

## Load disaggregation as enabler for new services in the smart grid

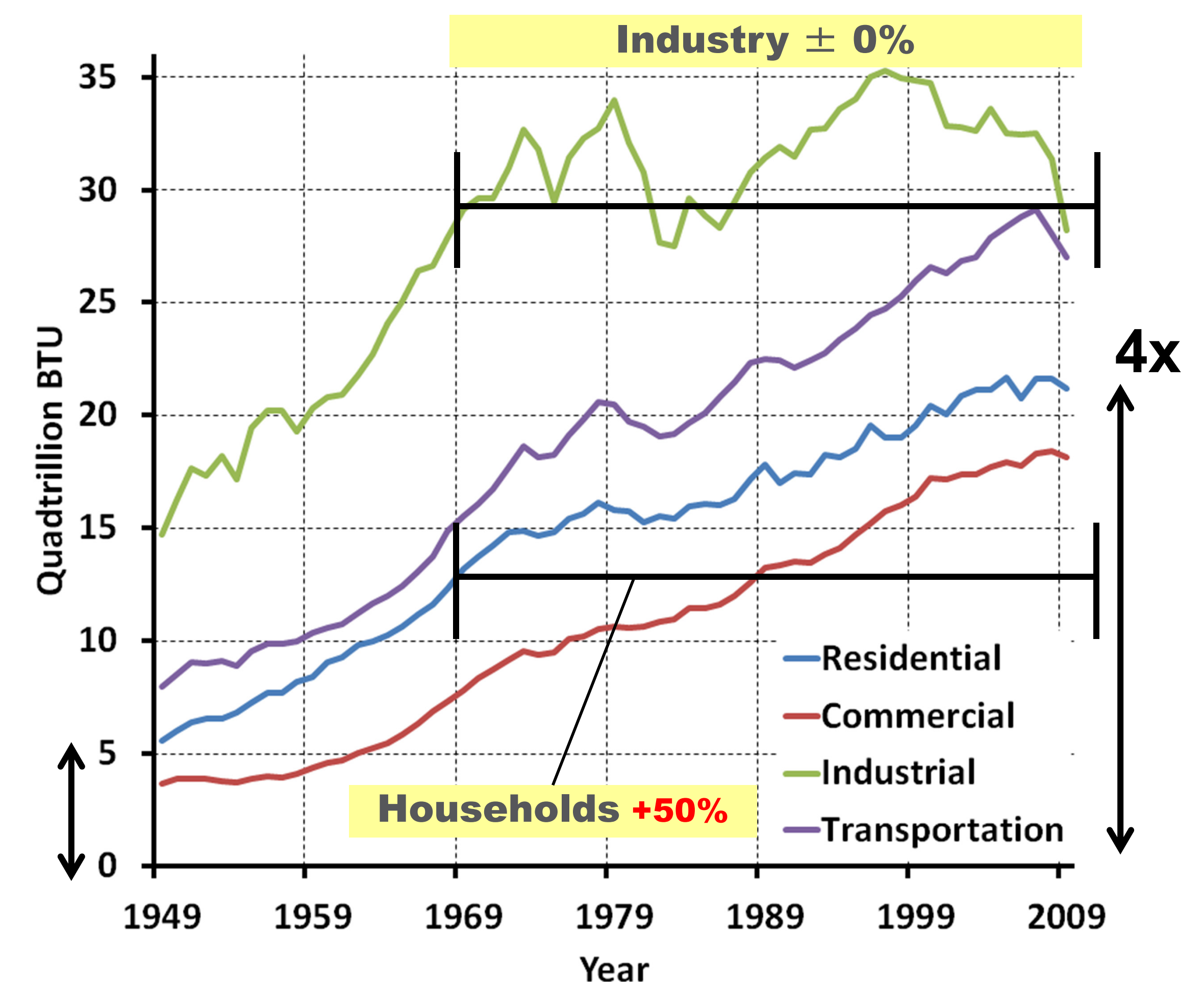
About 40% of the total energy used in the United States is consumed by the building sector<sup>1</sup>.

Consumption highly depends on both the operated appliances and on user behavior (more than factor 2)<sup>2</sup>.

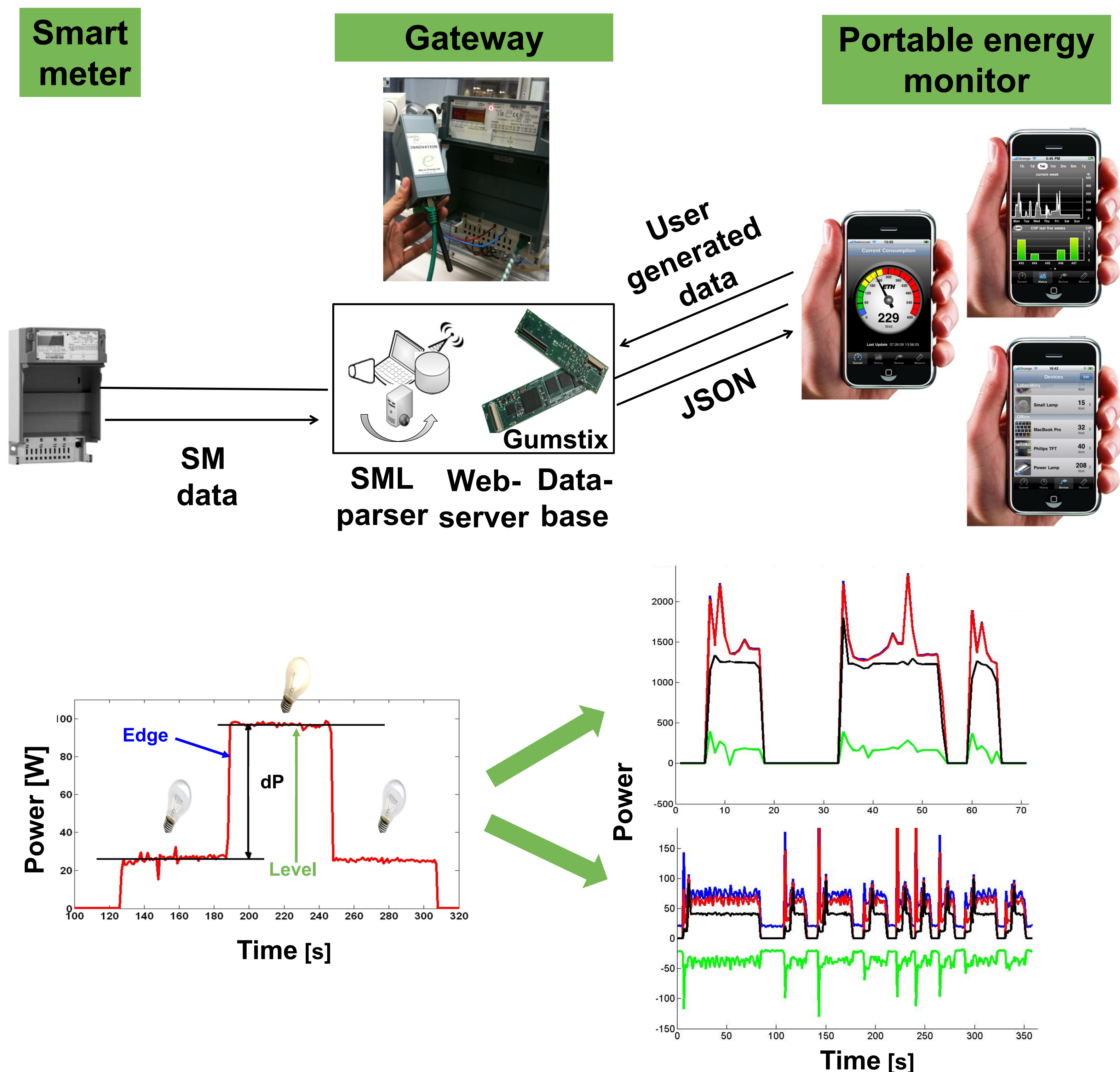
**Data analytics of metering data allows us to auto-identify the consumption of an individual appliance:**

- tailored energy feedback at no extra cost
- improved energy efficiency in combination with actuation
- new business opportunities in the smart grid

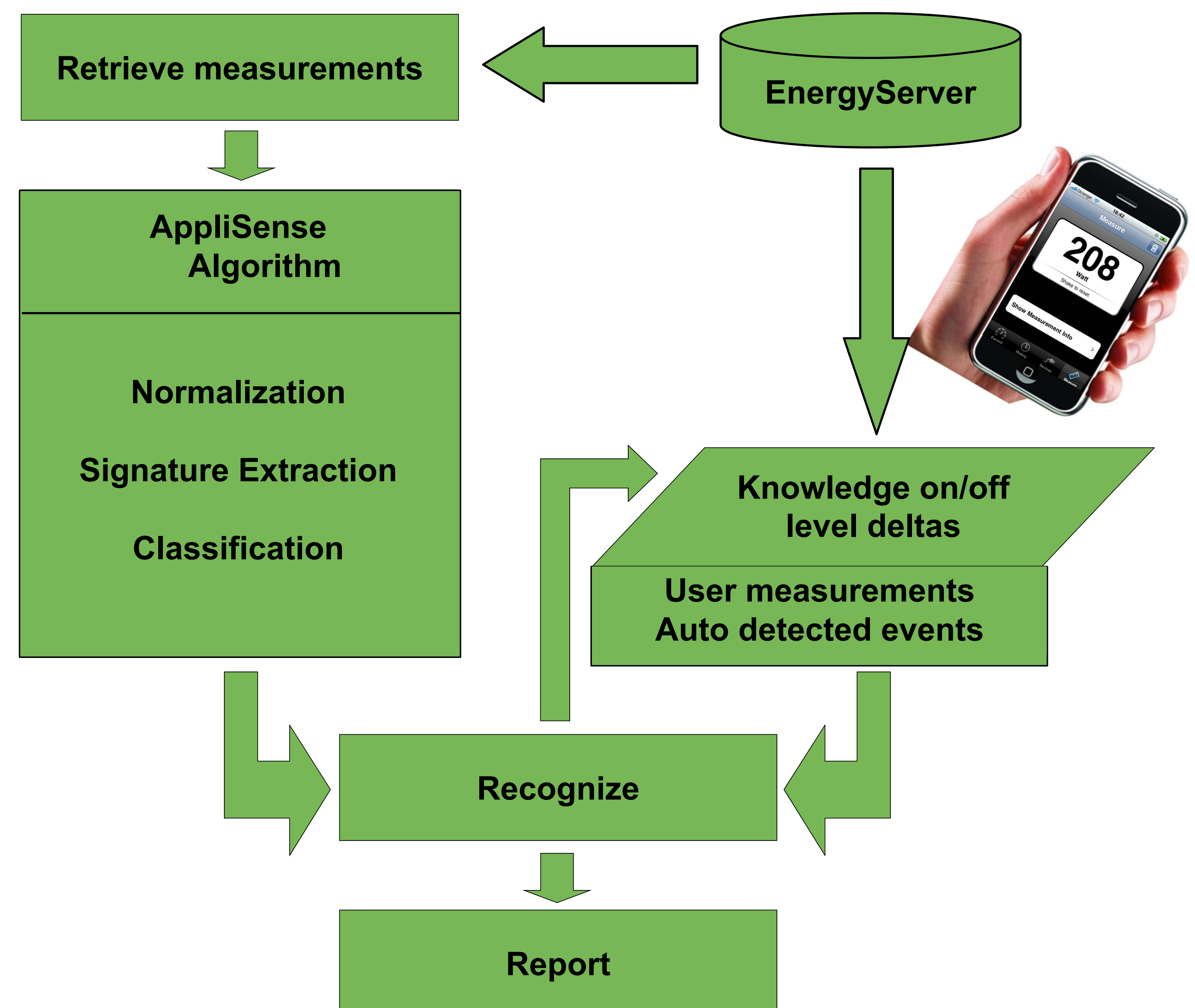
Energy Usage by End-Use Sector 1949-2009 (US)<sup>1</sup>



## Infrastructure<sup>3</sup> & Appliance Signatures<sup>4</sup>



## The AppliSense Disaggregation Algorithm



## Results & Future Work

- Recognition rate of about 91% in lab study.
- No false recognitions.
- System deployed in 4 households for over 6 months (9 million measurements).
- Refinements based on real-world deployment.
- Apply clustering algorithms for user feedback.
- Input for automated heating control.
- Use data on a higher aggregation level (e.g., streets, regions, etc.).

### References:

1. Annual Energy Review 2009, Energy Information Administration, 2010.
2. Parker, D., Hoak, D., Cummings, J., Pilot Evaluation of Energy Savings from Residential Energy Demand Feedback Devices. FSEC, Rpt: FSEC-CR-1742-08, 2008.
3. Weiss, M., Graml, T., Staake, T., Mattern, F., Fleisch, E., Handy feedback: Connecting smart meters with mobile phones. Proc. MUM 2009, Cambridge, UK, 2009.
4. Weiss, M., Staake, T., Mattern, F., Fleisch, E., PowerPedia - A smartphone application for community-based electricity consumption feedback. Proc. Smartphone 2010, Gwangju, South Korea, 2010.