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# Heating Electrification and Rate Design

## Urban Sustainability Directors Network/Building Electrification Initiative

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# Outline for Today

- Heating Electrification Economics
- Rate Design Overview and Principles
- Affordable Bills for Electric Heating
- Conclusions

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# Heating Electrification Economics





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# ***Beneficial* Electrification (BE) - Three Conditions**



1. Saves Customers Money  
Over Long-Term



2. Reduces Environmental  
Impacts



3. Enables Better Grid  
Management

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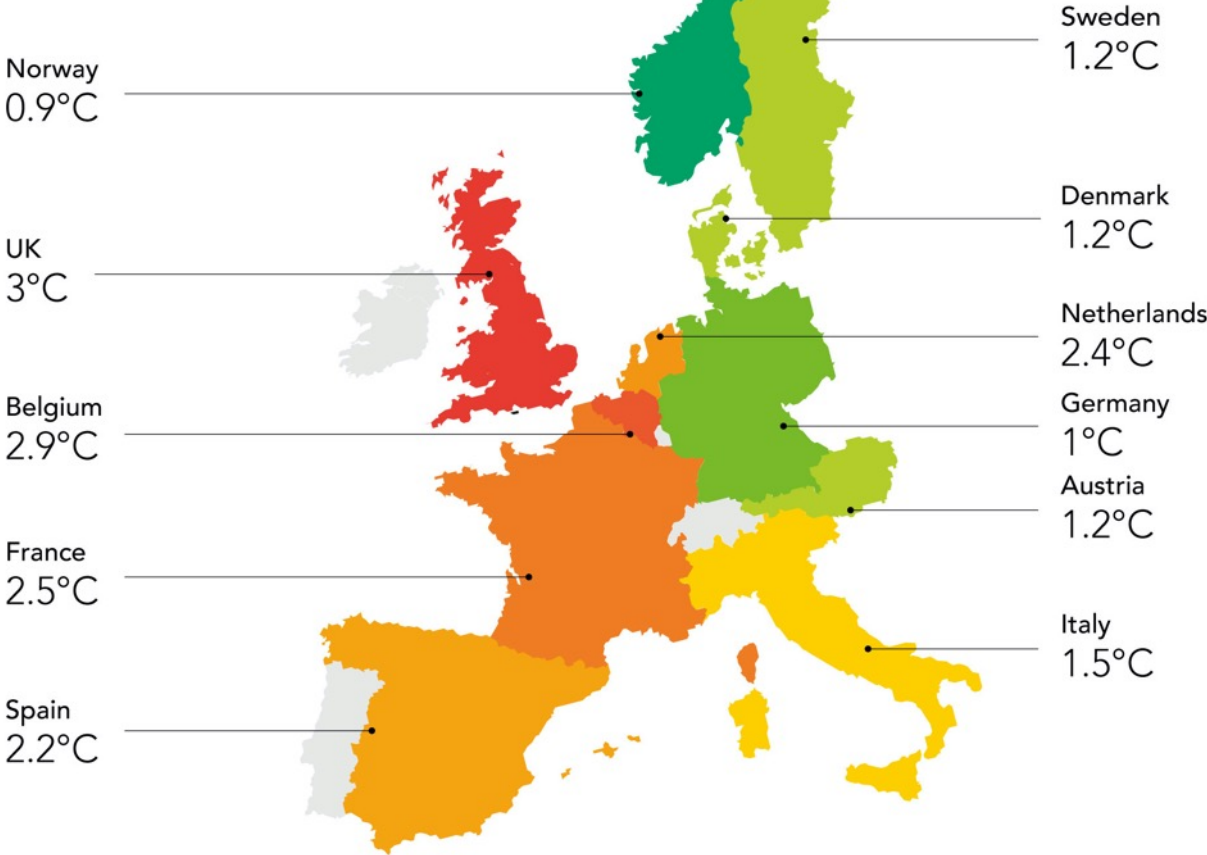
# Consumer Economics: Key Factors

- Incremental cost of installation
  - Space cooling desired?
- Efficiency of heating options
- Cost of fuel
- Building thermal efficiency

# Home temperature loss after 5 hours



With a temperature of 20°C inside and 0°C outside



Based on a sample of over 80,000 European homes

# 2

# Rate Design Principles





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# General Goals of Rate Design

- Efficient forward-looking price signals
- Recovery of revenue requirement
- Equitable intra-class cost allocation
- Customer understanding and acceptance
- Achievement of public policy goals

**Within overarching frame of imposing pricing discipline equivalent to competitive markets**



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# Key Terms for Rate Design

- **Customer Charge:** Fixed monthly fee to access utility service
- **Energy Charge:** Price per kWh of consumption
- **Demand charge:** A rate charged on a customer's highest 15- or 30-minute individual peak usage
  - Typically defined as highest non-coincident individual peak over whole month, but sometimes during “peak window”

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# Key Terms for Rate Design

- **Time of use (TOU) rate:** Time-varying kWh prices with preset times and price schedules
- **Critical peak pricing (CPP):** Higher rate for highest 50-100 hours in year
- **Peak time rebate (PTR):** Bill discount for reductions below baseline at peak times
- **Demand response:** Program that compensates customer for reducing load in response to signal

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# Smart Rate Design Principles

- **Principle #1:** A customer should be allowed to connect to the grid for no more than the cost of connecting to the grid.
- **Principle #2:** Customers should pay for power supply and the grid in proportion to how much they use, and when they use it.
- **Principle #3:** Customers delivering power to the grid should receive full and fair value -- no more and no less.

**Rate design should make the choices the customer makes to minimize their own bill**

**consistent with the choices they would make to minimize system costs.**



# Illustrative Smart Rate Design

	Residential	Medium C&I
Customer Charge (\$/mo.)	Multifamily: \$7 Small Single-Family: \$10 Large Single-Family: \$15	\$25
Site Infrastructure (\$/kW)	N/A	\$2
Off-peak (cents per kWh)	7 cents	5 cents
Mid-peak (cents/kWh)	9 cents	8 cents
On-peak (cents/kWh)	14 cents	13 cents
Critical peak (cents/kWh)	75 cents	75 cents

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## Affordable Bills for Electric Heating



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# The Opportunity of Time-Varying Rates

- Time-varying rates provide new electric end-uses the opportunity, but not a guarantee, of lower bills
  - Depends on ability to avoid high-cost times
- To what extent is high demand for electric heating correlated with high-cost times?
  - With extensive electrification of heating, more regions may be “winter peaking”
- Affordable battery storage will increase flexibility for all customers

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# Thermal Efficiency is Key

- Allows “pre-heating/cooling” in advance of high price hours without loss of comfort
- Allows efficient unit sizing
  - Reduces upfront costs and ongoing electricity costs
- Thermal storage (e.g., ceramic bricks or advanced construction materials) is another alternative, but may be costly



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# The Trouble with Rate Discounts

- Generous “whole house” rate structures for electric heat risk disincentivizing energy efficiency more broadly
- Separate rates for specific end-uses have additional metering and billing costs
- Efficiency of electric heating and transportation will be enormously important sooner rather than later

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# Grid Management Programs

- Demand response programs provide payments for curtailment at key times
  - Is it worth it for the customer? Is there a loss of comfort?
- Ancillary services markets provide payments for more granular responses to support the grid
  - Frequency regulation and voltage support

# 4 Conclusions



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# Key Takeaways

- Improved rate design can lower system costs and unlock demand-side resources
- Good rate design is typically technology-neutral
  - Opportunities to lower bills come from controlling load into low-cost times
- Thermal efficiency saves money in multiple ways
  - Lower capital costs, lower fuel costs, and increased flexibility for time-varying rates
- Specific grid programs are more sustainable than outright discounts



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# Resources from RAP

- [Smart Rate Design for a Smart Future](#)
- [Smart Non-Residential Rate Design](#)
- [Beneficial Electrification \(four-part series\)](#)
- [Beneficial Electrification of Space Heating](#)

# About RAP

The Regulatory Assistance Project (RAP)<sup>®</sup> is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at [raponline.org](https://raponline.org)



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