

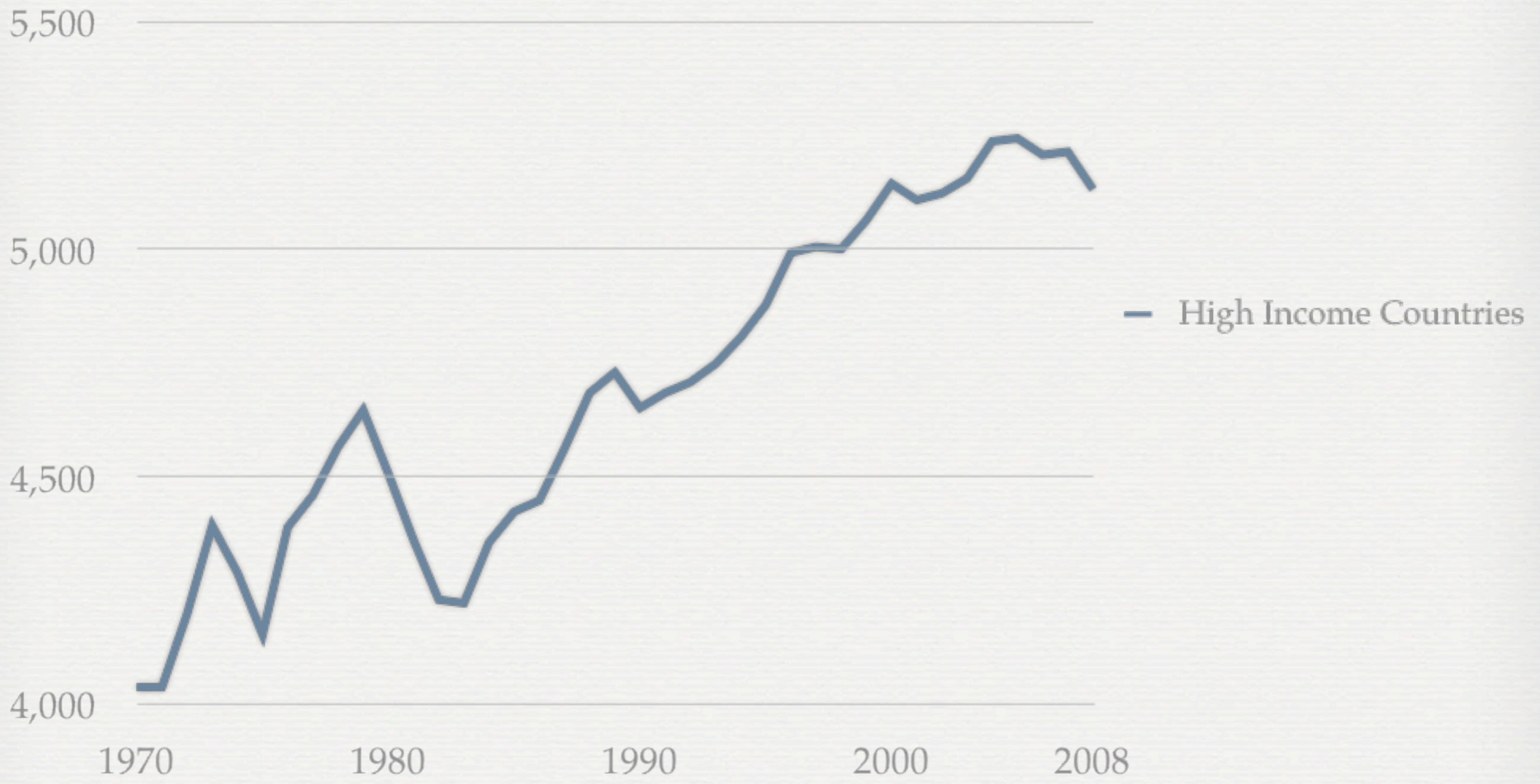
# USEM

Ubiquitous Smart Energy Management

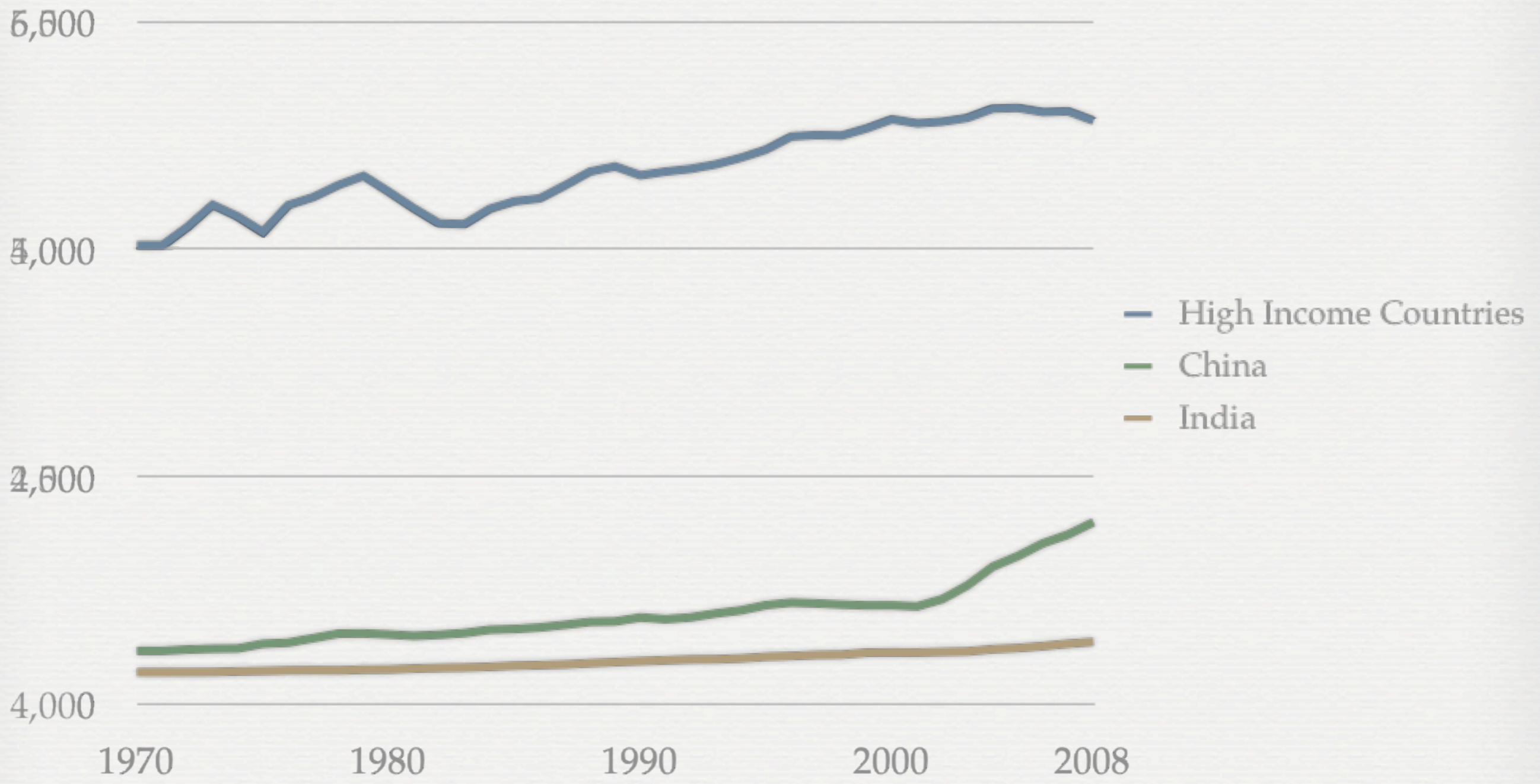


M. Kugler, F. Reinhart, K. Schlieper  
25 November 2011, IT4SE Workshop, Augsburg, Germany

# ENERGY CONSUMPTION PER CAPITA



# ENERGY CONSUMPTION PER CAPITA



# CHALLENGES

**“Use Energy More Efficiently”**

# CHALLENGES

## “Use Energy More Efficiently”

- Use energy when it is available
- Use energy when it is cheap
- Avoid energy wasting
- Avoid usage peaks

**HOW CAN USEM HELP?**

# HOW CAN USEM HELP?

*“USEM helps to smartly manage your energy usage and to analyze your energy consumption.”*

# OUR SOLUTION

- Intelligent scheduling of energy consuming tasks
- Advanced energy monitoring
- Combination of already existing systems
- Modular software architecture



# USEM WEB INTERFACE

“Designing a Control Interface for a Ubiquitous Smart Energy Environment”

The screenshot displays the USEM web interface. At the top, a user greeting reads "hello, Kevin Schlieper!". Navigation buttons include "New Task", "New Rule", "Show Rules", and "Configuration".

**Left Sidebar:**

- USEM**
- Rooms | Categories
- Kitchen**
  - Fridge
  - Oven
- Laundry Room**
  - Dryer
  - Washing Machine
- Living Room**
  - Lava Lamp
  - Speakers
  - TV
- Office**
  - Lamp
  - Michis Notebook
- Unplugged**
  - MacBook Air

**Main Content Area: New Task**

**What?**

- Rooms: Kitchen, Laundry Room (selected), Living Room, Office
- Categories: Dryer, Washing Machine (selected)
- Delicate, Color & White (selected)

**When?**

Task should...

- be finished by
- not be started before
- take place between

Start time: 2011-07-04 09:00 | End time: 2011-07-04 18:00 | Duration: 40 minutes

Tomorrow [morning](#) [noon](#) [evening](#) | Tomorrow [morning](#) [noon](#) [evening](#)

**Further Conditions?**

- Someone@Home**
  - Nobody  Anyone
  - One of the selected persons
  - Kevin Schlieper (selected)
  - Michael Kugler
  - Florian Reinhart
- Energy Condition**
  - cheap (global value of NZD 0.35)
  - cheaper than NZD 0.31
- someone@home** (icon)
- Weather** (icon)
- Cheap Energy** (icon)
- Related Task** (icon)

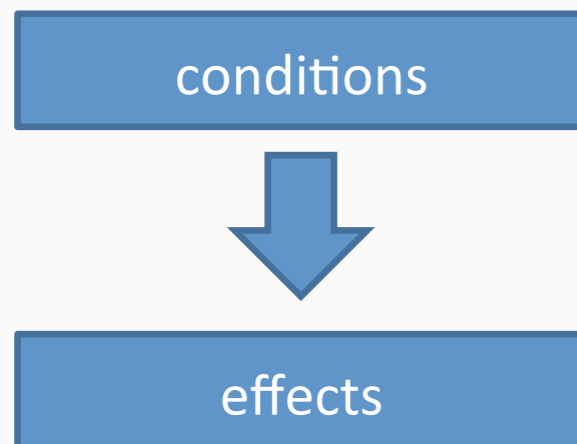
# FEATURES

- Configure USEM settings
- Browse devices
- View planned schedule
- Create tasks and rules

# RULES VS. TASKS

## Rules

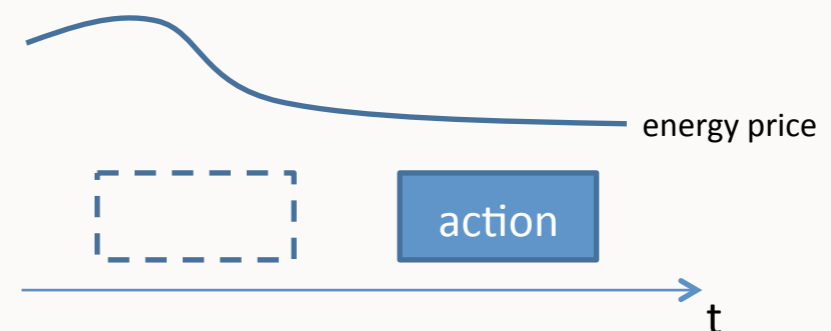
**“Switch off printer when all computers are off”**



- Conditions always checked in background
- No time conditions

## Tasks

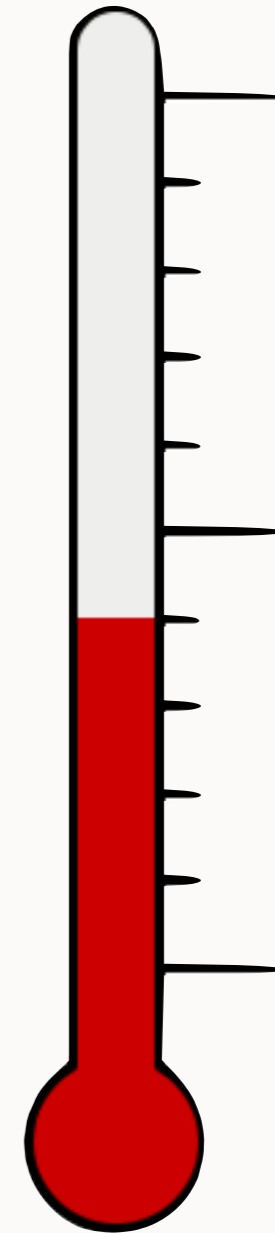
**“Do the laundry until tomorrow 6pm, but only if someone is at home”**



- Schedule device start
- Time boundaries
- Environmental conditions

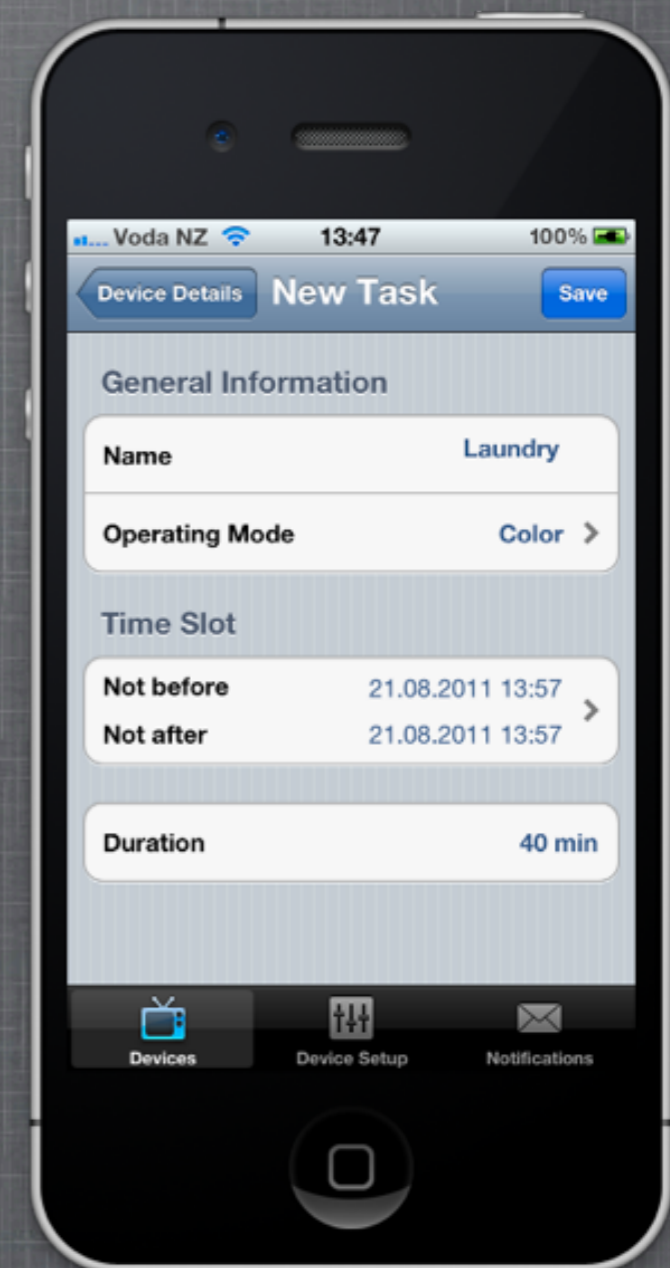
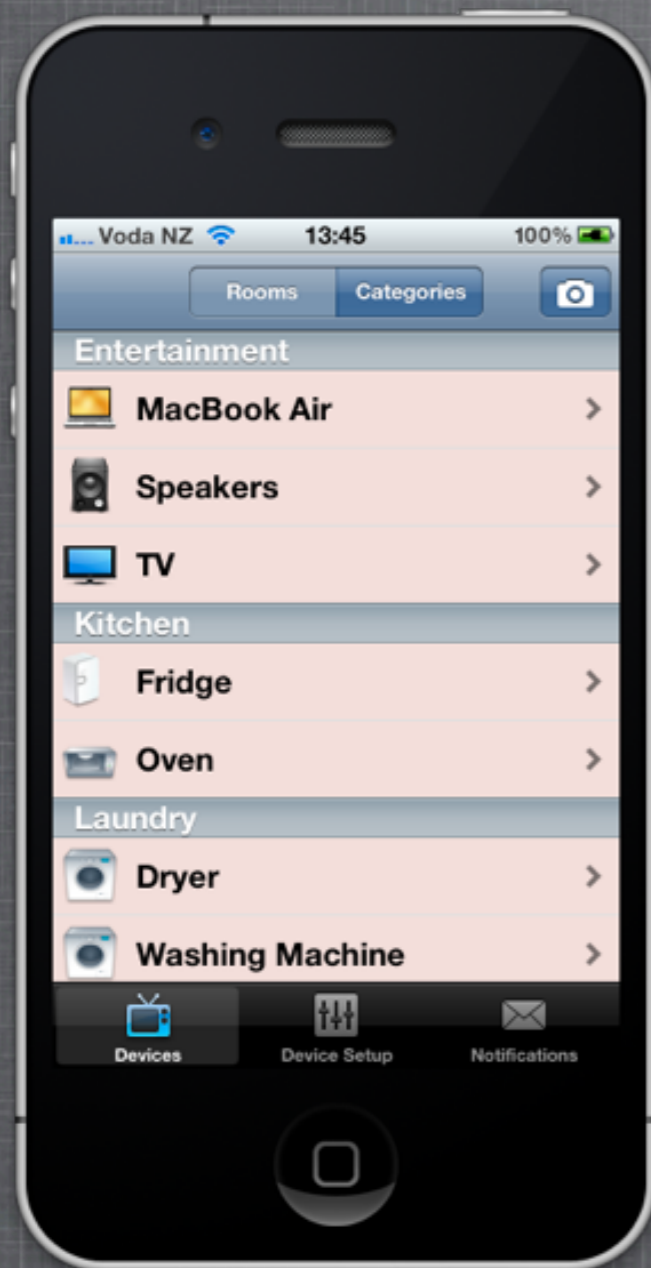
# CONTINUOUSLY RUNNING DEVICES

- No tasks or rules
- Standard level
- Special levels for timespans and / or conditions
- Examples: water heater, air conditioning, etc.



# USEM IPHONE APP

“Designing a Mobile Application for a Ubiquitous Smart Energy Environment”



# IDEA

- USEM **supports** the user in saving energy
- USEM needs the user to...
  - configure device / socket connections,
  - create tasks,
  - and make decisions.

# FEATURES

- Installing new devices
- Controlling of devices remotely
- Direct device interaction
- Task creation
- Notifications and notification handling



# USEM IPAD APP

“Designing a Tablet Interface for Effective Energy Usage Feedback Using Persuasive Technologies”





# IDEA

- USEM automatically uses energy efficiently
- But: People can still waste energy (often without knowing it)
- How can we change people's behavior?

# FEATURES

- Overall status of the system:
  - Active devices
  - Current power usage
- Historical power usage
- Saving goal
- Saving advices

# PERSUASION TECHNIQUES

- Reduction
- Tailoring
- Suggestion
- Self-Monitoring
- Surveillance

# USER STUDY



# STUDY PARTICIPANTS

- 13 participants
- 12 male, 1 female
- 11 students, 2 researchers
- 7 participants had multi-touch experience
- 4 participants owned a smartphone, 3 a tablet device
- All participants were using a PC daily

# FINDINGS

- Willingness to adapt daily routine to save energy
- USEM is helpful in regard to efficient energy usage
- Notifications are good, but only on important events
- Appliances with integrated USEM interface preferred
- Participants liked visualisations on iPad