

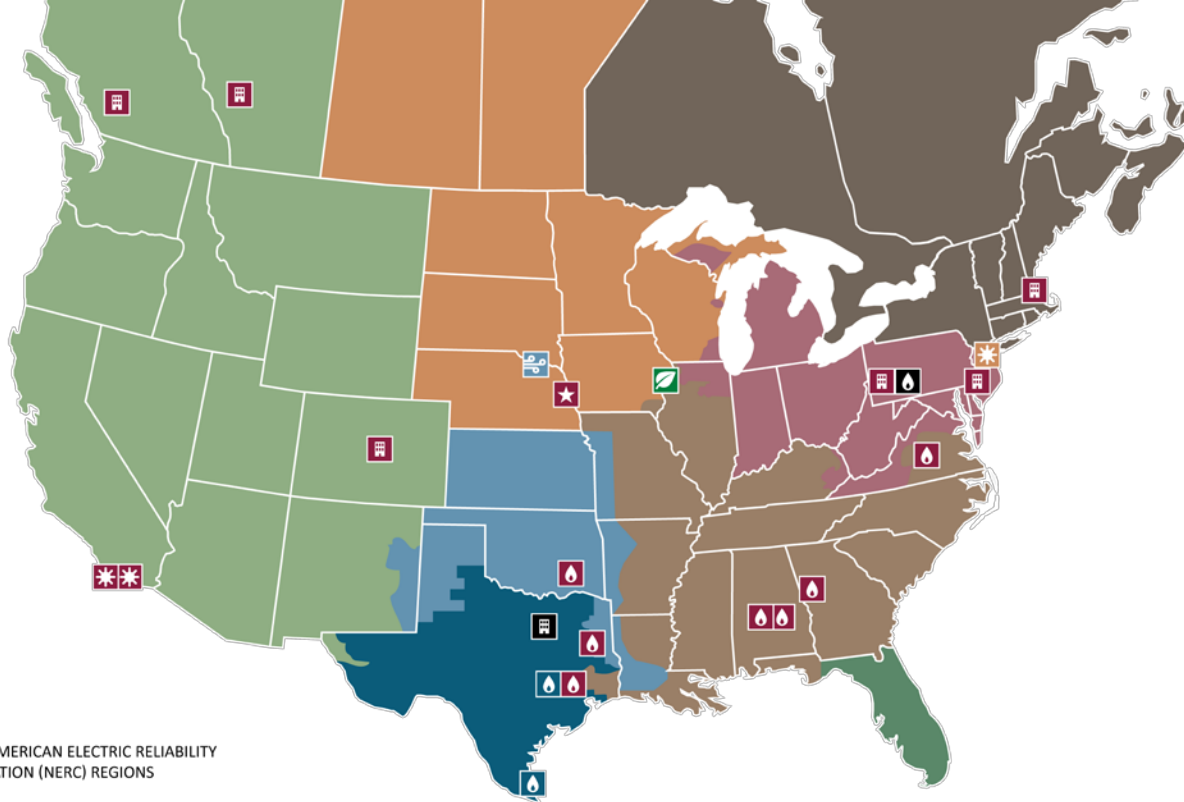
Virginia Executive Order 57 Tenaska's Recommendations

Larry Carlson, QEP

Vice President – Environmental Affairs

Virginia Executive Order 57 Work Group

October 6, 2016



NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION (NERC) REGIONS



PLANTS, PROJECTS & OFFICES

- Tenaska-Owned / Operated Natural Gas Plants
- Natural Gas Plants in Advanced Pre-Financing Development
- Natural Gas Plant in Construction
- Tenaska-Owned Solar Plant
- Solar Investment
- Wind Investment
- Agricultural Fuel Plant
- Headquarters
- Affiliate Headquarters
- Regional Office

Tenaska Power Generation

- ▶ 7,100+ MWs fossil generation managed & operated
 - 6 NGCC (OK, TX, AL, VA)
 - 1 NG peaker (GA)
 - 925 MW NGCC in construction (PA)
- ▶ 280 MWs of solar generation in operation (CA)



- ▶ 450+ MWs of wind generation in development (MN & ND)



Tenaska Energy Marketing – Natural Gas & Electricity



126 BCF
Natural Gas Storage Inventory



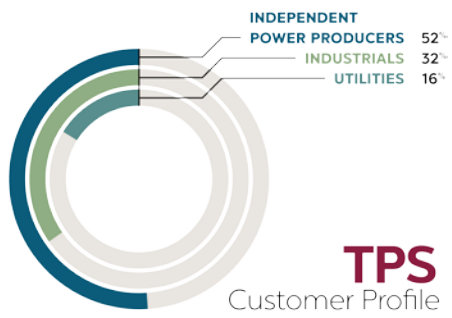
2.7 TCF

Natural Gas Sold Or Managed In 2015



10%

Total U.S. Natural Gas Consumption



24,495 MW

Power Marketing Contracts Managed

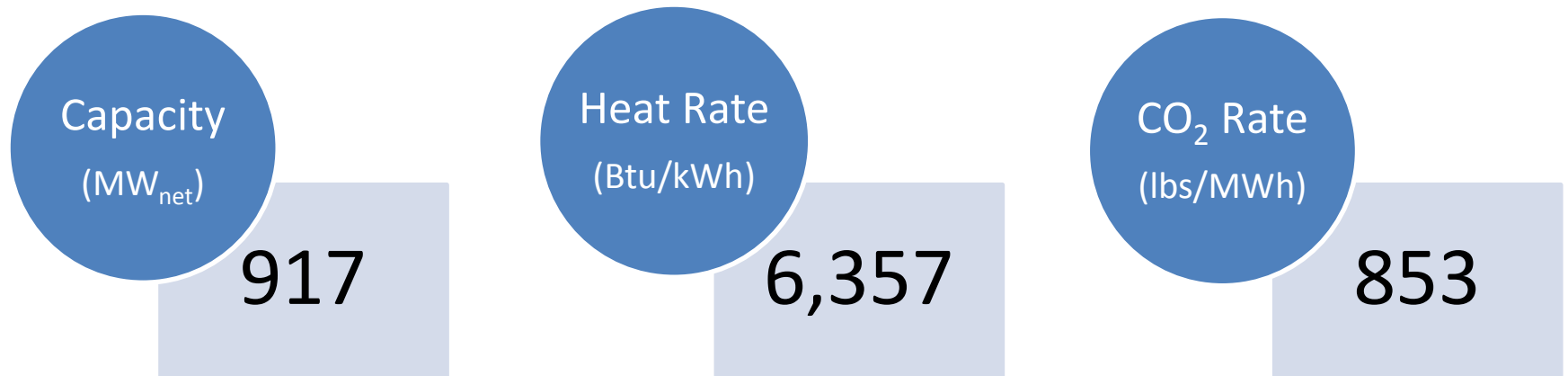


Tenaska Virginia Generating Station



Fluvanna County, Virginia – 2004 COD

Tenaska Virginia Generating Station

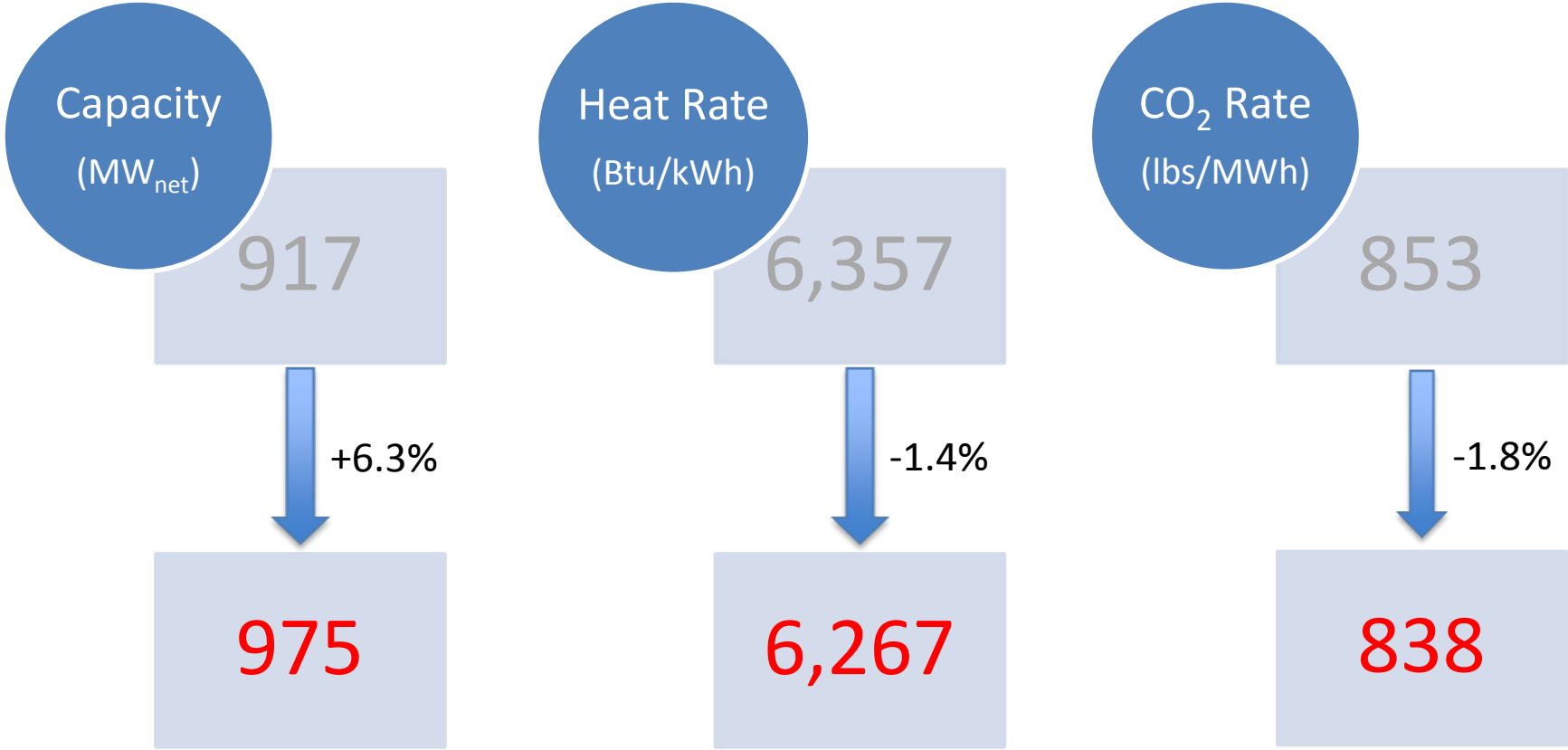


Notes:

Heat Rate is on baseload, unfired, LHV basis

CO₂ Emission Rate is based upon actual 2015 operating profile

Tenaska Virginia Generating Station



Notes:
Heat Rate is on baseload, unfired, LHV basis
CO₂ Emission Rate is based upon actual 2015 operating profile
Values in red represent post-AGP upgrade May 2016

Executive Order 57 – Scope and Guidance

In preparing their recommendations, the Secretary and the Work Group shall consider the following:

1. the establishment of regulations for the reduction of carbon pollution from existing electric power generation facilities pursuant to existing authority under Virginia Code § 10.1- 1300 et seq.;
2. the carbon reduction requirements for existing electric power generation facilities established under § 111(d) of the federal Clean Air Act, which are currently stayed pending final disposition;
3. the interaction between electric utilities and regional markets, including PJM Interconnection;
4. the impact any reduction requirements place on the reliability of the electric system;
5. the impact any reduction of carbon pollution may have on electric rates and electric bills;
6. the impact of reducing carbon pollution on low income and vulnerable communities;
7. the cost effectiveness of pollution reduction technologies that may be deployed;
8. the economic development opportunities associated with deployment of new carbon reduction technologies;
9. the implementation and administration of carbon reduction regulations; and
10. flexibility in achieving the goals of any carbon reduction regulation.

Executive Order 57 – Work Group Goals

Overall Goal of the Work Group:

- a. Develop a strategy under the Governor’s existing authority that will:
 - i. Create more clean energy jobs, and
 - ii. Reduce the Commonwealth’s carbon emissions.

Executive Order 57

High-level Recommendation

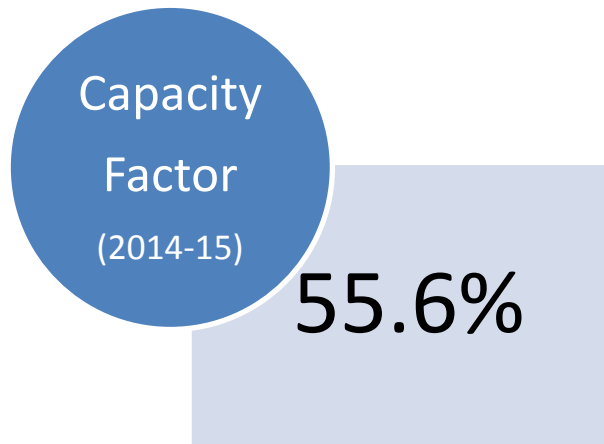
- The most timely and cost-effective way to materially reduce carbon emissions from the Virginia power sector is to:
 - increase utilization of existing, lower-emitting resources
 - decrease utilization of higher-emitting resources
- Primary basis used by USEPA in developing the Clean Power Plan

Tenaska Virginia Generating Station

Is it feasible to operate lower-emitting units significantly more? Yes.

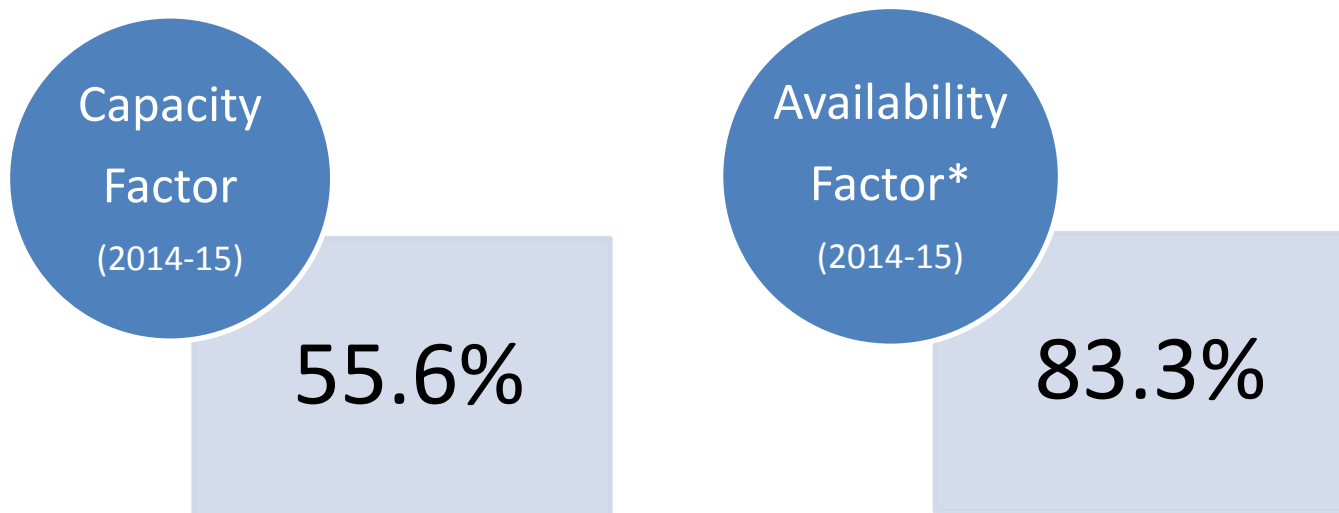
Tenaska Virginia Generating Station

Is it feasible to operate lower-emitting units significantly more? Yes.



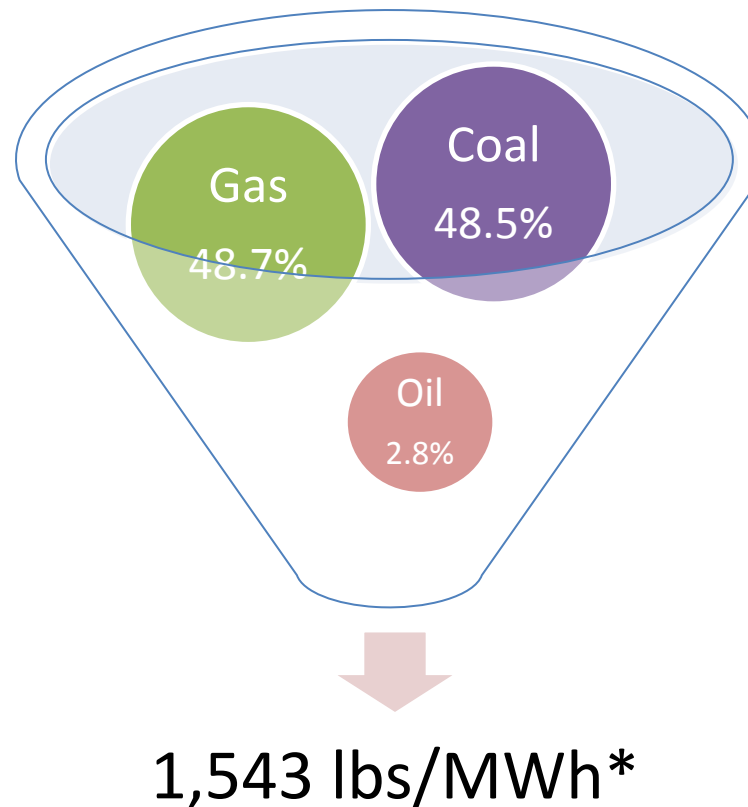
Tenaska Virginia Generating Station

Is it feasible to operate lower-emitting units significantly more? Yes.



* GADS data; includes planned and unplanned outages

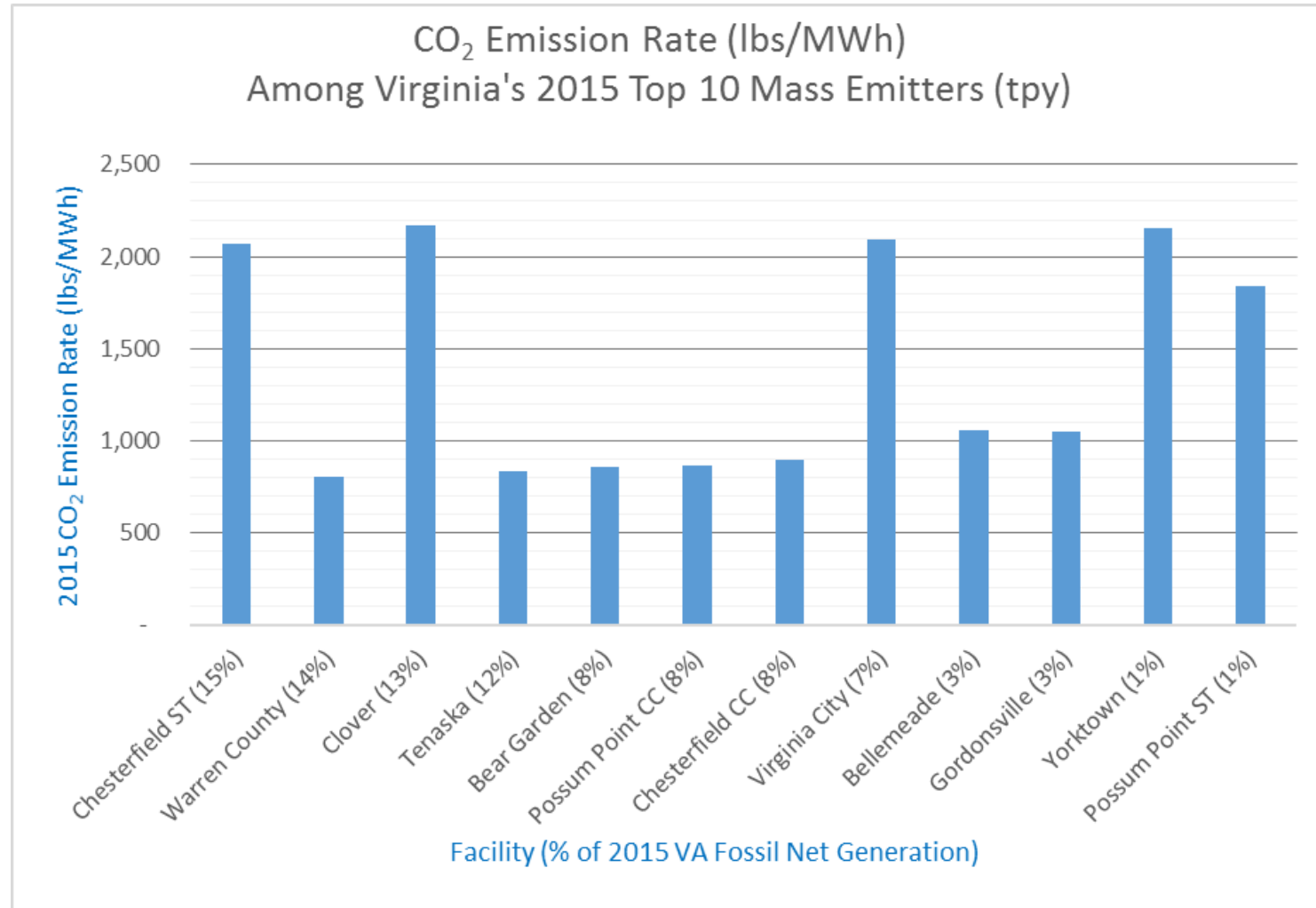
Virginia Fossil Power Sector CO₂ Emission Rate



*source: VDEQ 8/31/16 presentation (2014 data)

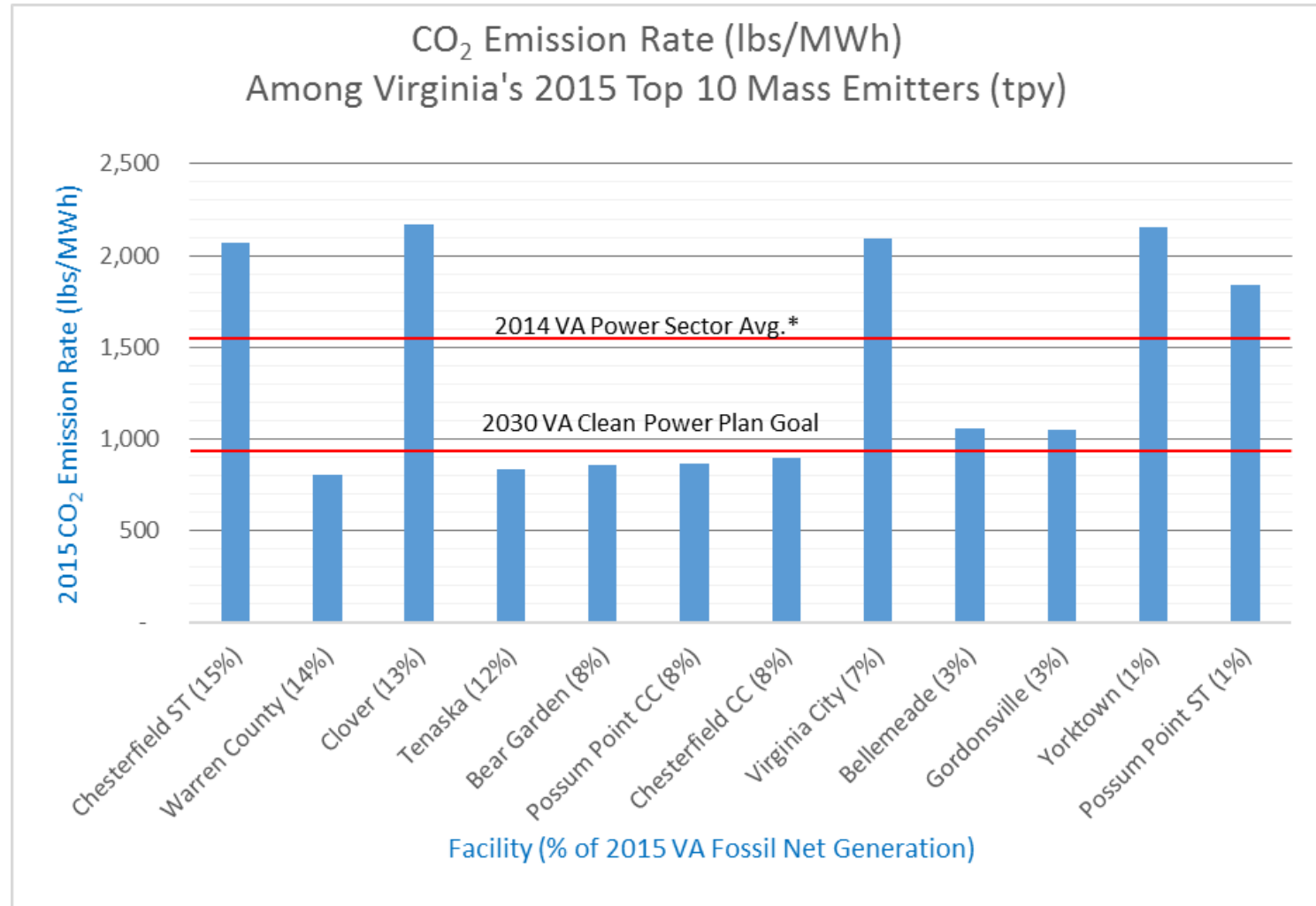
PJM's most recent CPP report ("EPA's Final CPP: Compliance Pathways Economic and Reliability Analysis" – 9/1/16) concludes rate-based compliance plans result in lower wholesale electricity prices relative to mass-based plans

Virginia Fossil Power Sector CO₂ Emission Rate



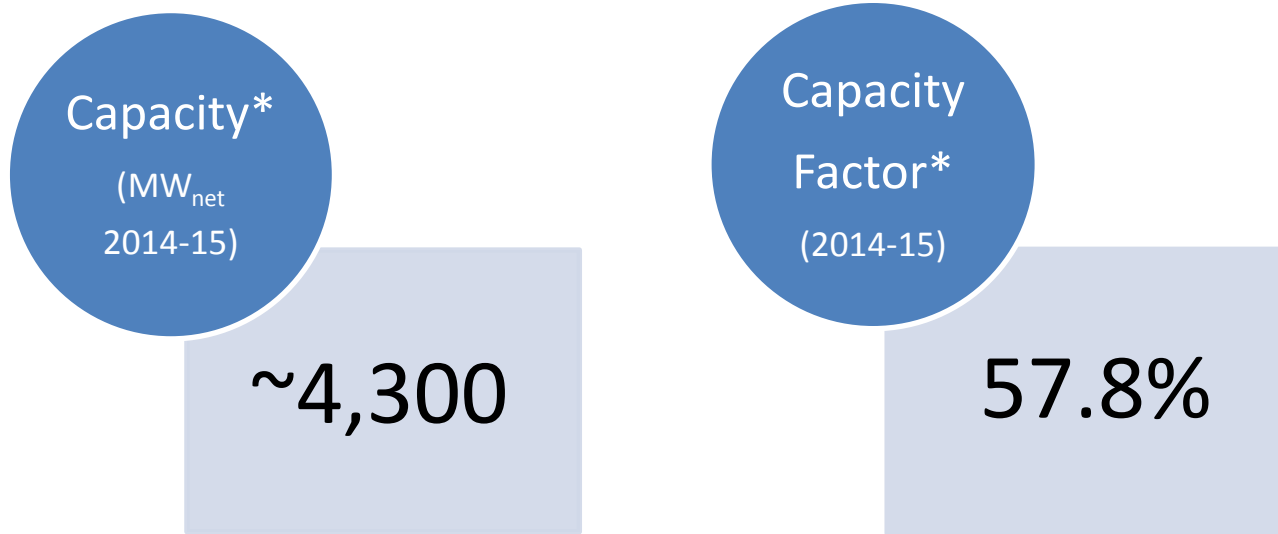
*source: VDEQ 8/31/16 presentation
 Top 10 Emitters collectively make up:
 80% of VA power sector emissions
 92% of VA net generation

Virginia Fossil Power Sector CO₂ Emission Rate

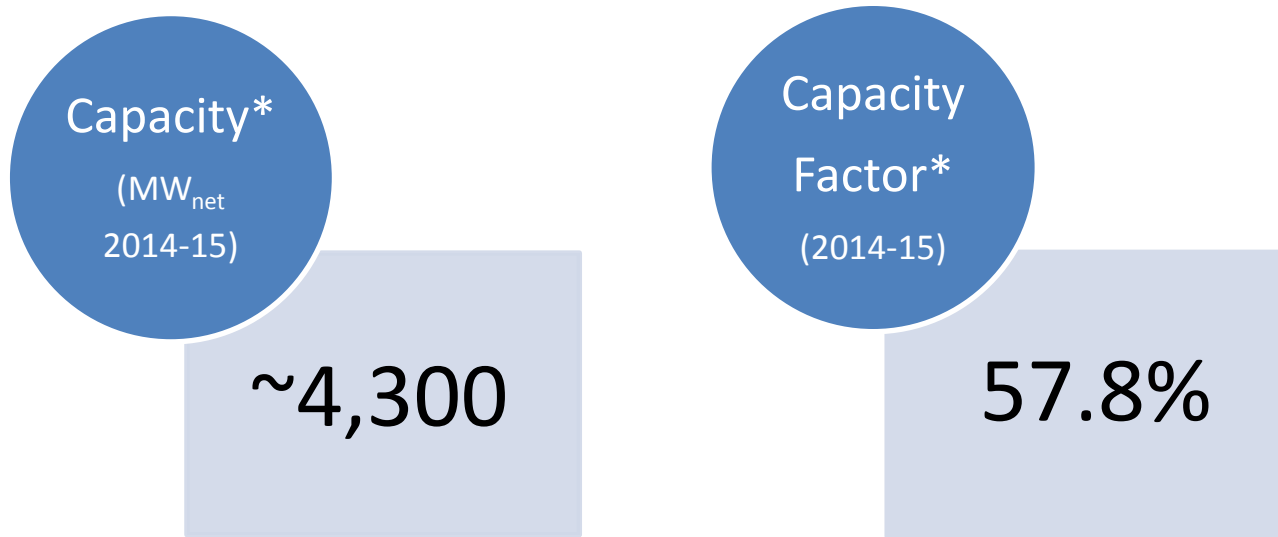


*source: VDEQ 8/31/16 presentation
Top 10 Emitters collectively make up:
80% of VA power sector emissions
92% of VA net generation

Virginia NGCC Capacity & Utilization

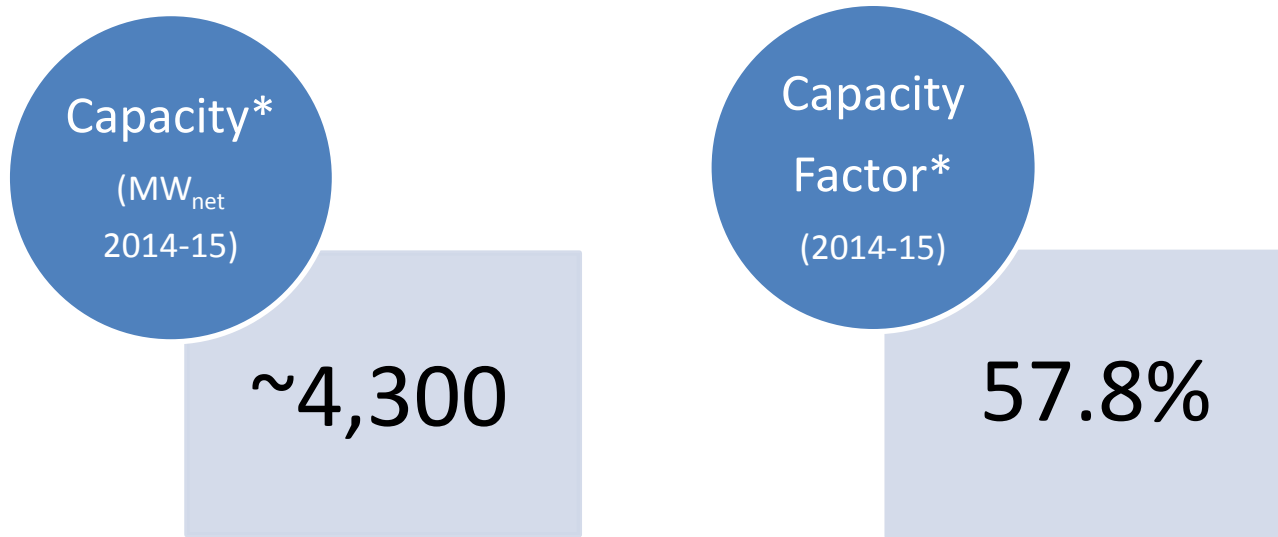


Virginia NGCC Capacity & Utilization



- If NGCC capacity factor would have been **75%**, and all additional NGCC generation would have displaced coal, annual CO₂ emissions from VA power sector would have been reduced by:

Virginia NGCC Capacity & Utilization

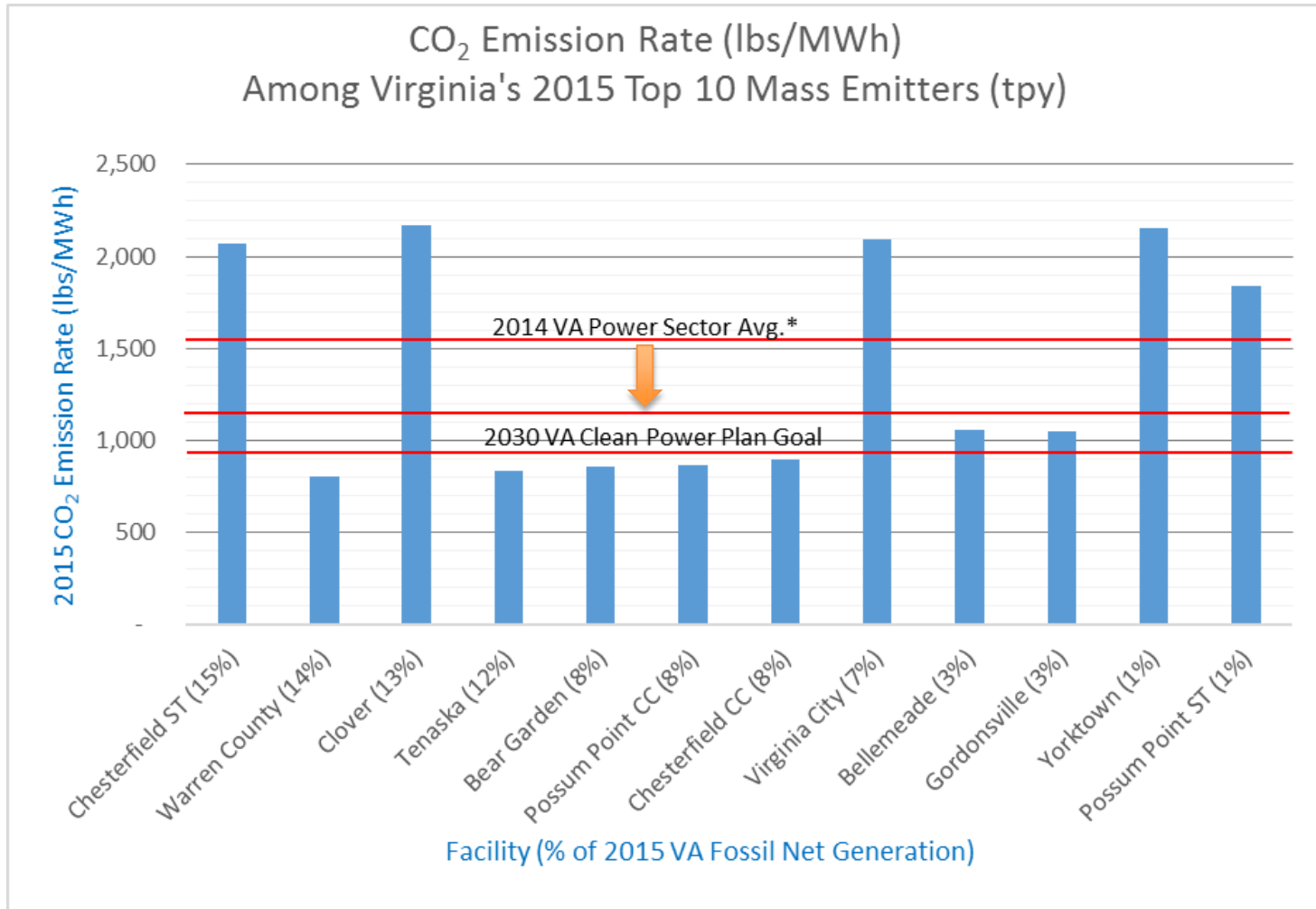


➤ If NGCC capacity factor would have been **75%**, and all additional NGCC generation would have displaced coal, annual CO₂ emissions from VA power sector would have been reduced by:

- ~ **6.8 million tons**
- ~ **21%**

as compared with 2014 state-wide actual emissions

Virginia Fossil Power Sector CO₂ Emission Rate



*source: VDEQ 8/31/16 presentation
 Top 10 Emitters collectively make up:
 80% of VA power sector emissions
 92% of VA net generation

Executive Order 57 – Recommendations

- Consider pathways to shift generation from higher-emitting to lower-emitting units
- Flexible trading mechanisms may also be reasonably considered for CPP compliance
- Our view is that a flexible system of emission rate credit trading would
 - minimize conflicts among stakeholders that would be competing for limited credits
 - result in lower cost to consumers
 - help maintain optionality in the event that nuclear generation must be replaced after 2032

Impacts on E.O. 57 Scope and Guidance

In preparing their recommendations, the Secretary and the Work Group shall consider the following:

2. the carbon reduction requirements for existing electric power generation facilities established under § 111(d) of the federal Clean Air Act, which are currently stayed pending final disposition;

- Virginia's Clean Power Plan (CPP) emission rate goals, as currently written (and stayed), require a 40% reduction in carbon intensity (lbs CO₂/MWh) by 2030 from the 2014 actual rate.
- Tenaska's recommendations herein for E.O. 57 would be consistent with Virginia's anticipated state plan for CPP compliance.

3. the interaction between electric utilities and regional markets, including PJM Interconnection;

- Tenaska's recommendations herein for E.O. 57 involve existing generating assets all located within PJM. Being existing assets, interconnect agreements and transmission capacity would already provide for increased generation up to facilities' declared capacity.

4. the impact any reduction requirements place on the reliability of the electric system;

- PJM's most recent CPP report ("EPA's Final CPP: Compliance Pathways Economic and Reliability Analysis" – 9/1/16) concluded resource adequacy is maintained regardless of compliance pathway and that there are no NERC reliability criteria violations.
- Tenaska's recommendations herein for E.O. 57 would be consistent with Virginia's anticipated state plan for CPP compliance.

5. the impact any reduction of carbon pollution may have on electric rates and electric bills;

- PJM's most recent CPP report ("EPA's Final CPP: Compliance Pathways Economic and Reliability Analysis" – 9/1/16) concludes the wholesale energy price in VA would increase 0.4% from \$46.6/MWh in the Reference case to \$46.8/MWh in the State Rate case in 2025, which mirrors E.O. 57 (i.e., both would be state-only programs).

Impacts on E.O. 57 Scope and Guidance

In preparing their recommendations, the Secretary and the Work Group shall consider the following:

6. the impact of reducing carbon pollution on low income and vulnerable communities;

- Reductions of CO₂ emissions from higher emitting assets via decreased generation would also reduce emissions of criteria pollutants from those same assets, benefiting the surrounding communities.
- Increased generation by lower emitting assets will increase emissions from those assets, but at a much lower rate given the significantly lower emission rate of all pollutants from NGCC plants relative to solid- or liquid-fired units.

7. the cost effectiveness of pollution reduction technologies that may be deployed;

- PJM's most recent CPP report ("EPA's Final CPP: Compliance Pathways Economic and Reliability Analysis" – 9/1/16) concludes:
 - the wholesale cost of electricity within PJM would increase 3.3% for a state-only compliance pathway
 - the wholesale energy price in VA would increase 0.4% from \$46.6/MWh in the Reference case to \$46.8/MWh in the State Rate case in 2025

These mirror E.O. 57 (i.e., the CPP cases referenced and E.O 57 are both state-only assumptions).

10. flexibility in achieving the goals of any carbon reduction regulation.

- Tenaska's recommendations herein for E.O. 57 involve multiple existing generating assets (essentially the entire VA fossil fleet), providing for maximum flexibility.

