ABOUT ME

• **Background in Psychology**

• **Started Ph.D. studies in Information Security this year**

• **Research topic on Human motivation – decision making**

• **Connected to IoTSec project funded by Research Council of Norway**
KEY POINTS

• Evolution of the Smart Electric Grid

• Customer Privacy Concerns

• Connecting the System to Human Decision Making and Risk Analysis

• Ideas from Psychology for the Prediction of Strategic Decision Making
TRADITIONAL ELECTRIC GRID

- Critical Infrastructure for modern society
- Centralized generation
- Electricity must be generated at the moment of consumption – Storage is not possible
TRANSACTION TOWARD A SMART GRID

Bi-directional flow of information & electricity
Enabled by IoT

More efficient operations
Improved load optimization

Integration of renewable resources
SMART GRID CHARACTERISTICS

- Big Data
- Autonomous systems
- Automated homes
- Consumption based on dynamic prices
- New services/markets for third parties regarding smart homes
THE SMART GRID ARCHITECTURE MODEL
SECURITY REQUIREMENTS RELATED TO SMART METERS

- **During data transfer**
- **During conversions and calculations**
- **During formatting**
- **During data storage**

**Confidentiality, integrity, availability, authenticity and utility of the data must be ensured.**
POTENTIAL PRIVACY THREATENING ACTIVITIES

- INFORMATION COLLECTION
  - 1. SURVEILLANCE
  - 2. INTERROGATION
- INFORMATION PROCESSING
  - 1. AGGREGATION
  - 2. IDENTIFICATION
  - 3. INSECURITY
  - 4. SECONDARY USE
  - 5. EXCLUSION

- INFORMATION DISSEMINATION
  - 1. BREACH OF CONFIDENTIALITY
  - 2. DISCLOSURE
  - 3. EXPOSURE
  - 4. INCREASED ACCESSIBILITY
  - 5. BLACKMAIL
  - 6. APPROPRIATION
  - 7. DISTORTION

- INVASION
  - 1. INTRUSION
  - 2. DECISIONAL INTERFERENCE
Profiles based on fine-grained electricity consumption
RISK ANALYSIS FOCUSING ON HUMAN BEHAVIOR (CIRA)

Incentive graph

Risk owner’s utility

Opportunity Risk

Cooperation

Avoidance

Consensus

Stakeholder types:
- risk owner
- utility factors
- strategy owner
- utility factors
- strategy

Strategy owner’s utility

Threat Risk

Legend

- ○ Acceptable risk event
- ● Unacceptable risk event
- Channel (for risk appetite)
WHO IS RESPONSIBLE TO FULFILL THE REQUIREMENTS?

Value chain of the Smart Meter

Silicon manufacturer → Equipment manufacturer → Deployment → Operation → Decommission

Reliance on third-parties
Simplified Data Flow Model of the Smart Meter

2. Operation - Smart Meter Data

Meter Sensor Data

Convert sensor data to metering data

Customer tampers Meter Data

Loss of Integrity

Accumulated Data - Billing & Others

Data Stored in Meter

Eavesdropping by malicious actor

Loss of Confidentiality for Customer

GSM/GPRS transfer

3. Data storage

Billing Operations Data

Eavesdropping by malicious actor

Loss of Confidentiality

Billing Operation/Bill generation

Elhub/Cloud Service Provider

Remote Access

Secondary use of consumption profile by insider

Breach of Privacy, Confidentiality for Customer

Customer

Service provider

Market actors

Remote access

Remote access
HUMAN BEHAVIOR

1. Person: needs, motives, goals

2. Situation: opportunities, possible incentives

3. Person x situation interaction

4. Action

5. Outcome

Consequences
* Long-term goals
* Self-evaluation
* Other evaluation
* Material rewards
SITUATIONAL FACTORS

• Organizational Culture (Values, Norms..)

• Financial (Bonus Systems Share Schemes), Moral, Coercive Incentives
Figure 1. Theoretical model of relations among ten motivational types of value

Basic Human Values
The Dark Triad

- Narcissism
- Machiavellianism
- Psychopathy

Lack of empathy
Priority of self-interest
Improved understanding of human aspects could lead to more secure systems
THANK YOU FOR YOUR ATTENTION!