Achieving Reliable Decarbonization

The Role of Energy Efficiency and Load Flexibility

Presented by Ryan Hledik, The Brattle Group

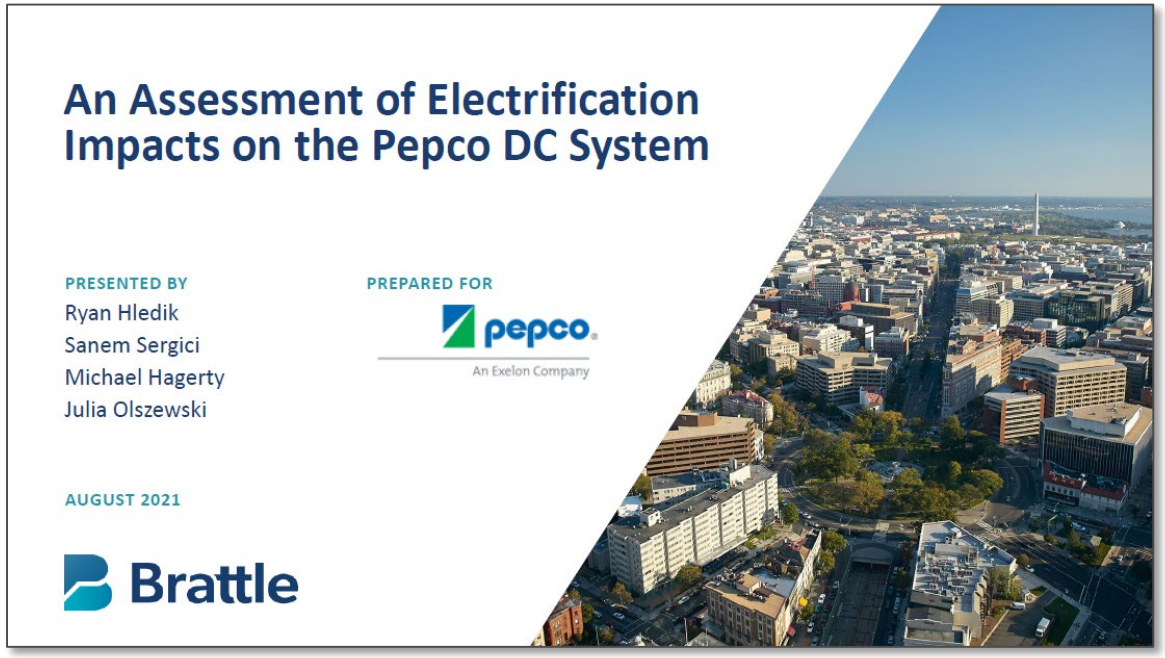
Washington, DC has big decarbonization ambitions

- Economy-wide carbon neutrality by 2050
- 100% clean electricity sector by 2032
- Strong policy emphasis on electrification

Key question: Can the District be electrified without overloading its power grid?

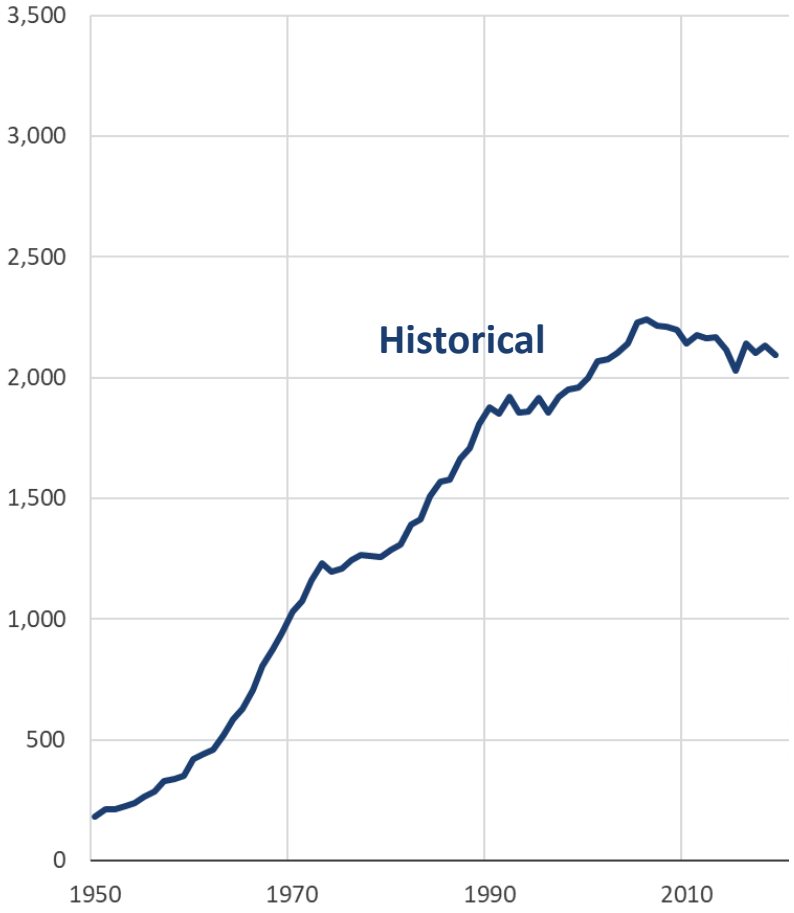
The purpose of our study

- **Assess impact of electrification on Pepco DC system**, assuming climate goals are met primarily through electrification
- **Explore role of energy efficiency (EE) and load flexibility** in managing system impacts



Download from: DC PSC Website.

Pepco DC's historical system peak demand



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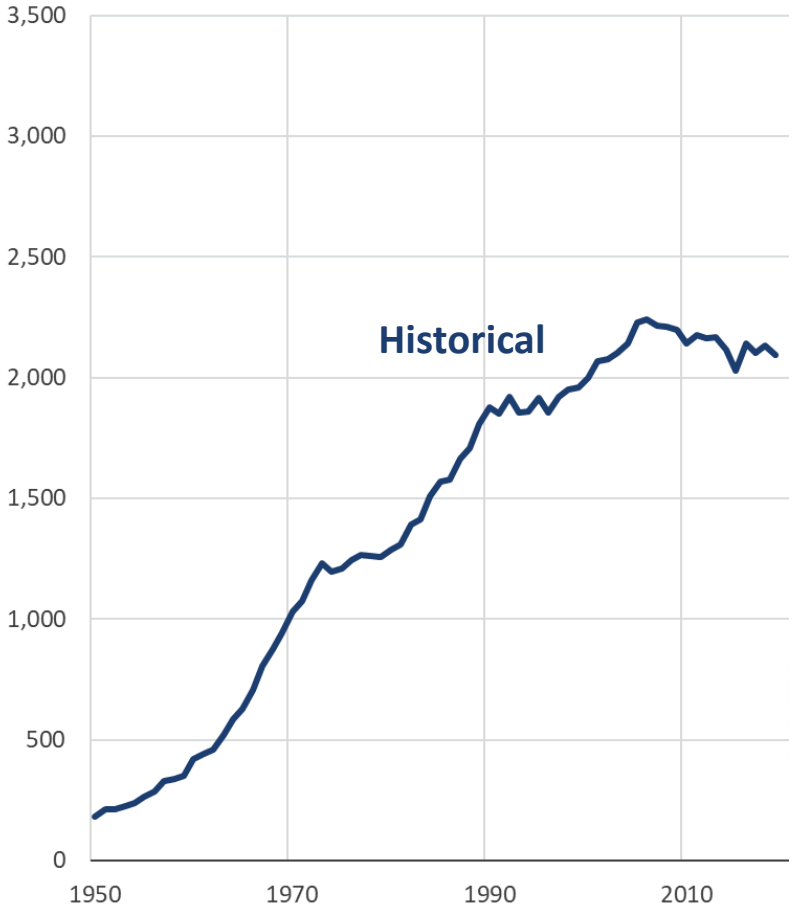

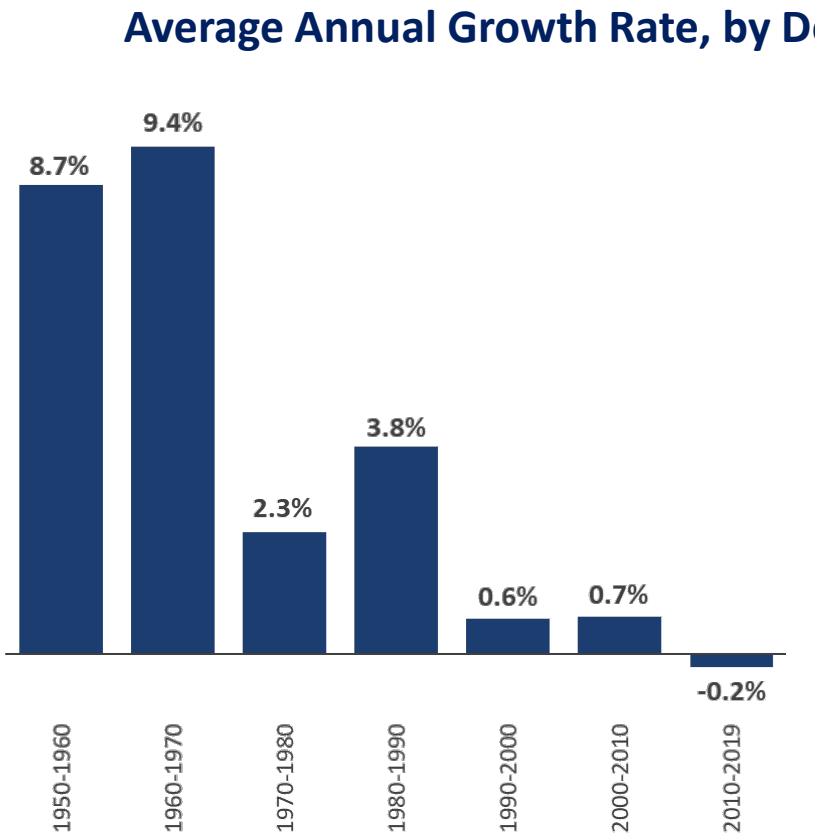

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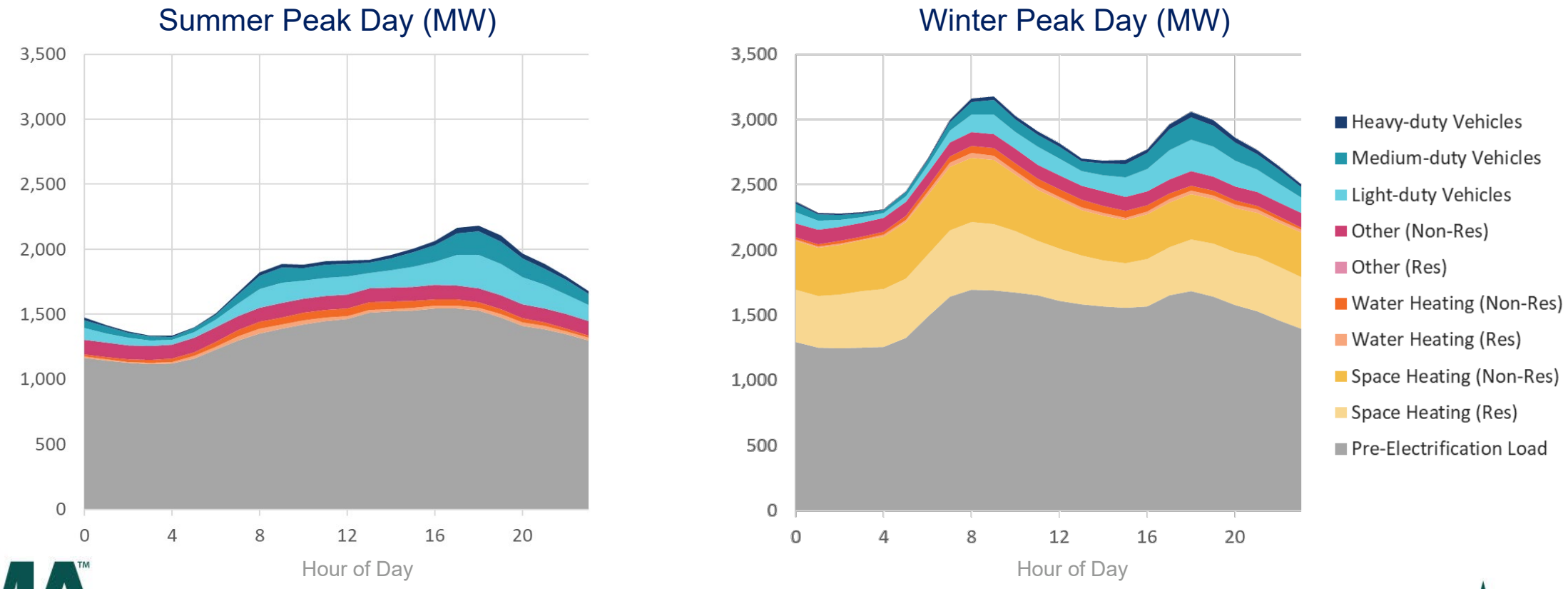
The system load impacts of full* electrification

* 100% of light-duty vehicles and 95% of buildings

2050 Pepco DC Load Profile with Electrification

Before EE and Load Flexibility



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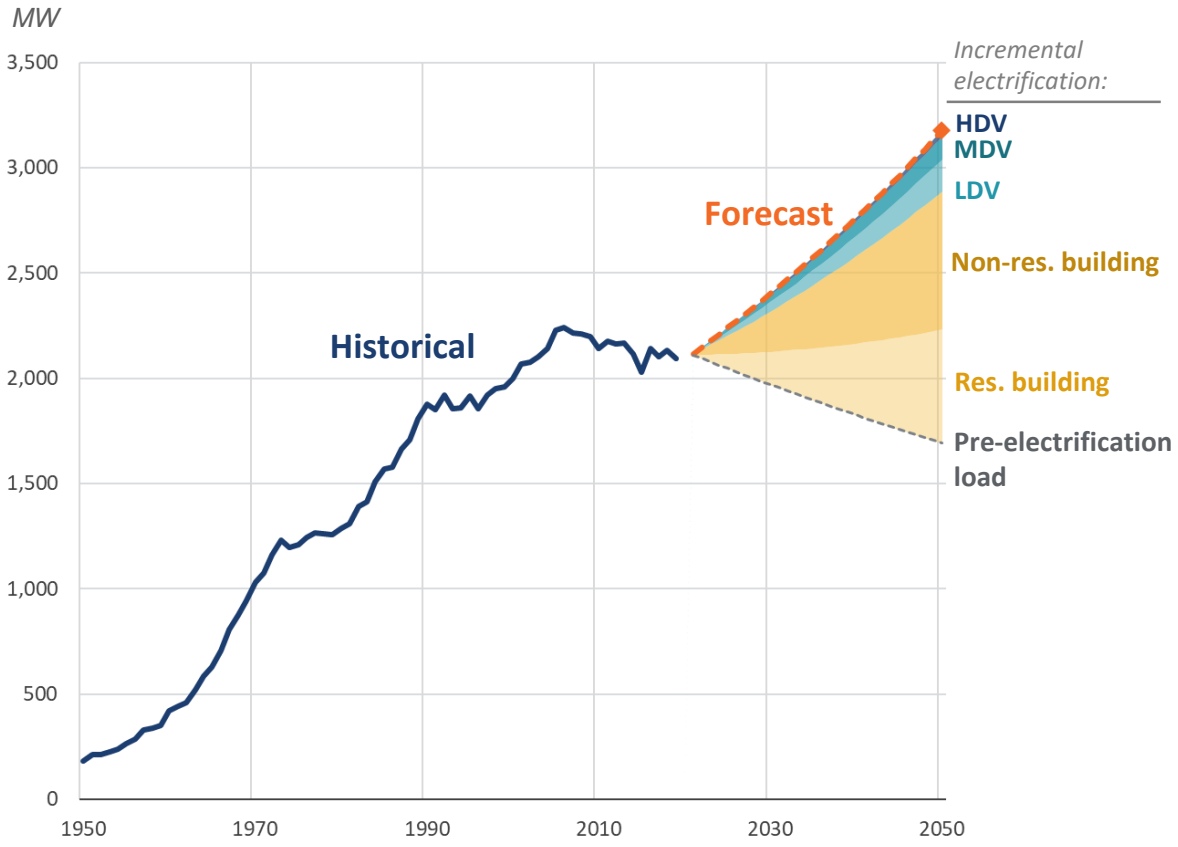
Pepco DC's system peak demand w/electrification



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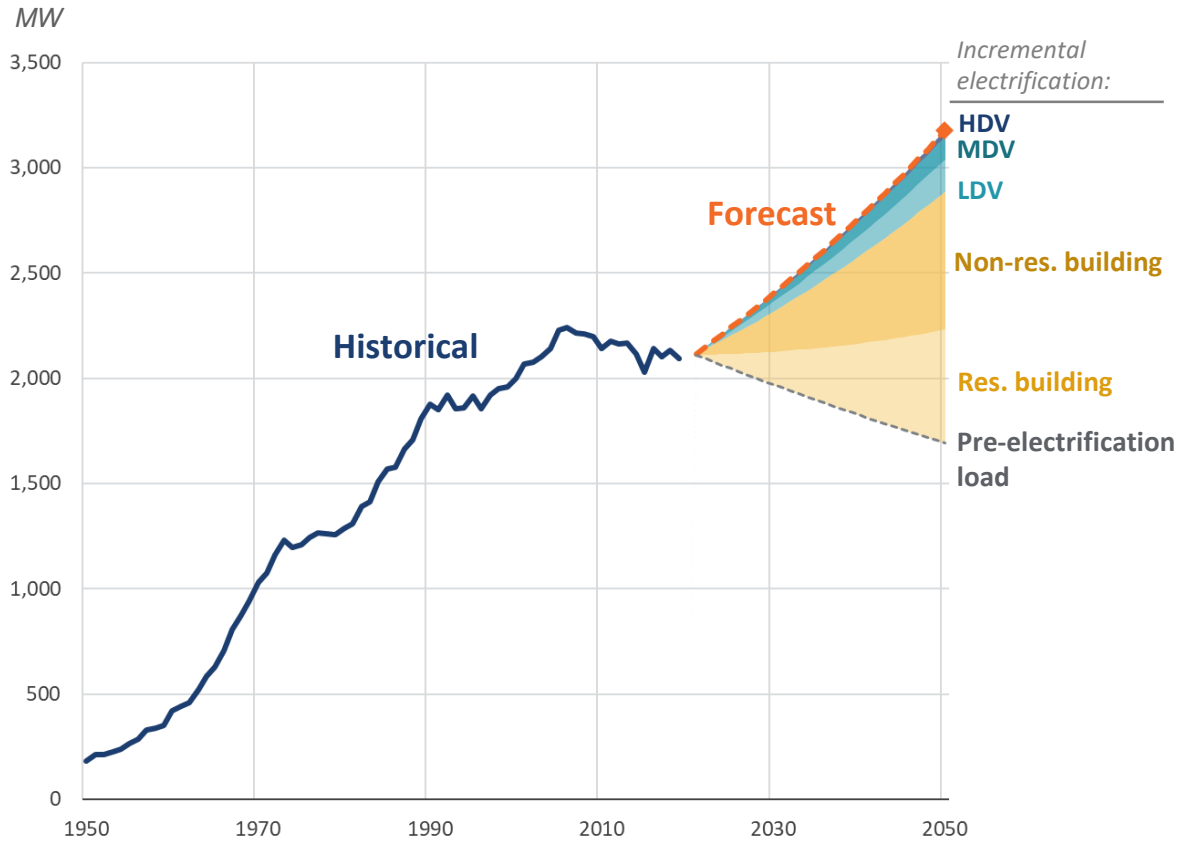

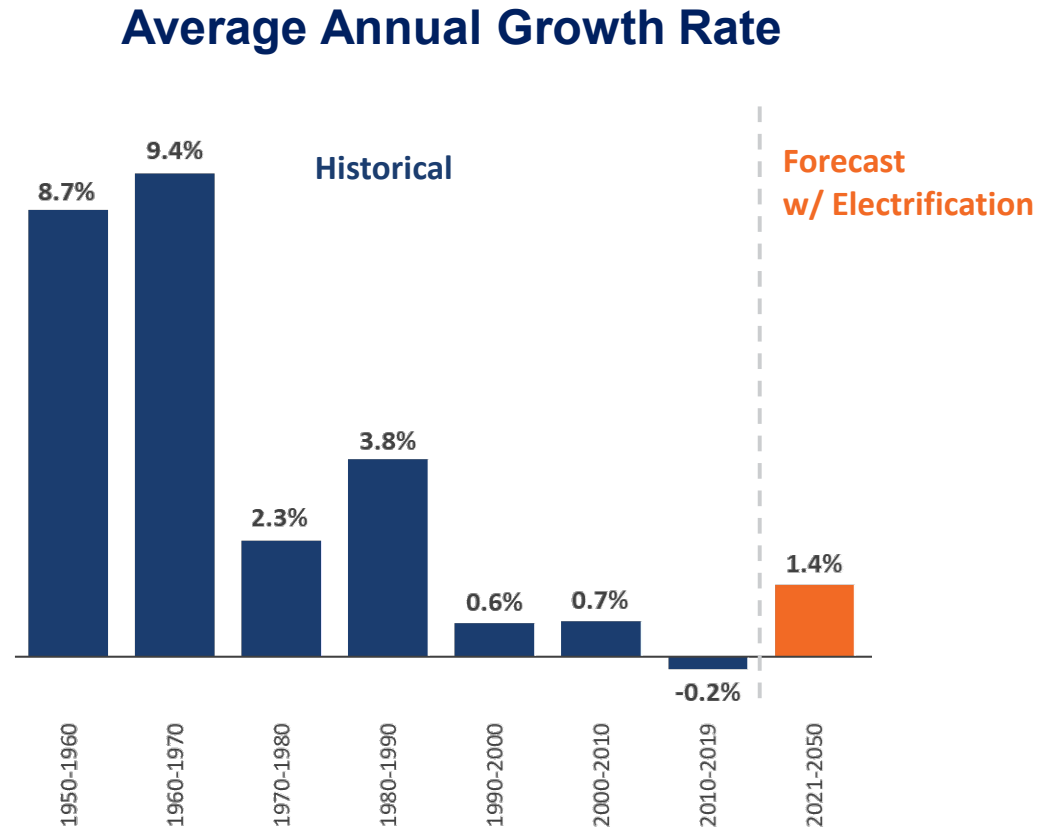

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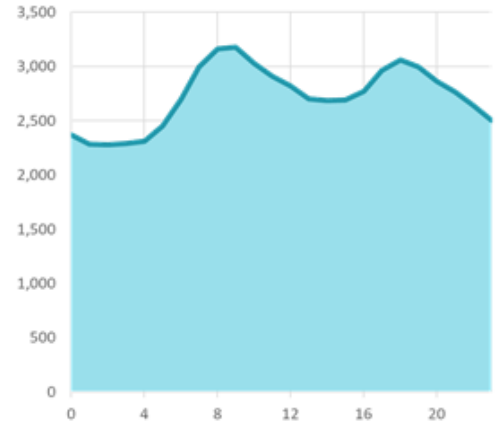
EE and load flexibility programs

Modeled options are based on achievable levels of customer enrollment, target winter peak

	EE / Load Flexibility Options	Description	Modeled 2050 peak reduction potential
Energy Efficiency	**High efficiency heat pumps**	Higher efficiency heat pumps are adopted when converting building space heating to electricity	3.5% (110 MW)
	Expanded EE initiatives	New EE initiatives would exceed business-as-usual efforts that are embedded in the baseline load forecast (e.g., focused improvements in building thermal envelope)	4.2% (135 MW)
Residential Load Flexibility	**Dynamic pricing**	Opt-in critical peak pricing (CPP) rate, with critical peak price that is 10x higher than the off-peak price.	1.5% (45 MW)
	Smart thermostat pre-heating	Homes are pre-heated before the morning peak period in order to reduce heating needs during the peak period.	0.9% (30 MW)
	Home EV charging TOU	TOU rates shift evening home EV charging load later in the night.	4.7% (140 MW)
	Behind-the-meter (BTM) storage	Customers with BTM batteries are eligible to participate in a storage load flexibility program, in which Pepco can discharge the battery on a limited number of days per year.	2.4% (75 MW)
Non-residential Load Flexibility	**Interruptible tariff**	Large commercial customers agree to curtail usage during the morning peak period for a limited number of events per year.	3.7% (115 MW)
	Dynamic pricing	A CPP rate with a critical peak price during the winter morning peak period.	1.8% (60 MW)
	Pre-heating	Similar to the residential program, commercial heating load is shifted from the morning peak period to earlier in the day by pre-heating the building.	0.4% (15 MW)

The impact of EE and load flexibility

1 Unmitigated 2050 Pepco DC load on winter peak day



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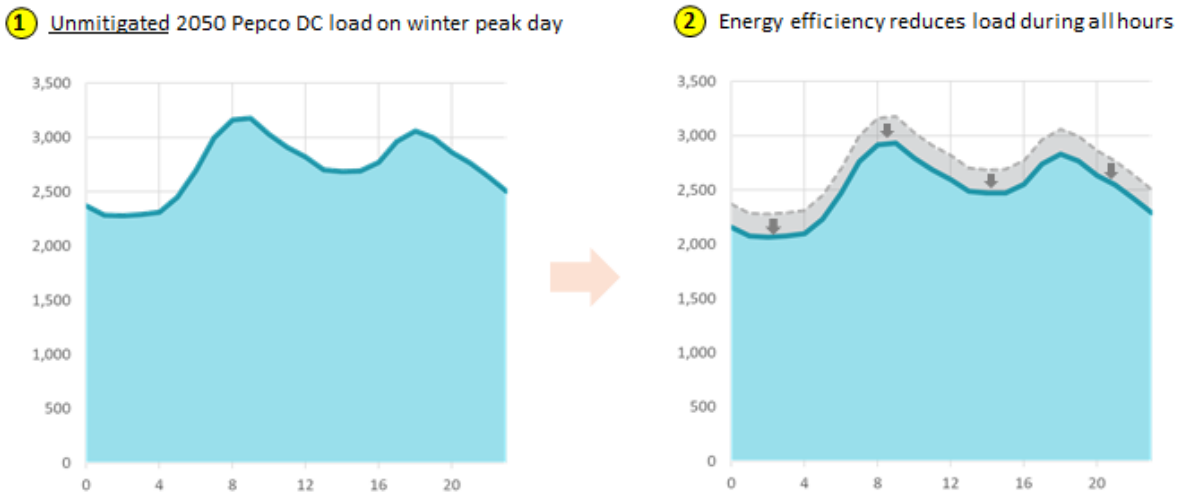

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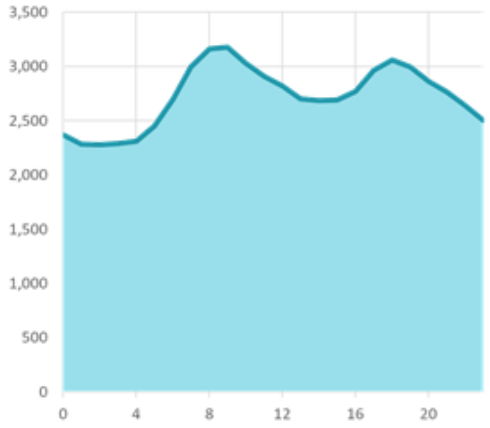
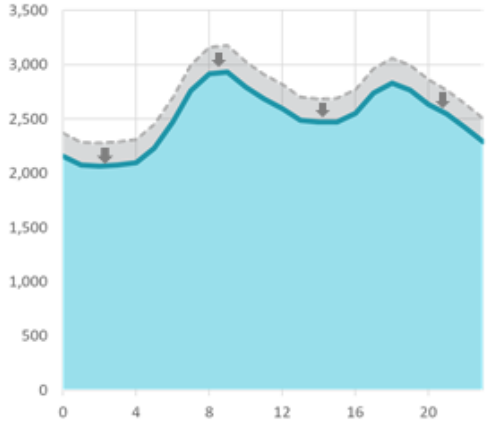
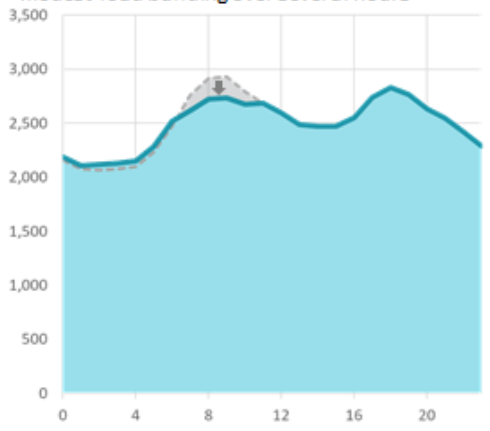


2 Energy efficiency reduces load during all hours



3 Dynamic pricing, interruptible tariffs, pre-heating, and BTM storage clip the morning peak with modest load building over several hours



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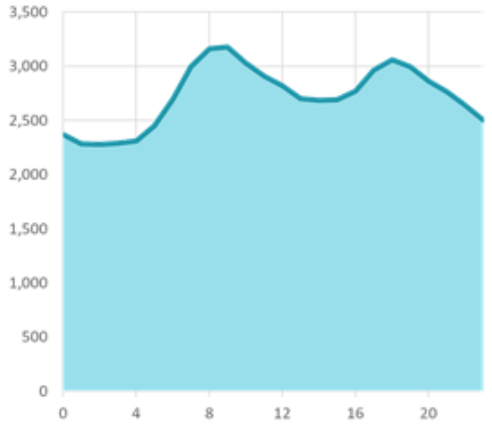

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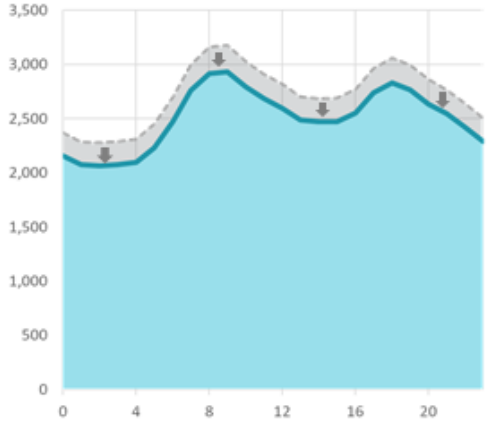

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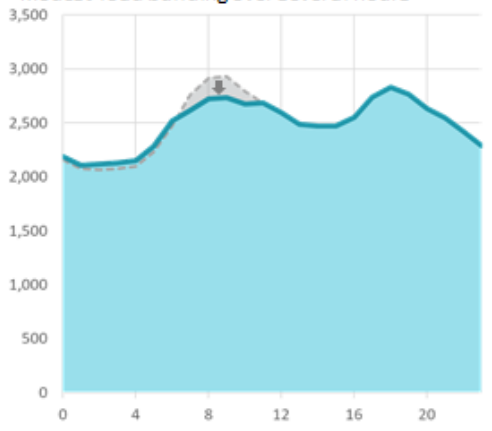
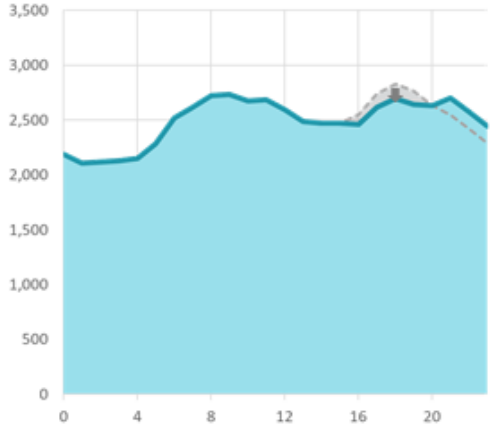


4 EV TOU reduces evening peak, shifting charging load to later hours



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The impact of EE and load flexibility

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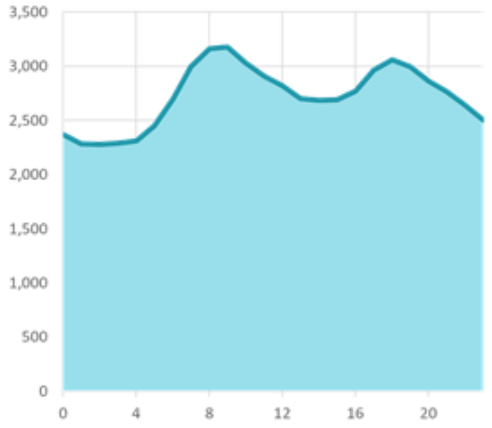

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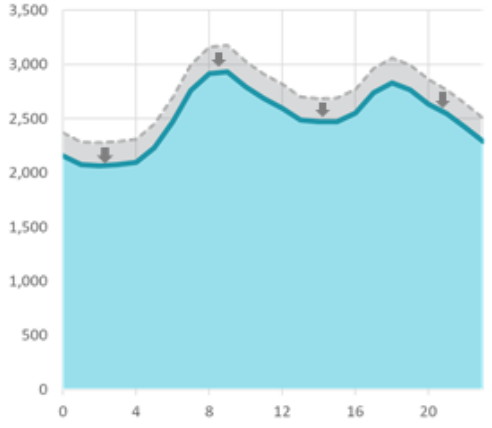

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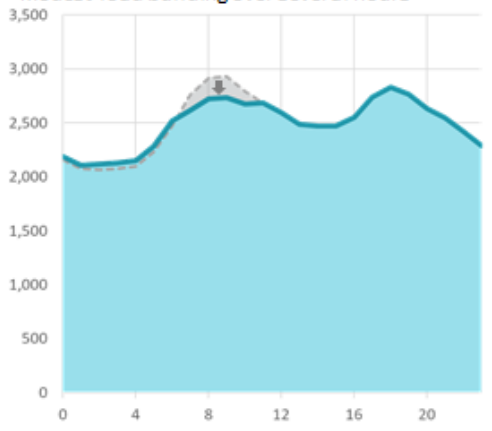

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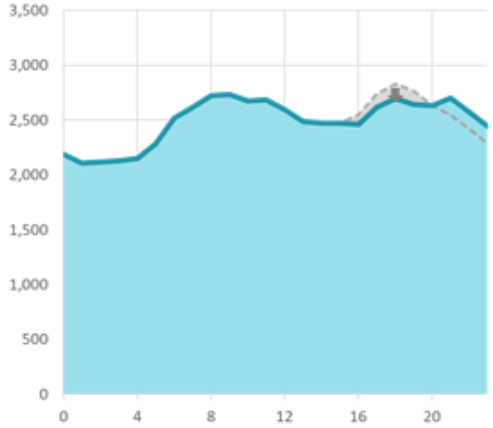
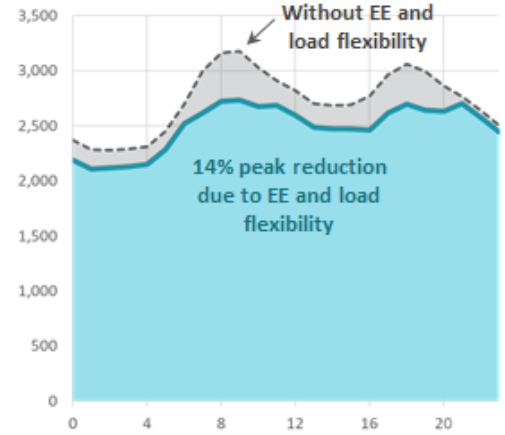


5 Mitigated 2050 Pepco DC load on peak day



Note: Load impacts are shown for one illustrative portfolio. EE and load flexibility options could be pursued in different combinations, with varying operational strategies and levels of enrollment.

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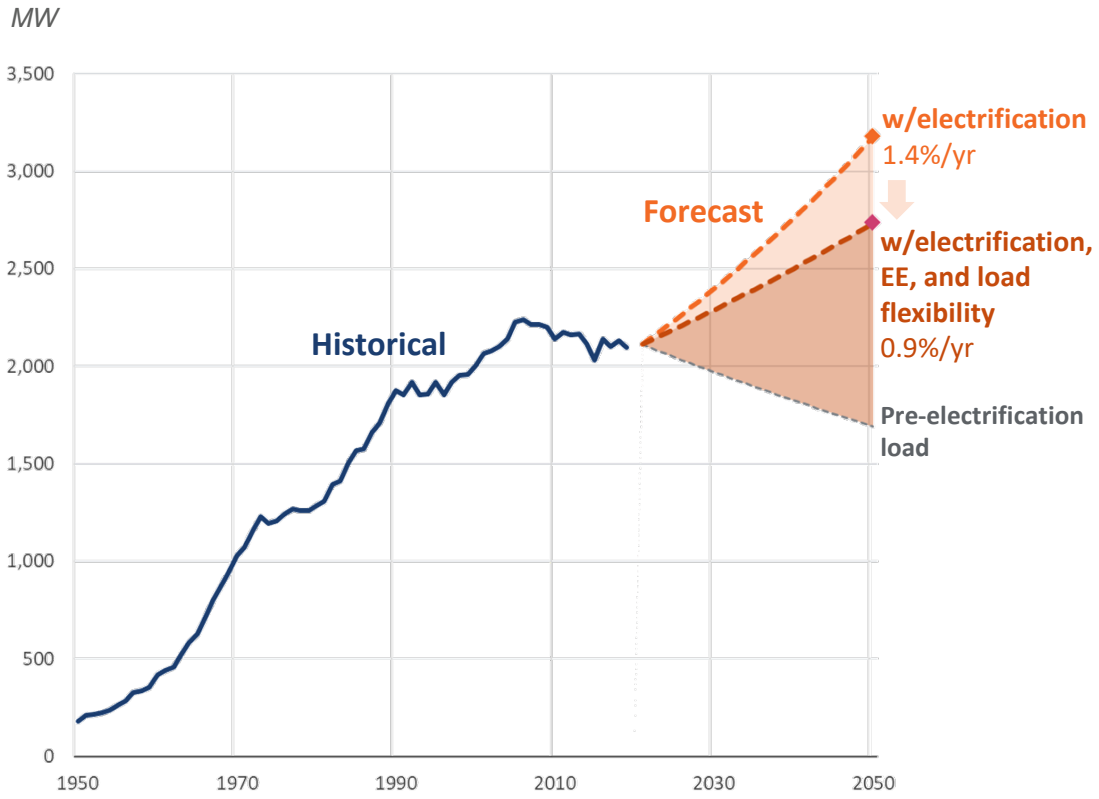
Pepco DC's system peak demand with electrification, EE, and load flexibility



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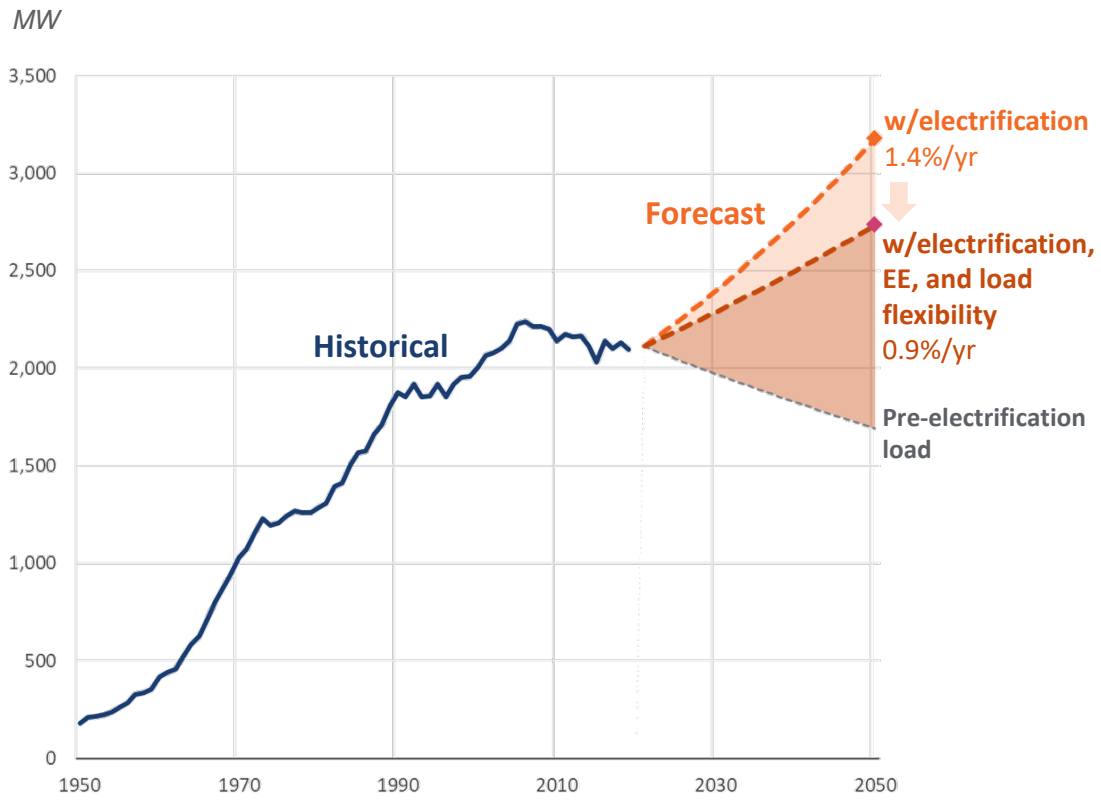

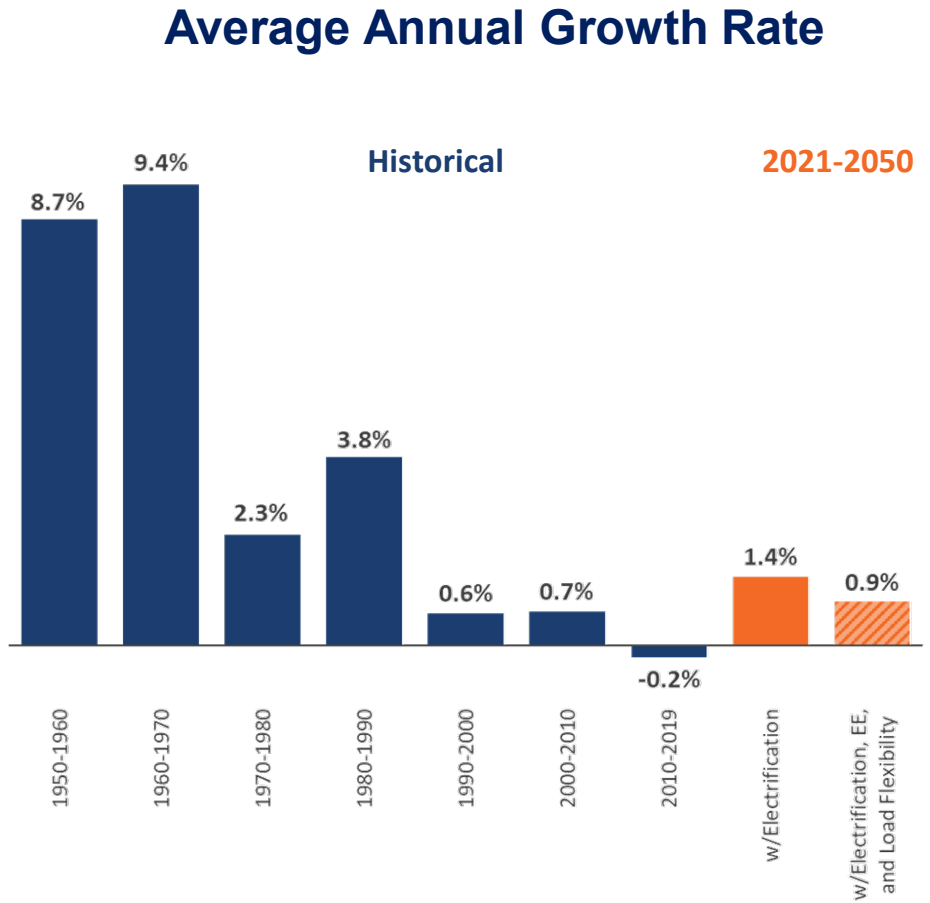

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Concluding observations

- Every utility is different – tailored analysis is needed
- A long policy horizon helps, but planning and investment need to start soon
- EE and load flexibility will be critical for regulatory approval of decarbonization plans

Pepco's new Climate Solutions Plan embodies these observations

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