Scalable, data-driven climate optimization in buildings



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Electricity use in buildings is largest emission category



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But, reductions in emissions from buildings are not on track for the IEA Sustainable Development Scenario



What is climate optimization?



The current energy and carbon optimization process is complex, time-consuming and expensive

- X Requires additional hardware or manual inspection
- X Done sporadically by energy managers or consultants.
- X No follow-up or monitoring
- X Only cost-effective for the largest companies





A 5-step process for scalable energy and climate optimization in buildings

- 1. Integrating standard datasources for building energy data
- 2. Build models of individual buildings to "understand" consumption
- 3. Create network of buildings to enable data-driven benchmarking
- 4. Determine best optimization actions from individual models and benchmark model
- 5. Verify actual savings and feed back results into ML pipeline











Integrating standard datasources for building energy data







Smart meters







https://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union



Individual AI building models

"Explainable" factors

- Weather data
- Datetime
- Holidays
- Corona
- Internal factors



Create network of buildings to enable data-driven benchmarking

Building comparison factors

- Activity and baseload profiles
- HVAC and insulation profiles
- Solar production
- Building information
 - Size (sqm, number of floors)
 - Usage category (i.e. retail store)
 - Heating source (district, heat pump, electric)
 - Year built



Determine best optimization actions from individual models and benchmark model



3 new cases across 48 buildings (185 MWh)

Location A High consumption at night	*
Yearly savings 96 MWh (23 tCO2, \$32k)	\rightarrow
Location B	×

Location C

Install heat pump as primary heating sourceYearly savings21 MWh (5 tCO2, \$7k)



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Verify actual savings, and feed back results into machine learning pipeline





...even when savings are non-obvious!



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Using already-available data and new machine learning methods, we can make the process fast and cost-effective

- \checkmark Fast and cheap to understand potential
- Presenting and supporting the best and most cost-effective reductions
- Automated verification and bookkeeping of improvements
- Reassurance from constant monitoring



Supporting the sustainability engineering workflow



Thank you!



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