Privacy and the Law in Demand Response Energy Systems

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Agenda

• What is demand response?
• Goals of Legal/Privacy Team
• General Principles of Technology & Privacy
• Legal Landscape
• Mapping Legal Rules Onto Demand Response Architectures
What is demand response?

• Step 1: advanced metering
• Step 2: time-varying energy rates
  – Voluntary manual response to changes in price
• Step 3: new technology elements
  – Voluntary automatic response to changing tariffs OR
  – Forced response to signal from utility
• Step 4: the Wired House
Background

- Response to California Energy Crisis 2000-01
  - CEC & CPUC Roles
  - PIER
- Statewide Pricing Pilot 2003-04
- Current CPUC proceedings on deployment of advanced metering and demand response
- (Federal) Energy Policy Act of 2005
- California Proposition 80
Legal/Privacy Team Goals

- Meet with technologists to understand current and planned systems, and assess the architectural and data needs of the system.
- Research existing federal and state privacy law:
  - expectations in home versus business records
  - regulations on use and disclosure of utility records
- Meet with utilities and other developers of demand response infrastructure to understand data practices and policies controlling data use.
- Meet with law enforcement to learn about their demand for and practices regarding utility data.
General Principles of Technology & Privacy
“...how, when, and at what level does privacy matter?”

• Legal context and social context are both important
• Expectations of privacy are shaped by what is technically possible, what is technically possible in turn informs a court’s analysis of reasonableness
Status Quo, Technology, & Law

“reasonable expectation of privacy”

dog sniffing
aerial photography
thermal imaging
Pot diaries

- **U.S. v. Starkweather (9th Cir. 1992)**
  "The public awareness that such records are routinely maintained…negate[s] any constitutionally sufficient expectation of privacy…"

  "We think that obtaining by sense-enhancing technology any information regarding the interior of the home that could not otherwise have been obtained without physical intrusion into a constitutionally protected area constitutes a search -- at least where (as here) the technology in question is not in general public use. This assures preservation of that degree of privacy against government that existed when the 4th A was adopted."
Lessons Learned

• A little recording can mean a lot:
  – Generates records held by others

• Location matters:
  – Imperceptible without trespass or in plain view?
  – Home versus public street
  – Is only rendered perceptible by technology?

• Government use of precise, accurate technologies with low false positives may be outside the 4th A

• Use of “Police-Only” technology is unreasonable, but use of readily available technology may not be
Legal Landscape
CA Public Utilities Privacy Laws

- Different amounts of protection for utility records and personal information
  - Written consent required for release of personal data: billing, credit, usage
  - Utility records may be released in certain circumstances if customer not identified
  - Exceptions for law enforcement

- More extensive protection in telecommunications:
  - Calling patterns, service choices, individual or aggregated demographic data may not be released without written consent.
Privacy Laws regarding other parties

Third Party Service Provider / Data Manager
- Data security & data handling practices promulgated from utility to third party through contract and audit

Law Enforcement
- Relatively stringent rules for tech-assisted criminal investigation (Kyllo)
- Relatively easy access to utility records
- New infrastructure means new access points for law enforcement to obtain customer data:
  - Easier access to business records held by third parties?
  - Access to unfiltered sensor network data?
  - Where else might police access information?
Unauthorized Access to Computer Systems

• Federal computer fraud laws apply to intentional, unauthorized access to “a computer” which “obtains … information”
  – What elements in DR system count as “computers”?  
  – Does lack of access-control imply authorization?

• Federal wiretap laws apply to interception of “electronic communications”

• CA penal code defines expansive set of unauthorized computer use offenses
  – Access or use of data or services, provision or assisting provision of means of access
Privacy under California Constitution

• California Courts have determined that consumers do have a reasonable expectation of privacy in PERSONAL information under some circumstances

• Themes
  – Virtual current biography
  – Disclosure not volitional

• *People v. Chapman*, 36 Cal. 3d 98 (1984) (customer who paid to keep her name, phone number, and address unlisted in telephone directories had a reasonable expectation of privacy in that data, and so a warrant was required to obtain that data from the telephone company)
Mapping Legal Rules Onto Demand Response Architectures
Theoretical Implementation Models

• **Centralized Implementation**
  – Communication to utility through one-way collector network
  – Data concentrator at utility
  – Load-control through broadcast network

• **Distributed Implementation**
  – Intelligent portal on consumer premises
  – Communications to and from utility go through portal
  – Portal controls load based on pre-configuration by consumer

• **Hybrid Implementation**
  – Third-party data and network management services
Expected Implementation: Meters & In-home elements

• **Short term**
  – Meters with limited storage and processing capability
  – All data collected and processed at utility

• **Medium term**
  – Meters with increasing storage and processing capability
  – Two-way communication from utility to meter, smart thermostat

• **Long term**
  – Network of in-home sensors communicating with meter, smart thermostat, other in-home smart appliances
  – Significant process capability and intelligence inside the home
Legal / Privacy Issues: Meters & In-home elements

• Consumer has high expectation of privacy for in-home data
  – Highest legal protection for this data through property and privacy law
  – Consumer preference to keep data in-home
  – Potential of network to expose information to others without trespass

• With increasing intelligence in-home, more potential for on-site processing,
  – meter-computing-bill?

• Security & encryption of in-home transmissions
  – In-home sensor data & transmissions may expose information on in-home activity
Expected implementation: Data Transmission to Utility

- **Short term**
  - Substation scheduling collection of hourly data from individual meters
  - Data routed to utility for aggregation and processing
  - Segments of transmission path outsourced
  - Use of public/private wireless transmission systems
  - Encryption on selected segments on cost-benefit basis

- **Longer term**
  - Move to broadband over powerline, provision of additional services with BPL
  - Utility ownership of key hardware
Legal/Privacy Issues: Data Transmission to Utility

- Currently, meter data security based on proprietary data format rather than encryption.

- Unclear levels of privacy protection when customer data passes from utility to third party:
  - Security & data handling requirements enforced by utility through contract and audit.
  - Unclear whether law enforcement can access more easily.
  - Customer preference for utility ownership of system so privacy and data handling requirements clear.

- Over time, utility may start to look like a telecommunications provider:
  - Telecom corporation responsible for ensuring privacy of communications over its telephone system.
Expected Implementation: Data Processing and Use

• **Short term**
  – Central collection and storage of hourly data from advanced meters
  – Aggregation of data for billing
  – Real time access to data by customer service
  – Data feedback to customer for education purposes

• **Longer term**
  – Upgrade of legacy systems to adapt to increased data set
  – Data mining
  – Research looking for ways to use hourly data to optimize systems, reduce operating costs, improve load planning
  – Storage of 7 years worth of hourly data
Legal/Privacy Issues: Data Processing and Use

- Possible threats to privacy
  - Sale or disclosure of data in “business records”
  - Unregulated, unrestricted access to real-time information

- Mining of hourly data may expose information on in-home activity
  - Explore aggregation, anonymization
  - Use of in-home processing capability to reduce exposure
  - Need to balance utility system optimization via data mining and customer privacy

- Access to in-home sensor data may expose information on in-home activity

- Over time, utility may start to look like a telecommunications provider
  - Disclosure restrictions on personal calling patterns, service program choices, and individual or aggregated demographic information.
Specific Architectural Choices to Promote Privacy

- Identify precise data requirements for utility sub-systems (e.g., billing)
  - Create separate pathways for systems that require identifiable data
- Minimize amount of raw usage data that enters external networks
  - Use in-home processing capability
- Minimize granularity of information transmitted, at every step
- Focus on security
  - No security = no privacy
Goals

1. Keep data in-home as much as possible, protect to the extent possible when data leaves the home
   • Meter-computing-bill an example
   • Split data paths for billing and other functions
   • Aggregation / anonymization of high granularity data
   • Security of data in the home also an issue

2. Protect privacy prospectively, through design
   • Hard (technology) v. soft (legal) protections
   • Architectural choices will constrain subsequent policy choices
   • Policy choices are “hardened” when incorporated in architectural design

3. Ensure that rules and regulations incorporate privacy and technological developments as they evolve
   • Strong privacy protections should travel with the data
"It would be foolish to contend that the degree of privacy secured to citizens by the 4th A has been entirely unaffected by the advance of technology...the question we confront today is what limits there are upon this power of technology to shrink the realm of guaranteed privacy."

-- U.S. Supreme Court, *Kyllo*
Recommendations: security

• Encryption is recommended over manufacturers’ proprietary formats for securing data over the entire transmission path, from meter to utility.
• We recommend that designers adhere to published, well-studied, and where possible, provably secure standards.
• We recommend the use of authentication for all data.
• We recommend that spread-spectrum radios be used if feasible.
• We recommend that a single-hop network be used if possible for sensor networks.
Recommendations: systems development

- Access to hourly customer usage data should be limited within the utility.
- Separate data pathways should be built into the system.
- In-home processing capability should be developed to enable the performance of necessary energy-related functions in-home: energy monitoring, demand response control, self-education, and billing.
- Smart appliances and BPL systems for the home should be designed to protect the a customer’s reasonable expectation of privacy in his activities and preferences, and CEC regulation should enforce this principle.
Recommendations: regulation

• Data privacy and business record handling rules must apply uniformly to data held by utilities AND 3d parties.
• CPUC should set guidelines as to how much data should be stored for purposes of customer service and other functions.
• Data-mining of hourly usage data should be monitored and regulated.
• Law enforcement access to utility records should require a warrant.
• Services provided via broadband over powerline (BPL) should be subject to stricter telecommunications laws.
• Collection of data from in-home smart appliances, sensors, smart thermostats should be prohibited.
Learn more about what can be learned from data mining of sensor data

Looking for collaborations
Legal/Privacy Team

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