

On the security economics of electricity metering



Ross Anderson, Shailendra Fuloria
Computer Laboratory,
University of Cambridge

Smart Grid and Smart Meters

- Intend to save energy by intelligently matching distributed generation with demand
- Smart Meters form the last mile
- Mandated in Europe by 2022
- In UK by 2020
- >300m meters, >£30bn cost
- Some really serious problems!
- We have five recommendations...



Energy Management

- Inclination towards centralised energy management
- Meter communicates with the utility every 15 to 30 minutes
- Supplier controls appliances
- Customer interface
- So what is the problem?



Storage and Communication

- Storage of huge data volumes
 - estimated 9 Pb per year for UK meters (sample rate of 30 minutes)
 - almost 10 times for US!
- Communication challenges
 - proposal to use GPRS
 - do existing networks have the capacity/resilience?
 - who pays for the communication?

Privacy

- Possible to extract sensitive, personal information
 - when do you get up, which appliances do you use, how many people live in the house, is there a dialysis machine in the house etc
 - Google and Microsoft would like the idea!
 - energy companies too can use it to sell exploitative tariff plans
- Section 8 of the ECHR comes in the way
- In April 2009, the Dutch First Chamber declared smart meters illegal
- So is there a real benefit?

Behavioural aspects

- Ofgem's pilot project shows insignificant benefits
- Reason: Behavioural aspects of energy saving largely ignored
- Tough intertemporal choice
- Who wants 48 rates per day!
- So why should energy suppliers need such fine grained information?



Conflict of interests

Energy Companies	Governments	Customer
peak demand shaving, same overall demand, direct access to customer data, confusion-pricing, lock-in	peak demand shaving, reduction in overall demand, centralised data gathering, price transparency	the bulb still glows, lower energy bills, interoperability

- Ofgem driving the smart meter project (the UK energy regulator)

Recommendation 1

- Smart meters should, by default, send only the data necessary for billing and essential technical operations
 - black-out, emergency button
- The meter data must belong to the customer
 - some energy companies think otherwise
- Information sharing must be done by explicit consent

Recommendation 2

- Focus on interoperability
 - easy in UK with 4 large meter vendors and 6 large energy suppliers
- Have open standards whereby smart meters can communicate as necessary with distributors, energy suppliers and energy management companies
- Design a command language for meters

Recommendation 3

- Assurance of fairness to the distributor and market operator
- Energy audits by a third party
 - not the government
 - not the energy supplier
 - the distribution network operator is probably best placed and motivated

Recommendation 4

- There's a plan to have remote switch-off button in all UK meters
 - for rolling power cuts, prepayment etc
 - a serious security vulnerability! so...
- Active demand management should be left to private contracts between the energy companies and the customers
 - interruptible tariffs could be supported by means other than remote switch-off



Recommendation 5

- We need an independent authority to monitor the project which
 - stands up for customer interests
 - ensures dependability and security of supply
 - encourages market competition
- It can't be Ofgem if Ofgem is running the communications network and billing database!

Conclusions

- The EU smart meter system is complex socio-technical system in the making
- It has non-trivial technical and economic problems
- Our paper describes some fundamental problems with the design philosophy
- We make 5 recommendations
- More work is needed to understand the incentives and behavioural economics

