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The Value of Regression Models in Determining Industrial Energy Savings

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Lawrence Berkeley National Laboratory

ECEEE Industrial Efficiency 2016

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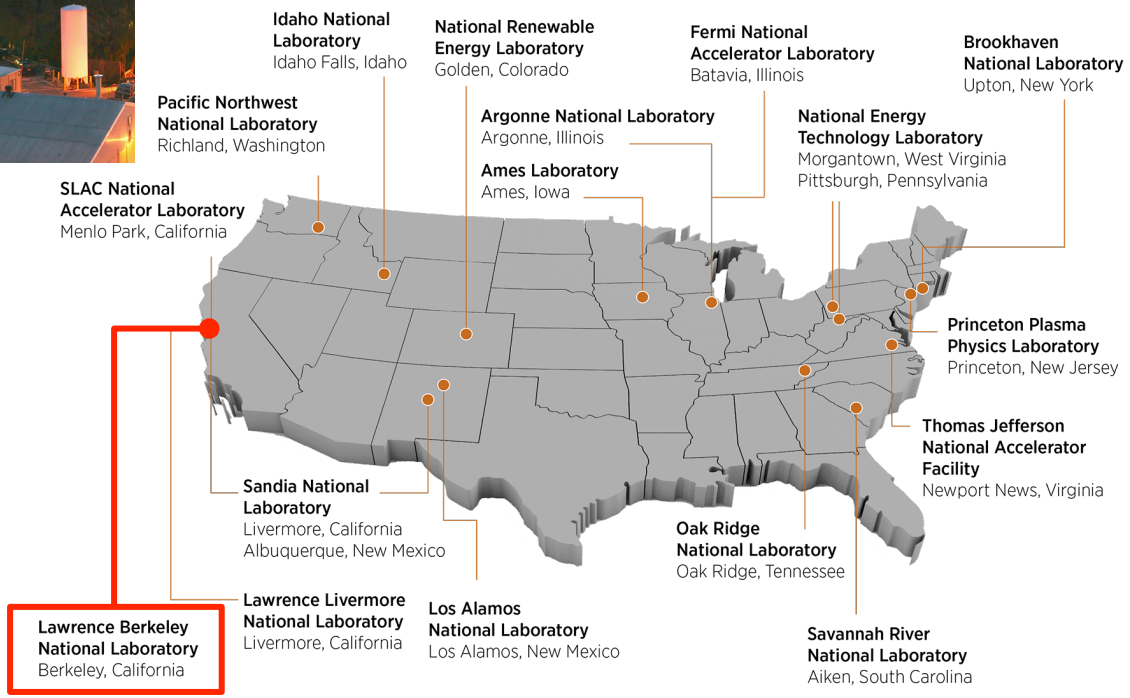
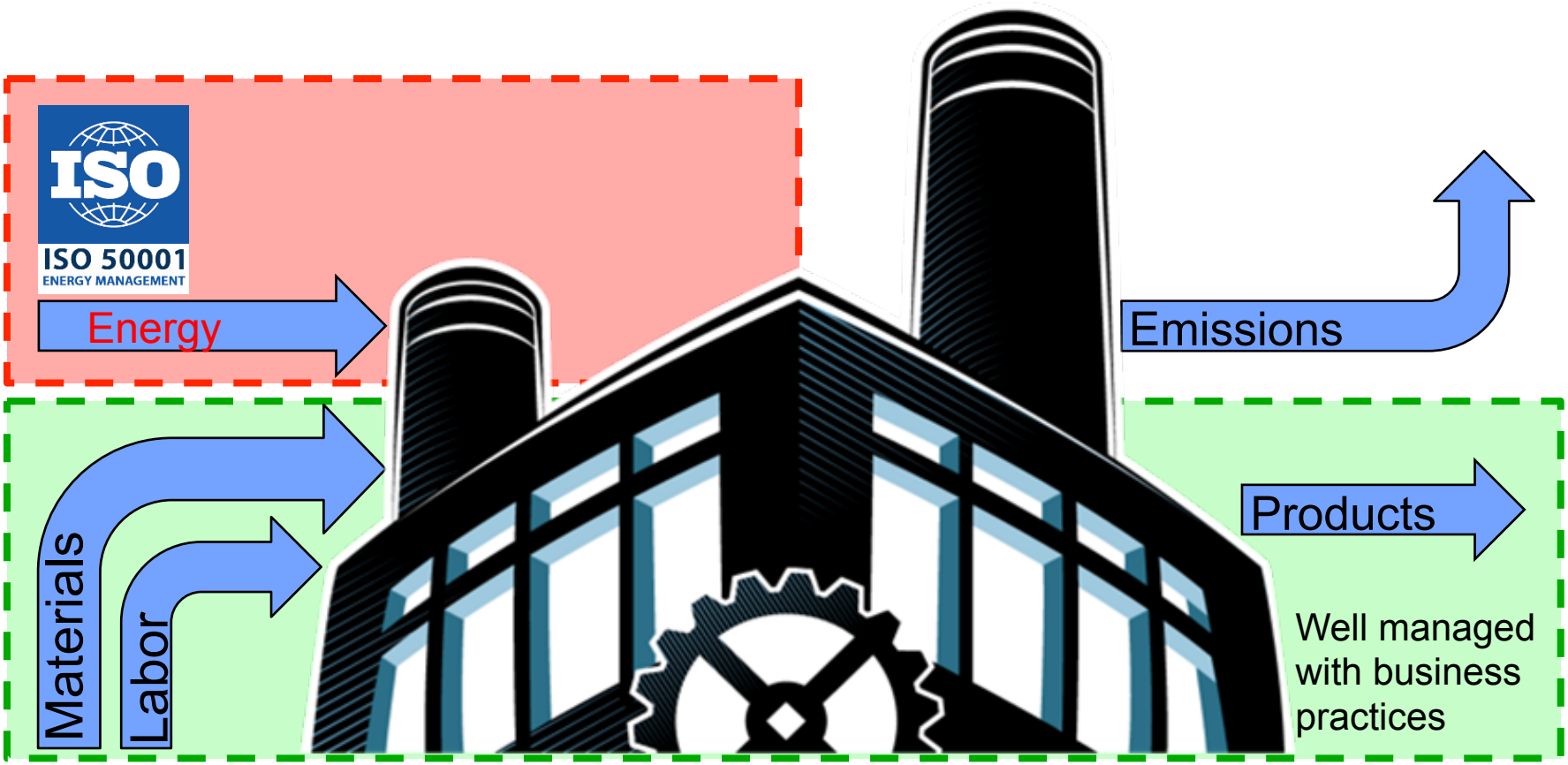
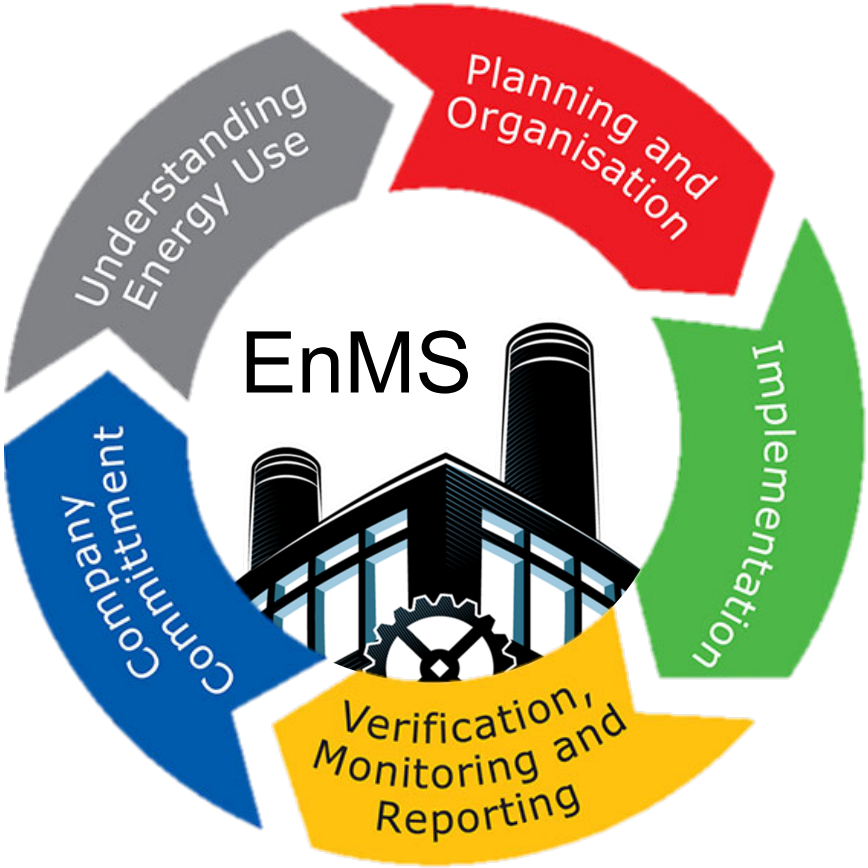
Lawrence Berkeley National Laboratory



ISO 50001 Overly Simplified



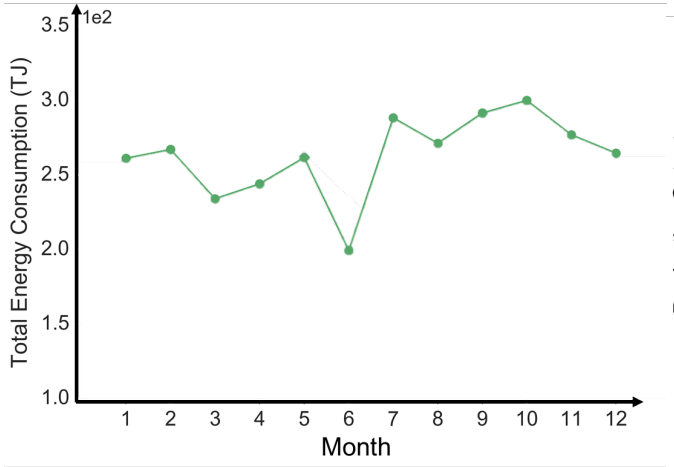
Energy Management Systems



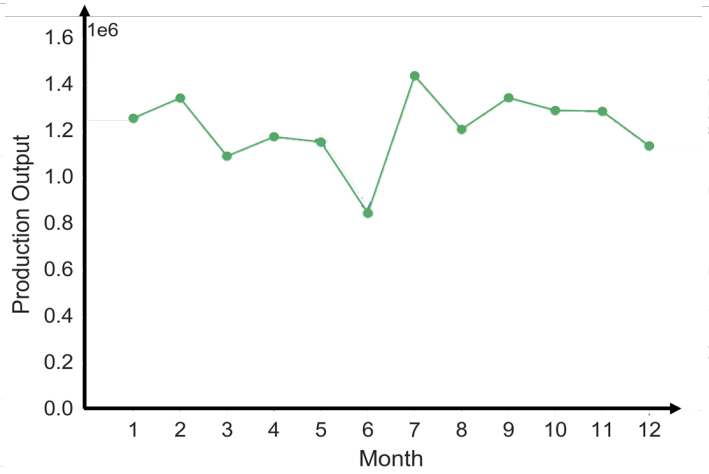
Three Approaches to Energy Savings Calculations

1. Absolute
2. Intensity
3. Normalization

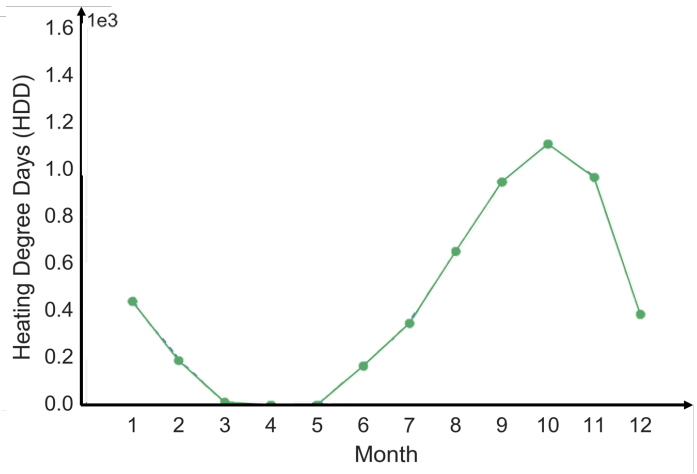
Energy consumption



Relevant variable 1



Relevant variable 2

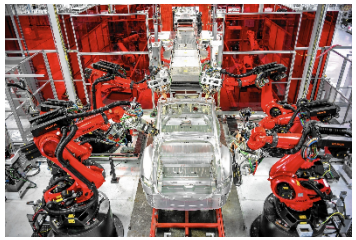


Analysis of Five Industrial Facilities using the three Approaches

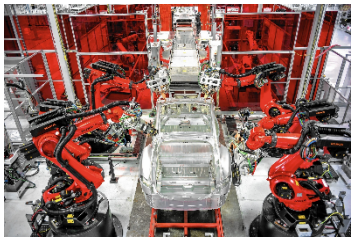
Chemical

Equipment Manufacturing

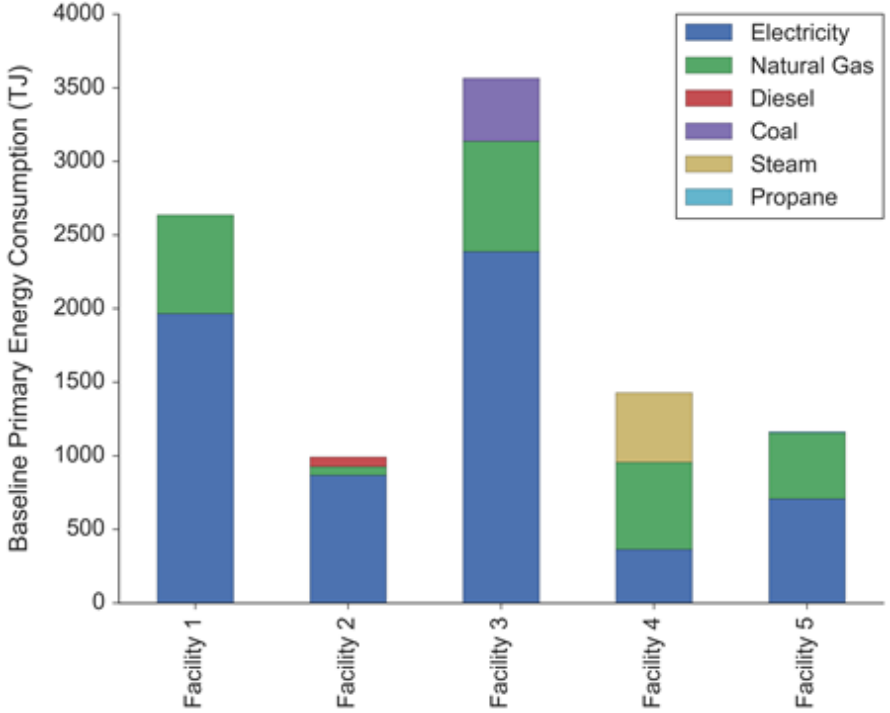
Food Processing



Automotive Assembly



Automotive Assembly



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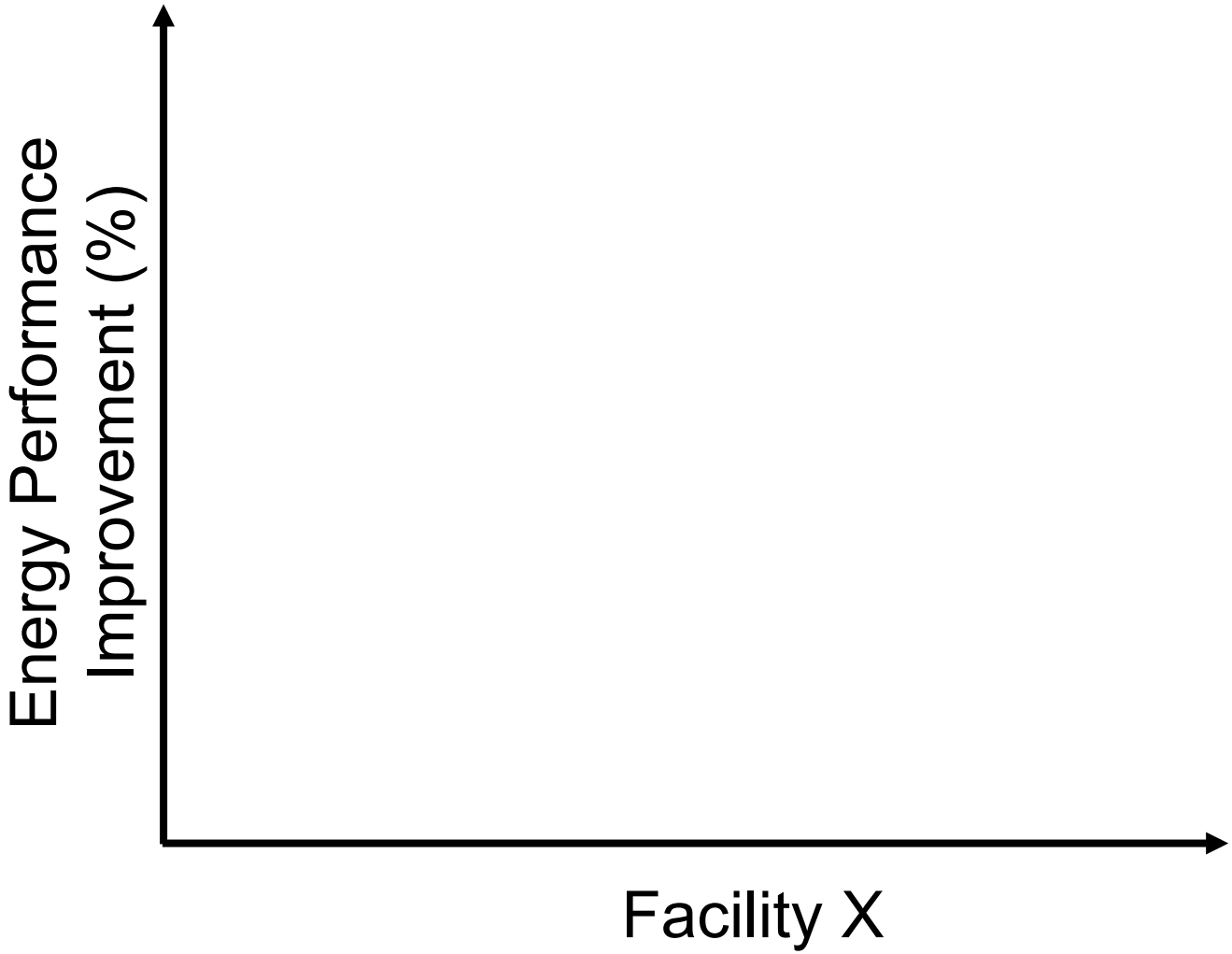
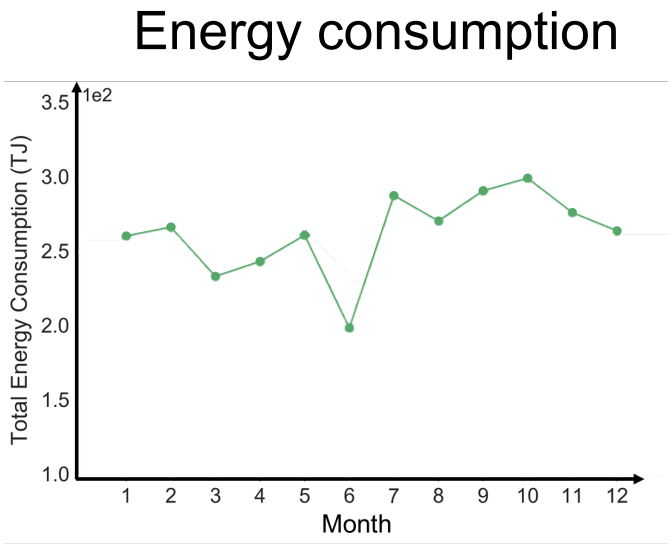
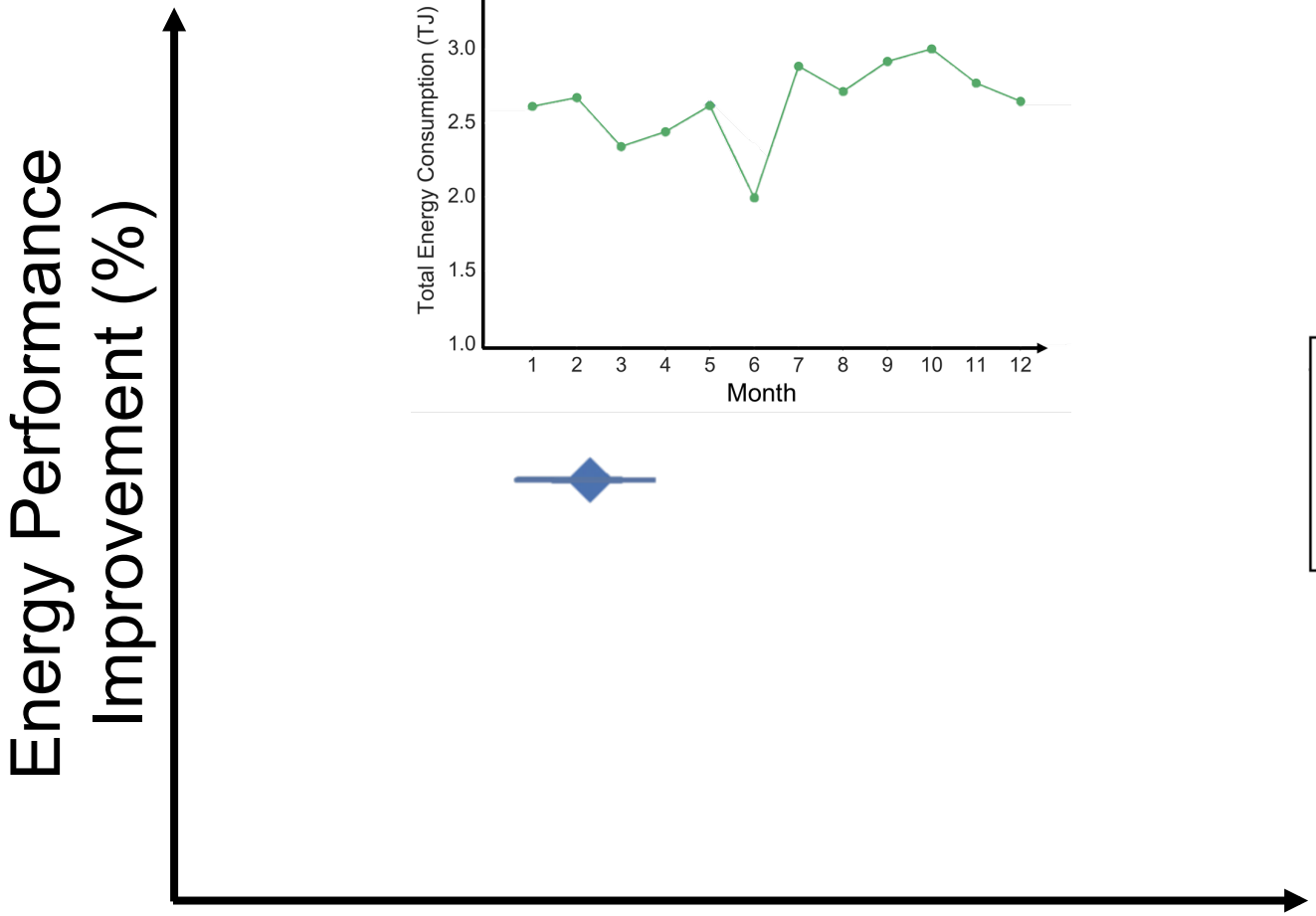
SEP M&V protocol to calculate forecast energy savings for normalization

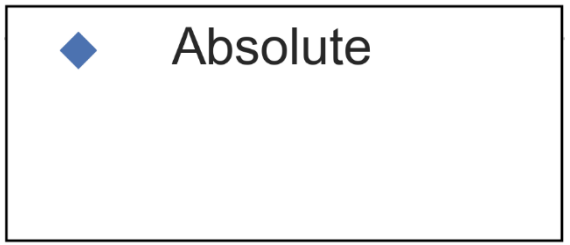
Facility Wide Energy Savings



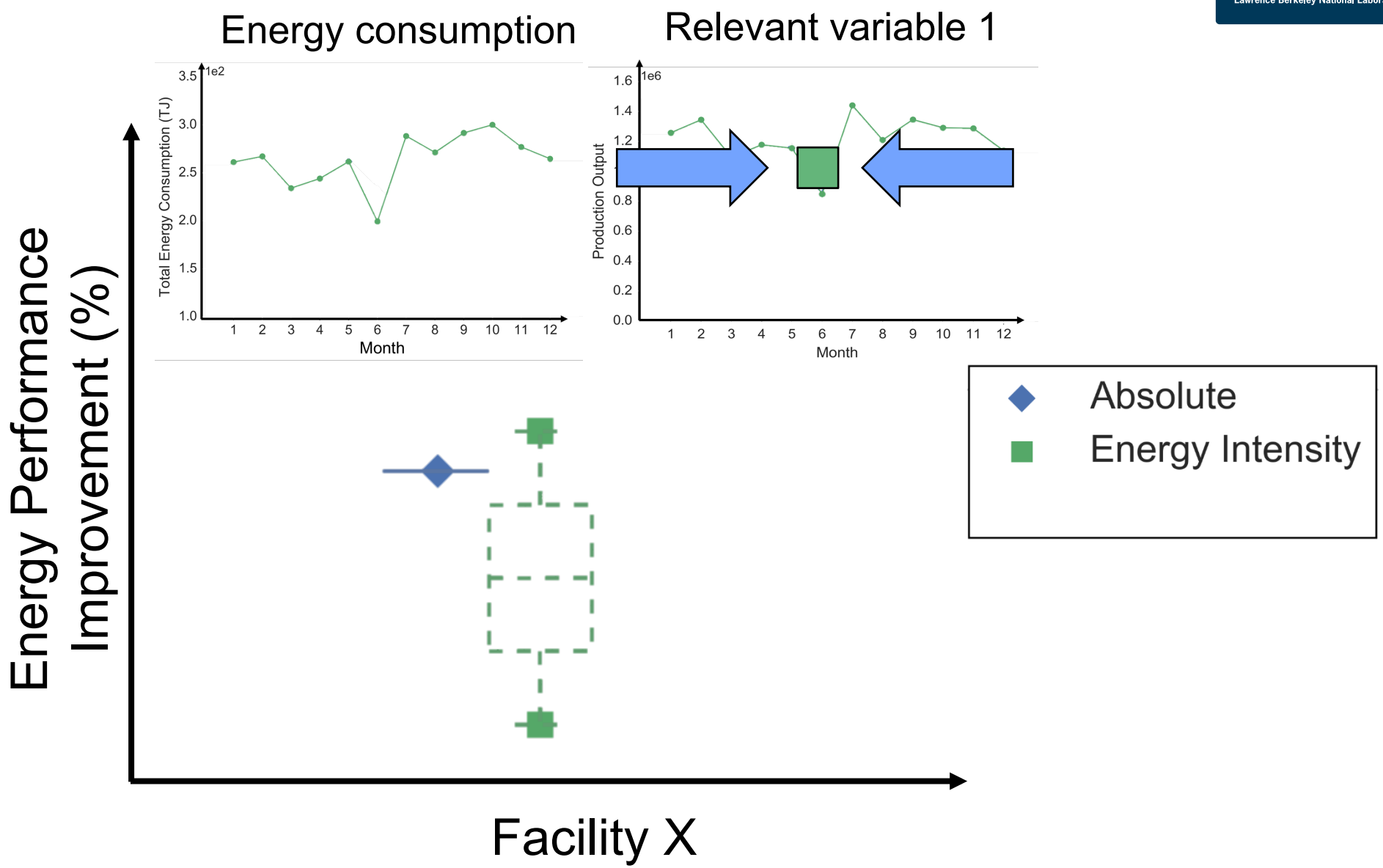
Facility Wide Energy Savings



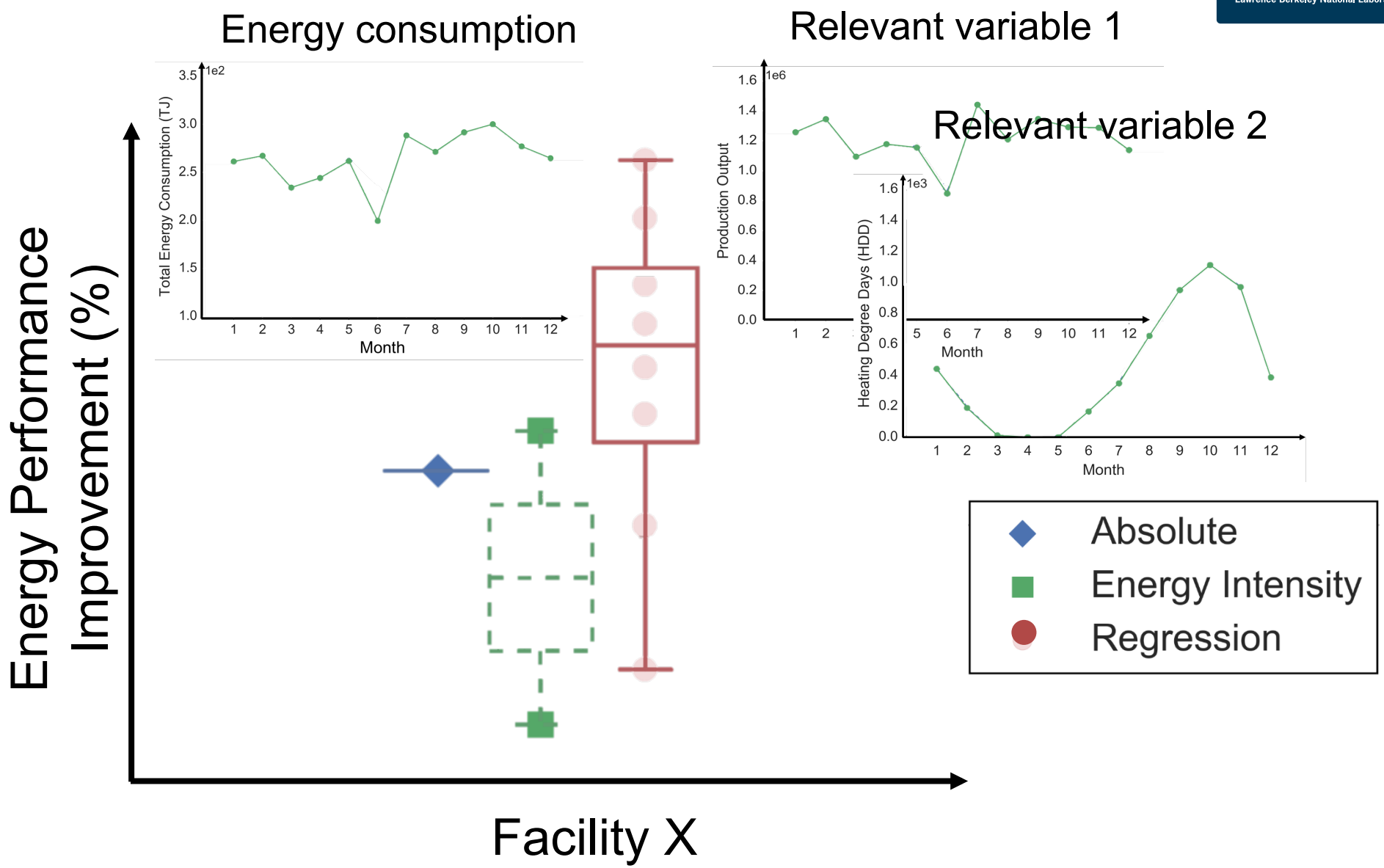




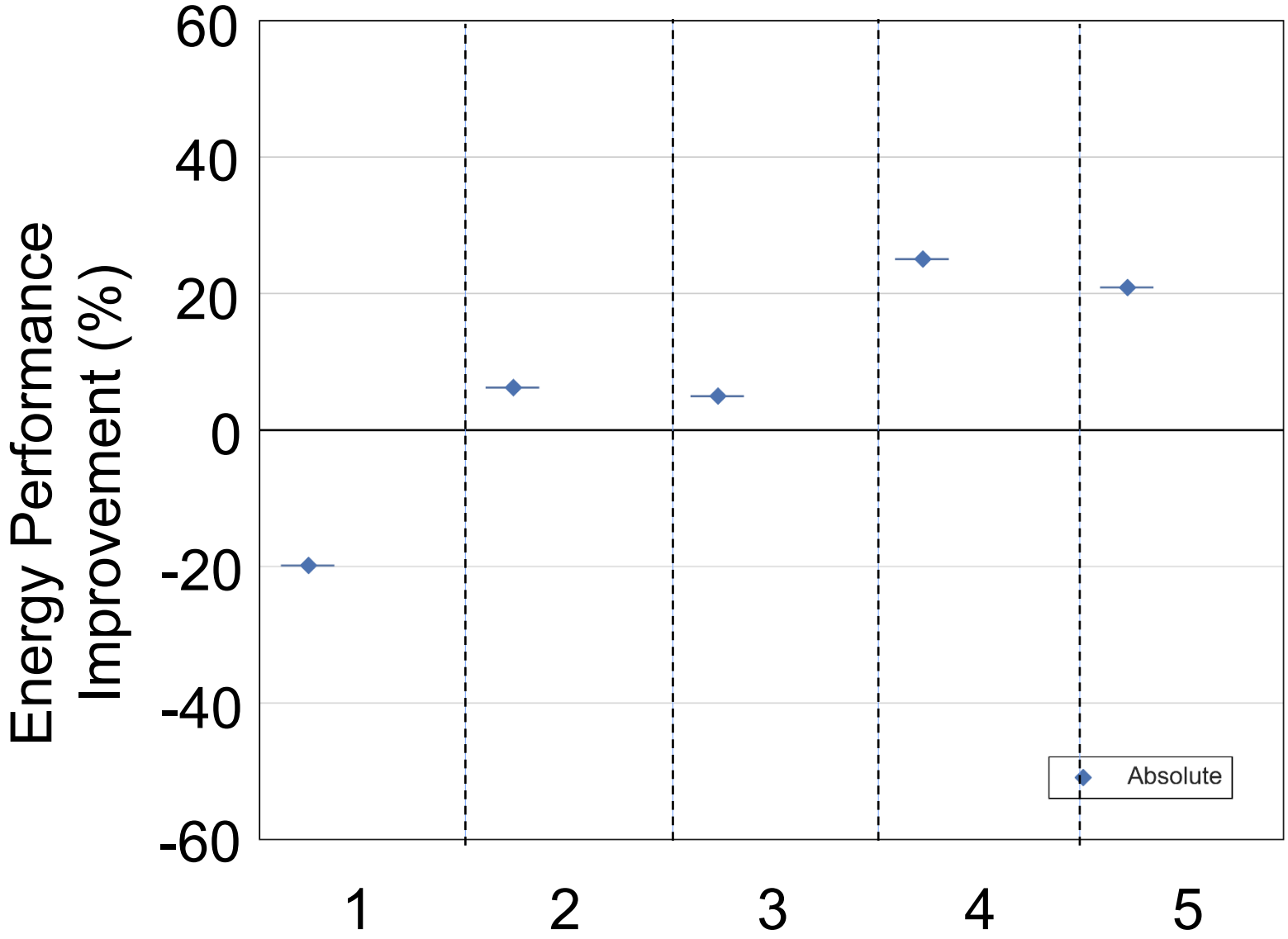
Facility Wide Energy Savings



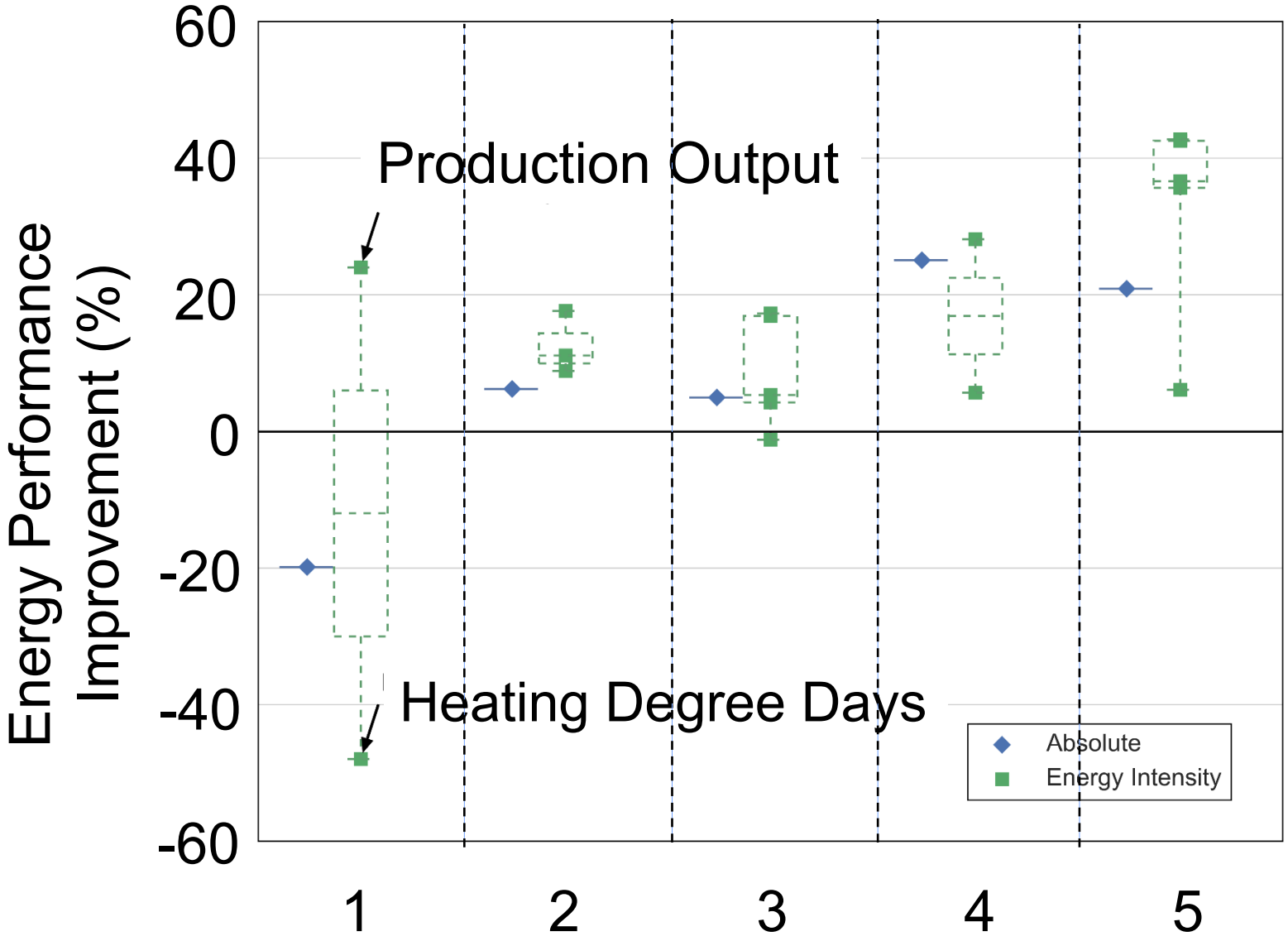
Facility Wide Energy Savings



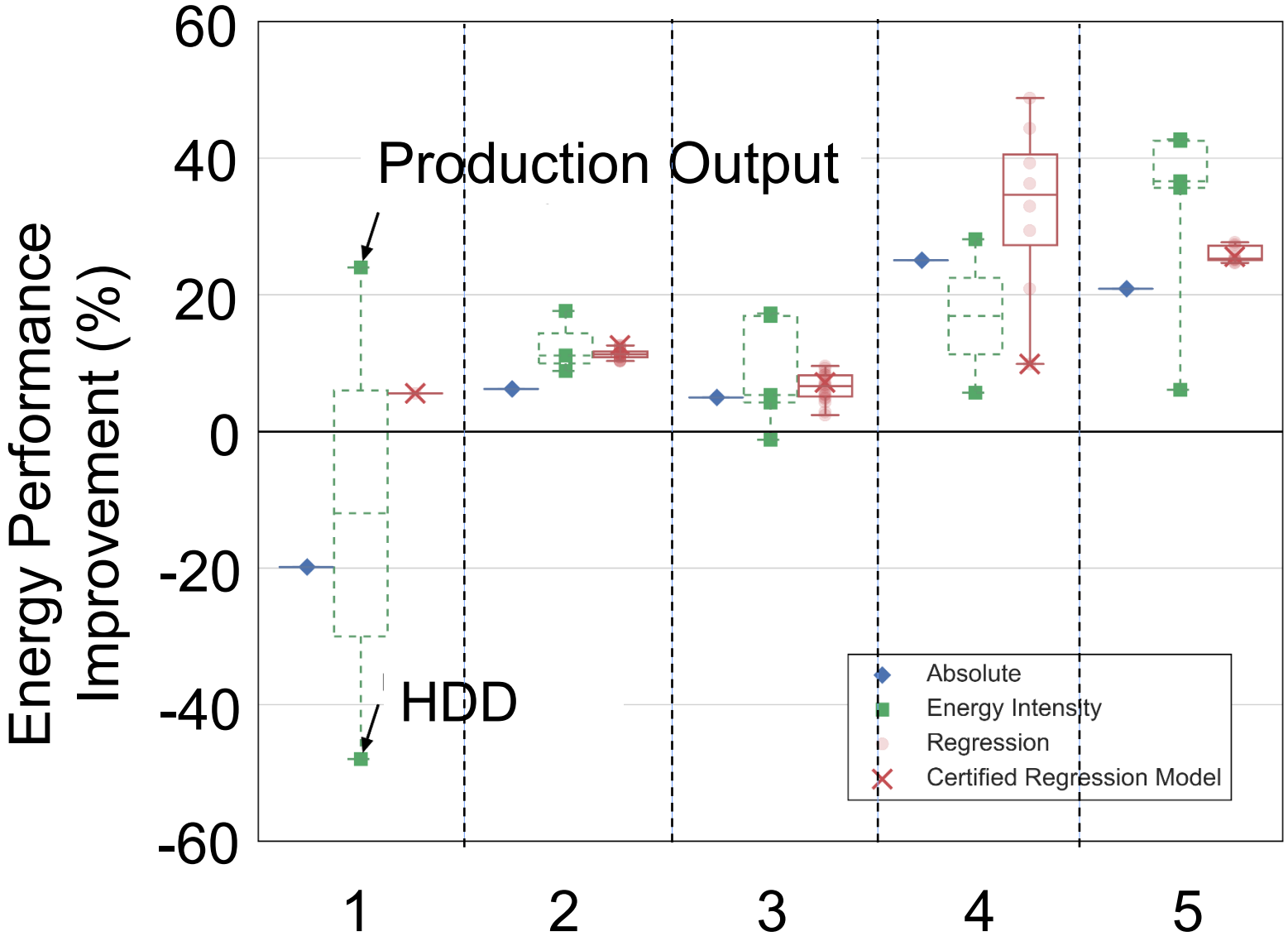
Snapshot of Analysis Results



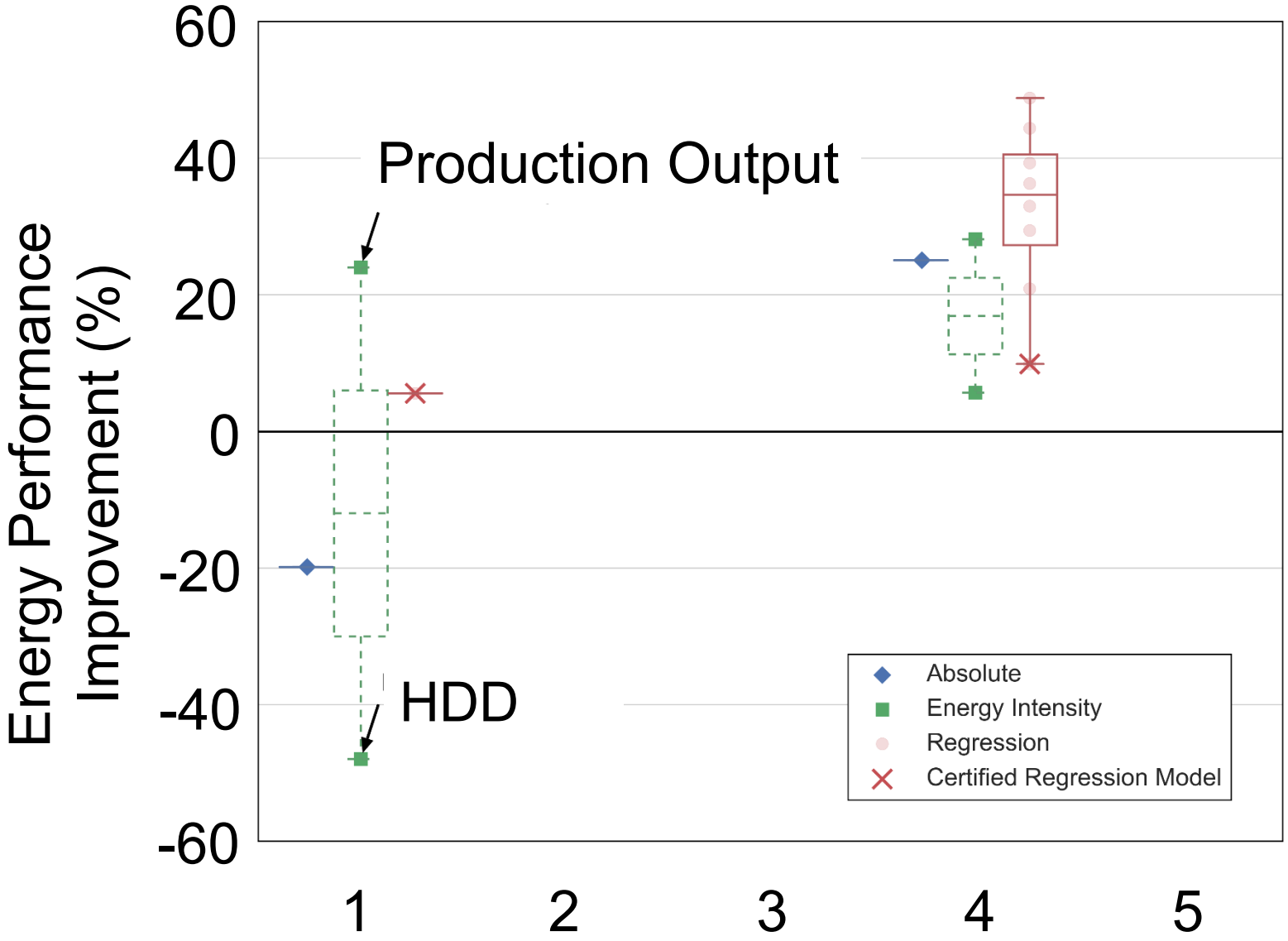
Snapshot of Analysis Results



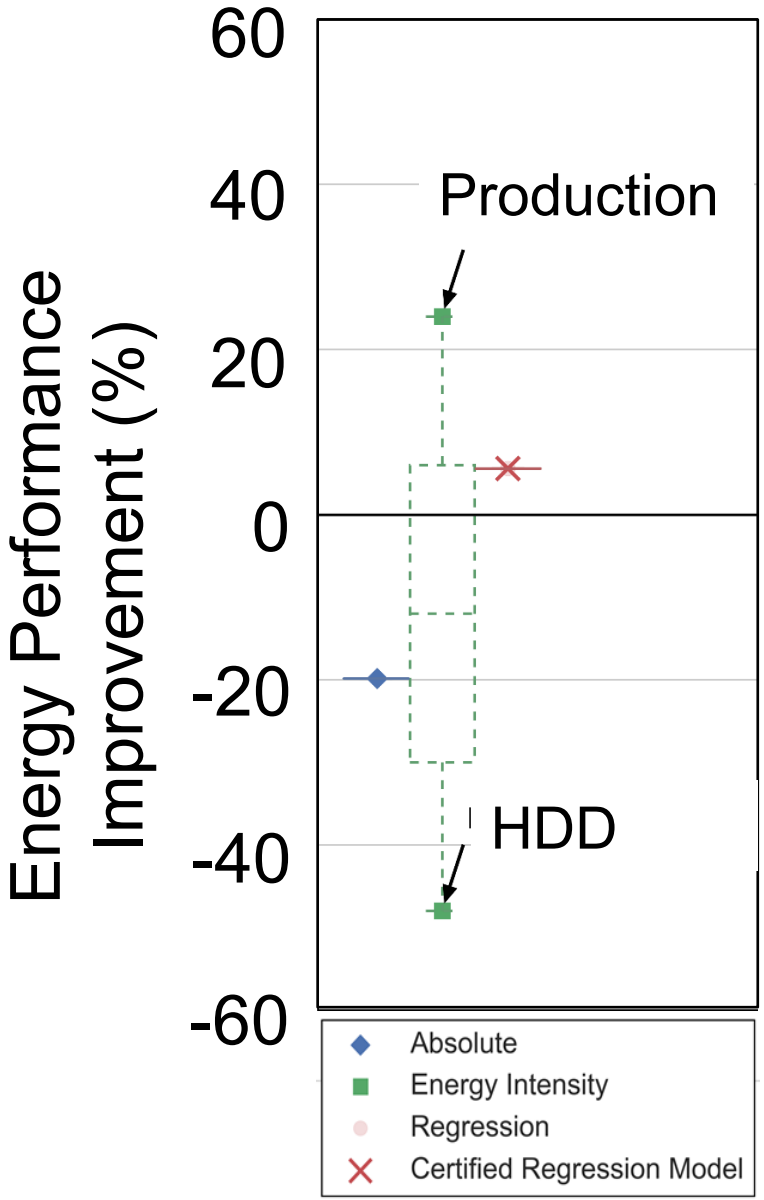
Snapshot of Analysis Results



Focusing on Facilities 1 and 4



Facility 1 – A Case Where Normalization Makes Sense to Use



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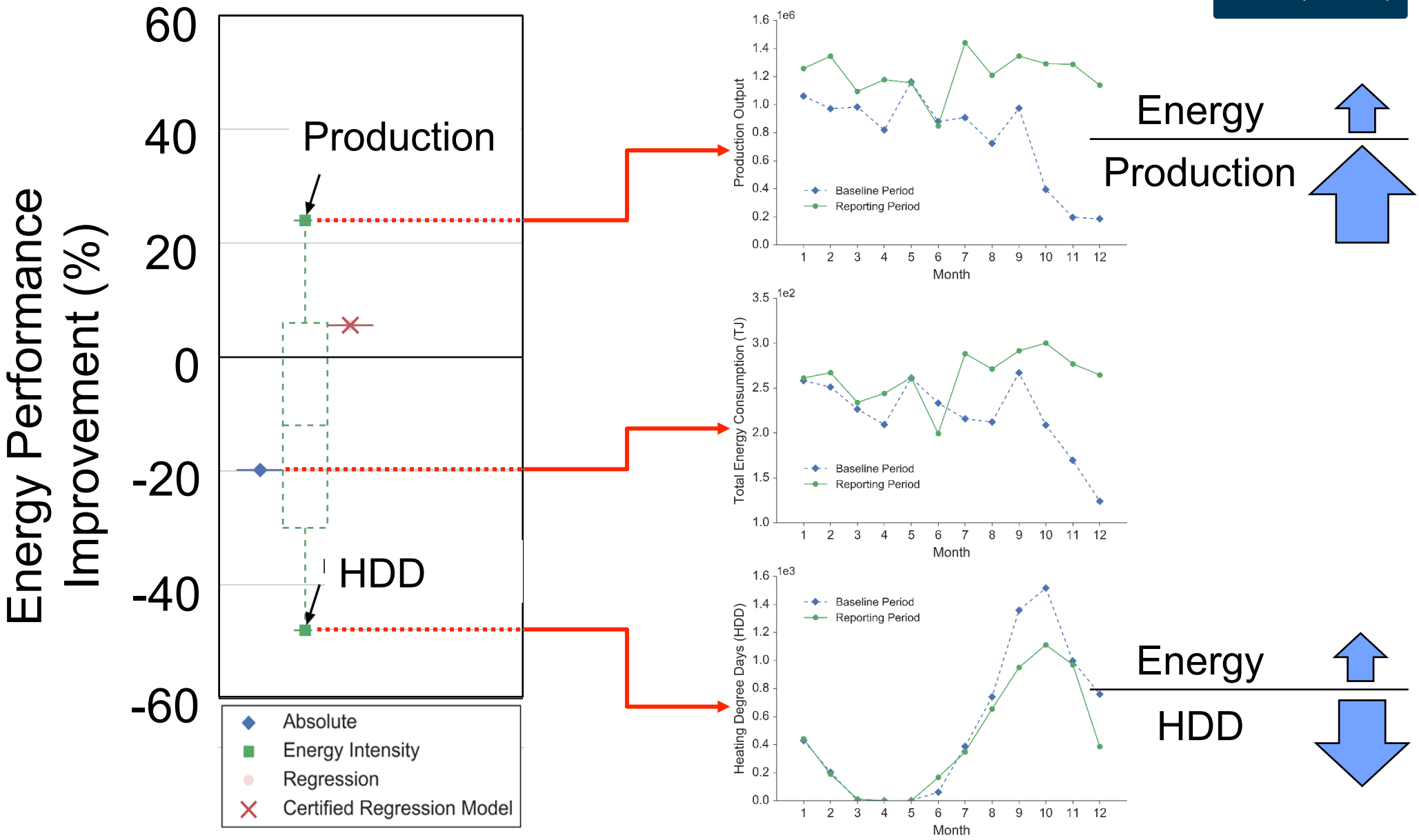
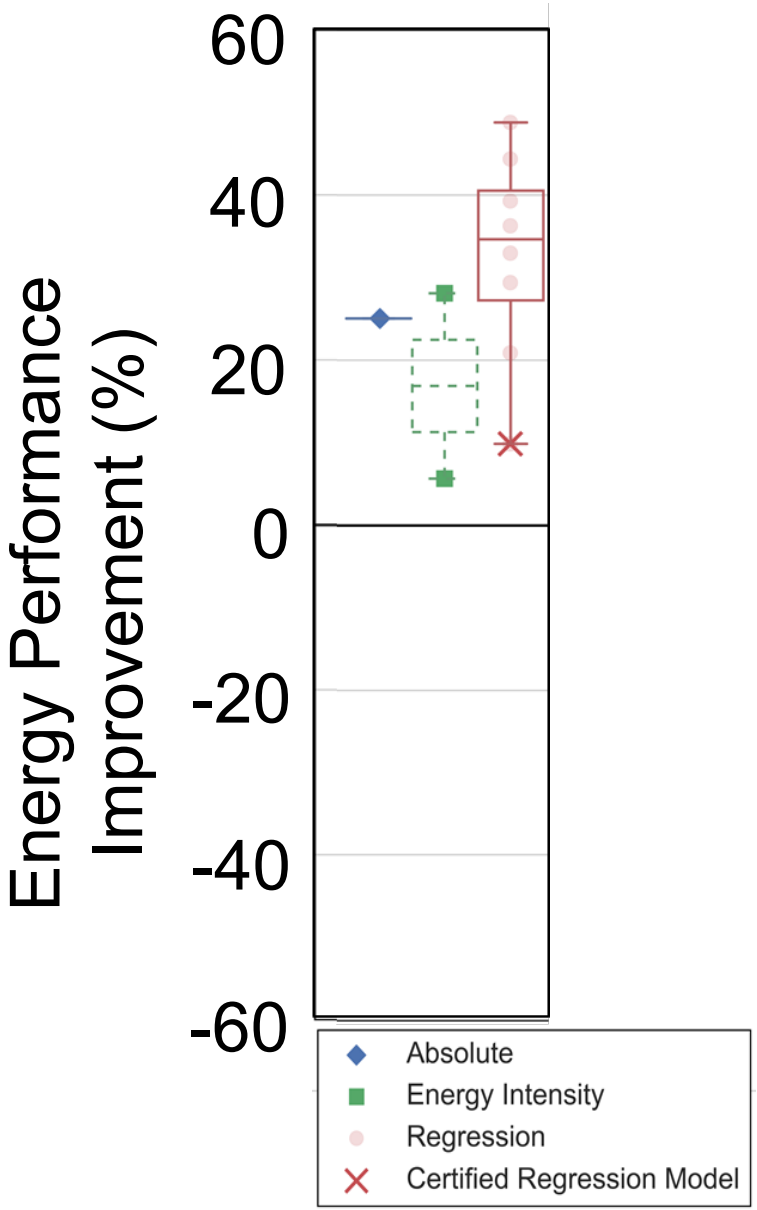
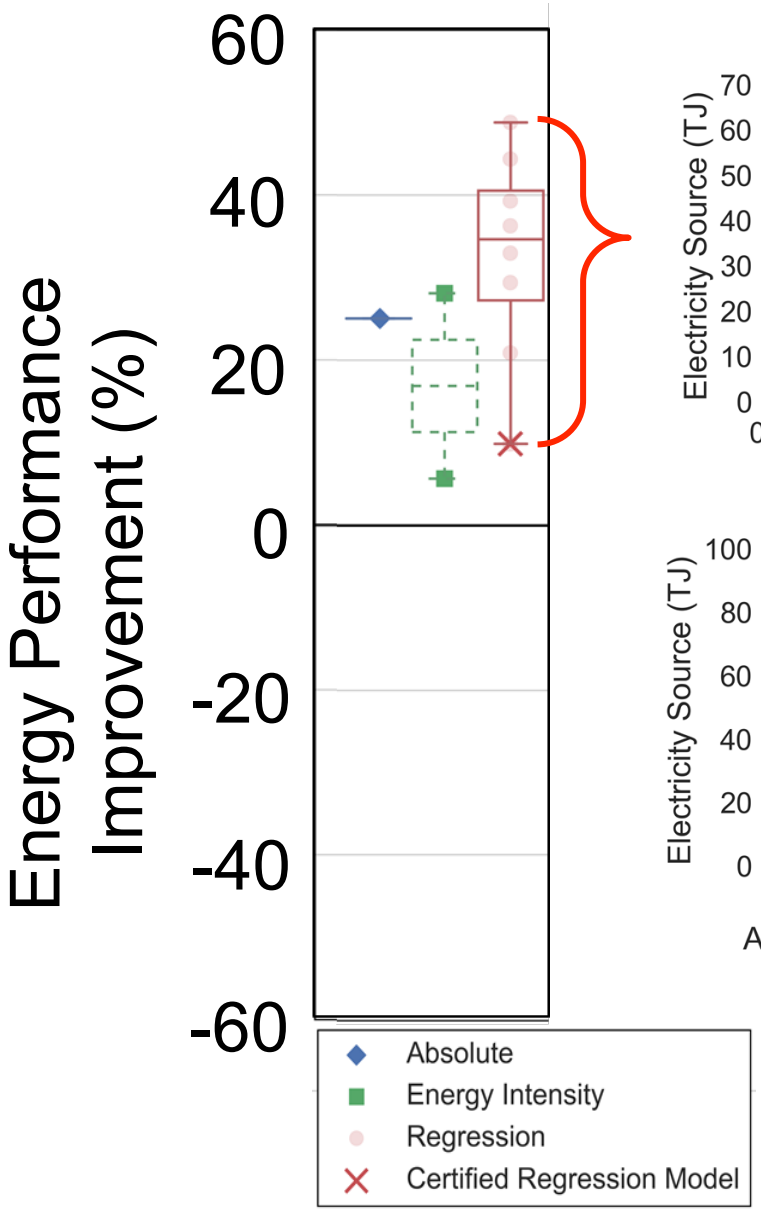
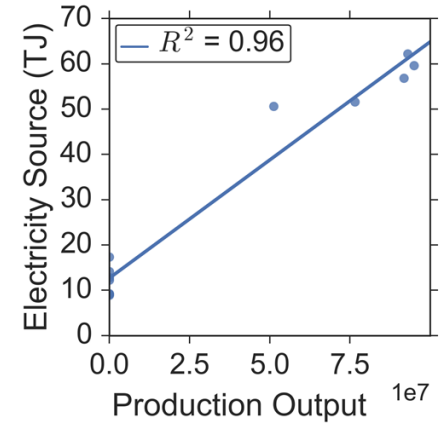


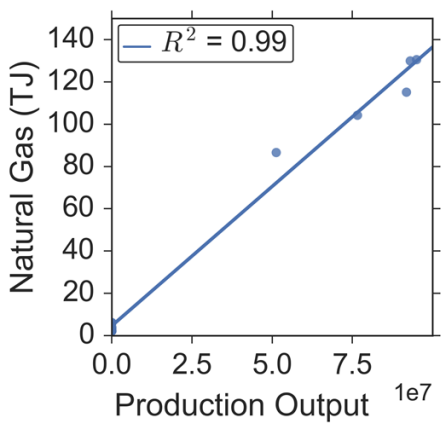
Facility 4 – A Case Where Normalization is Complicated but Still Makes Sense

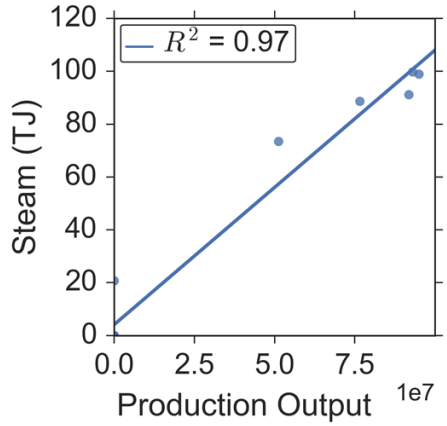


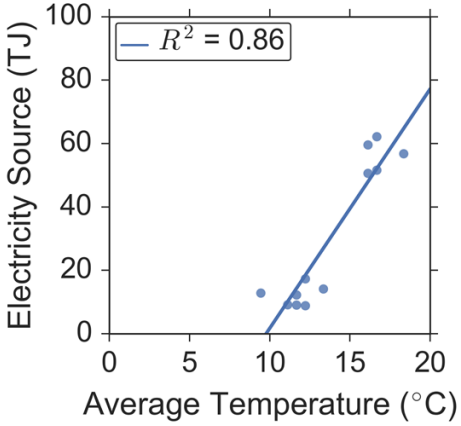
Facility 4 – A Case Where Normalization is Complicated but Still Makes Sense

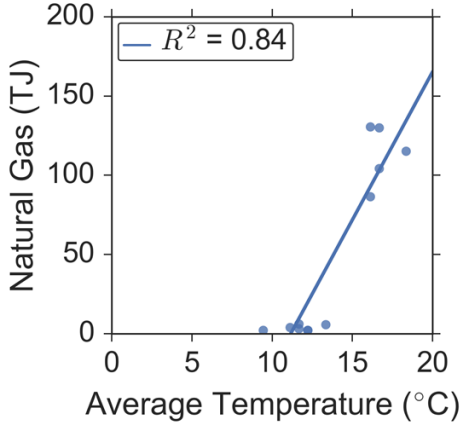


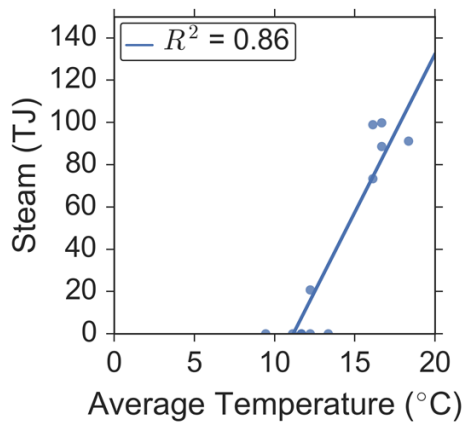












Conclusions

- Energy savings can be calculated on an absolute, intensity, and normalization basis.
- Absolute energy savings values represent the actual change in energy consumption at a facility.
- Intensity and normalization basis savings values are adjusted and are thus estimations of actual savings that account for variations in one or more relevant variables.
- Engineering logic, in addition to statistical tests, must be applied to ensure normalization results have meaning.
- Energy performance improvement may be best represented by a combination of EnPIs generated by calculating energy savings value from a number of the bases detailed.