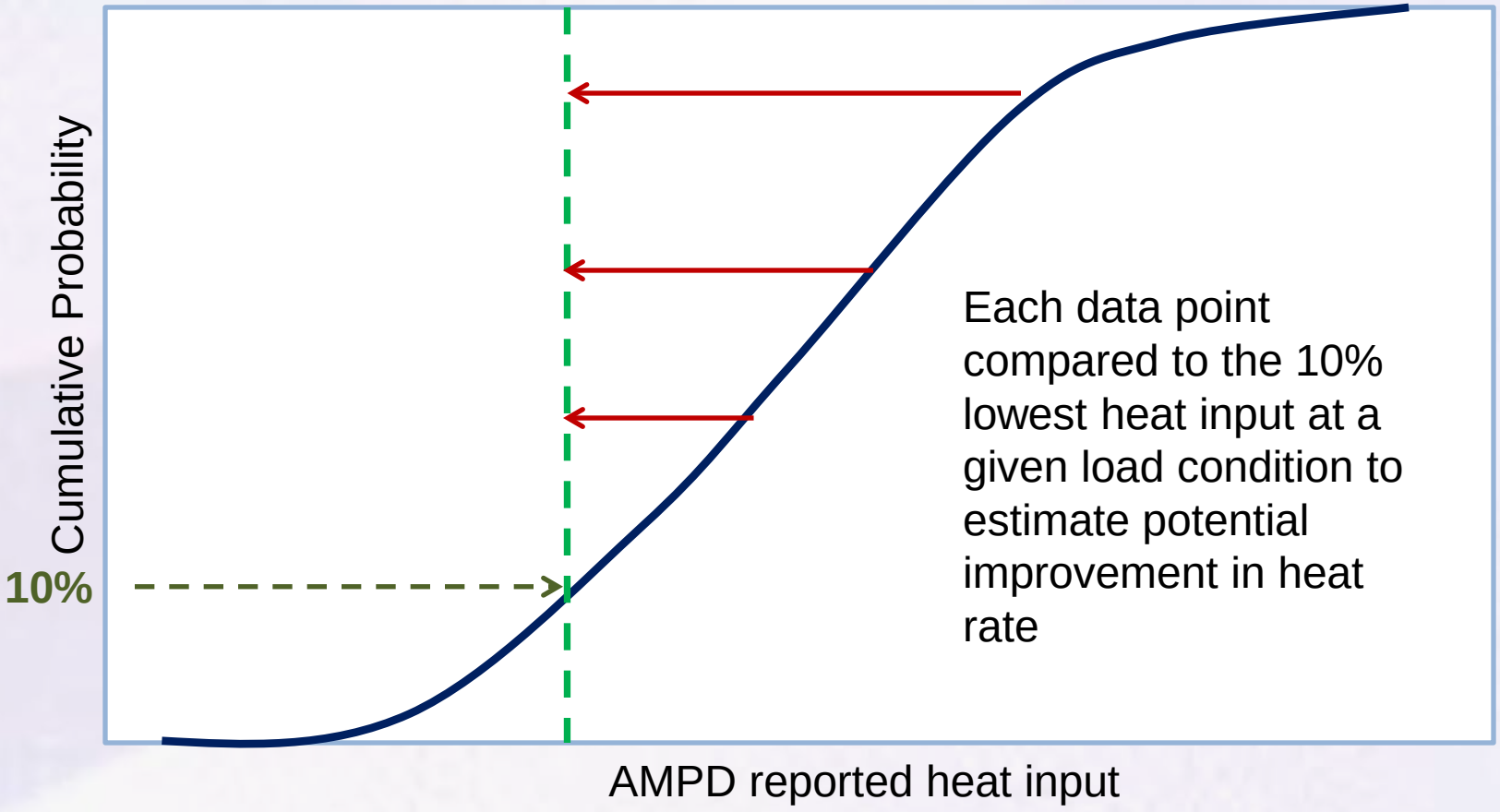
Apparent heat rate improvement opportunities

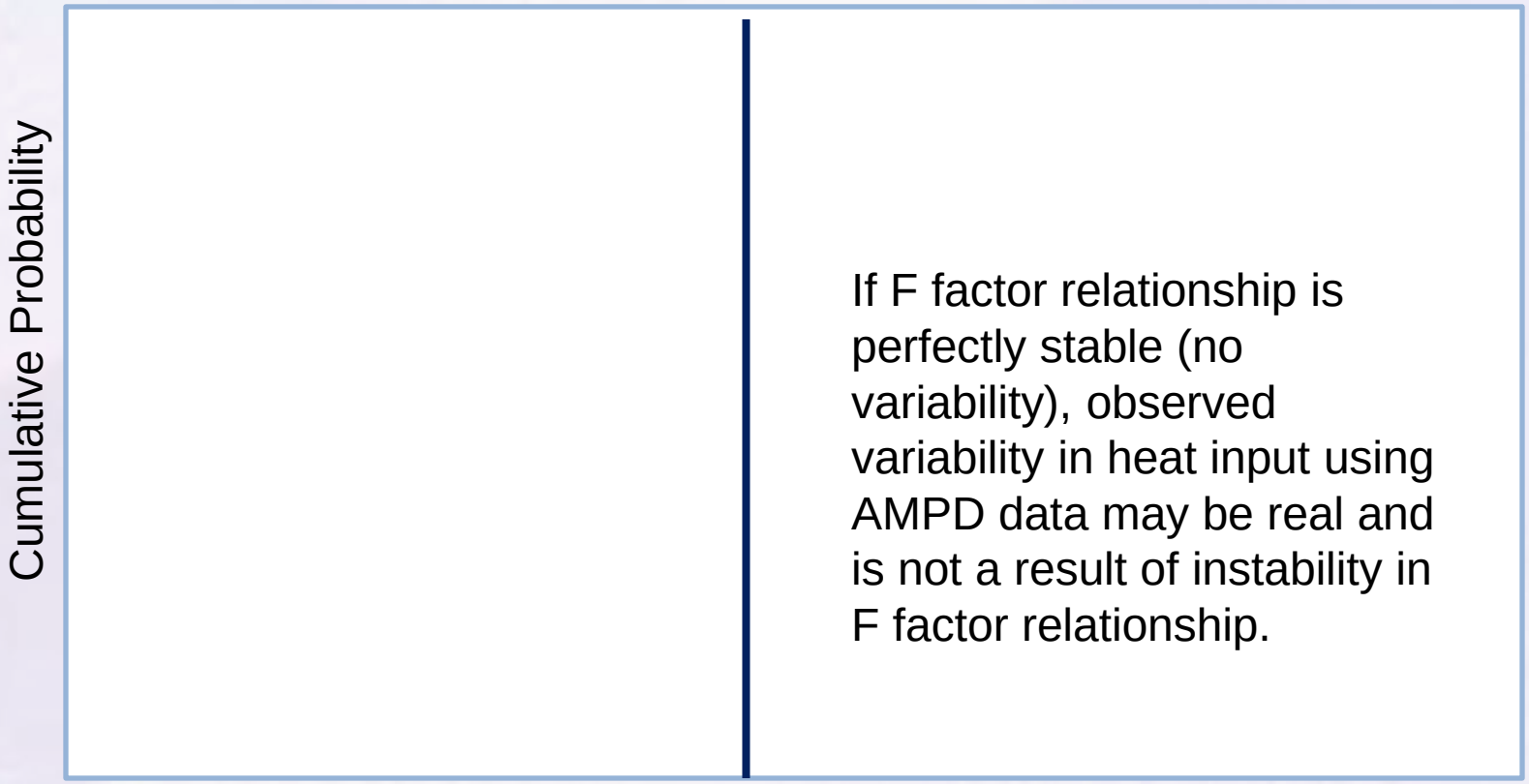
- If hourly heat rate calculated from AMPD appears to vary under a given condition that *may* indicate an opportunity to improve heat rate.
  - This was basis of EPA's Building Block One assessment
- What if the observed variability of inferred heat rate at a given condition is, in fact, due in part to F factor instability rather than actual change in heat rate?
  - How significant is this effect?

Heat Input Variation – EPA's BB1 approach

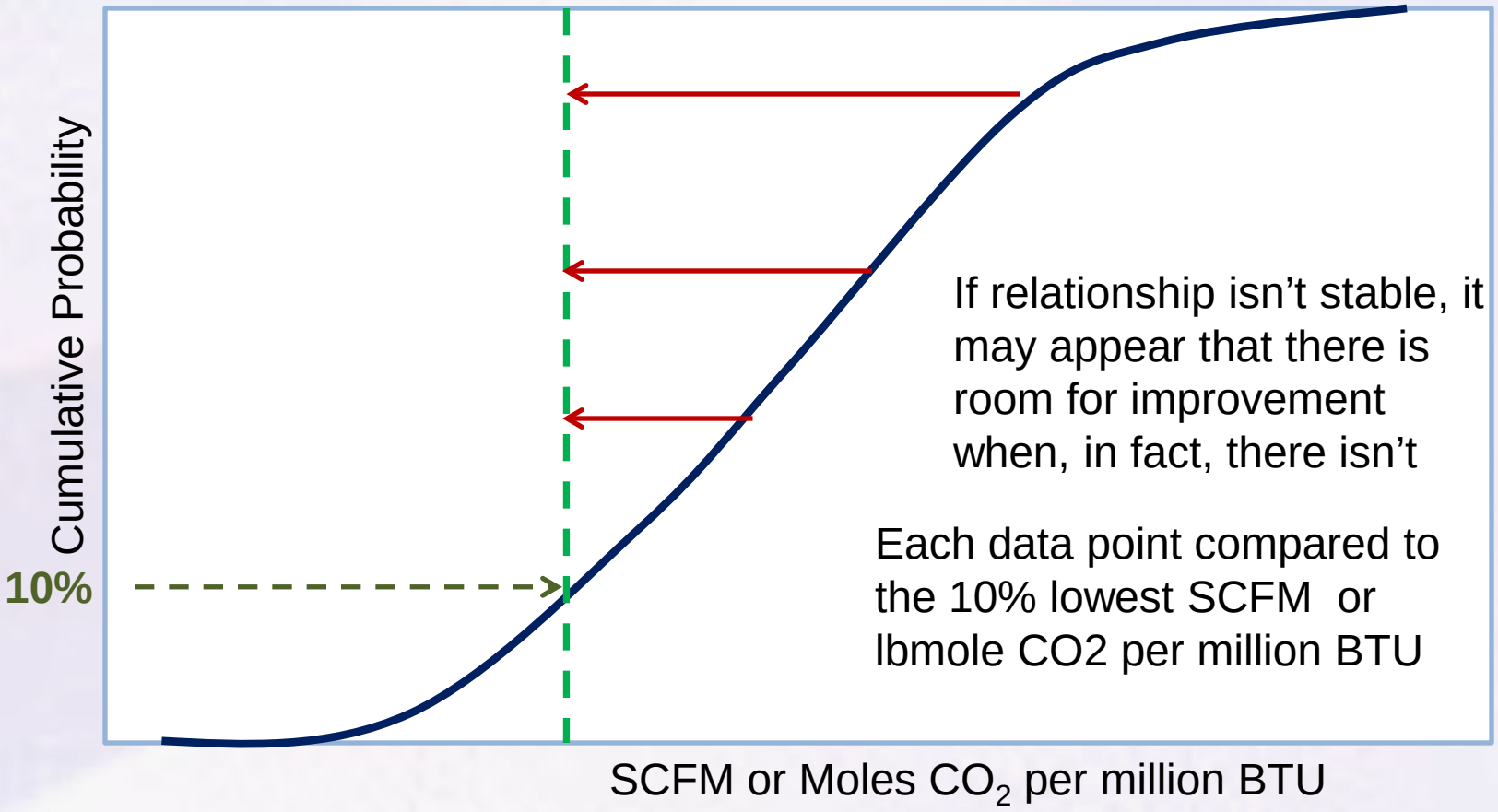
evaluation of heat input variation at specific load and ambient temperature conditions



“Apparent” improvement opportunity in heat input



“Apparent” opportunity for improvement in heat input from F factor instability



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“Apparent” improvement in heat rate resulting from instability in the relationship between flowrate and heat input.

MT PRB	WY PRB	NAP	WY PRB-NAP Blend	KY CAP	VA CAP	WV CAP
3.53%	3.95%	1.56%	4.43%	1.09%	1.11%	1.28%
2.16%	2.36%	2.93%	3.47%	1.48%	1.57%	1.90%

Conclusions – F factor stability

- F factor relationship used to determine heat input in AMPD does not appear to be stable for most coals
- Impacted by fuel type and whether or not there is blending
- May have significant impact on “apparent” heat rate improvement when performing heat rate variability analysis in the manner performed by EPA for BB1
- *This does not factor in flow monitoring variability, which would increase the effect.*

Recommendations

- Need to better understand differences in the AMPD heat input and the EIA fuel use data
  - Hopefully make data more consistent
- Need to examine the issue of instability in F factor relationship and impact on apparent variability in heat rate
  - Examine more plant coal data
  - Include the impacts of flow monitor performance variability

- For Questions or Comments
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