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# Observing and analyzing operating modes of staff using IT appliances

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**ETSAP Workshop, 15-17 November 2010 at Cork (Ireland)**

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## Agenda

- Context
- Operating modes
- Operating modes and Socio Markal
- Operating modes: the research approach
- Case study
- Concluding remarks

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## Context

- EU's Joint Research Centre (JRC) about electricity consumption
  - ✓ ICT equipment consume over 8% of electrical power in the EU and produce about 4% of its emissions
  - ✓ 108 PJ of energy is wasted because many of us simply forget to shut down our computers when we aren't using them
  - ✓ Widespread use of consumers electronics appliances/ increased number of double or triple appliances: these figures could double by 2020!
  - ✓ Savings potential of ~ 20 % can be achieved if specific measures are taken
  - ✓ If we could improve the efficiency of how we use our PCs, the value of energy saved would be over $3 billion dollars!

JRC (2007, 2009)

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## Context

- From an industrial (material-based) to a service based (dematerialized) economy
- Moving from a « paper-based » to an « IT-based » economy
- Future energy consumption will be driven by IT appliances (Erumban and de Jong, 2006; Huber and Mills, 1999).
- This change will modify our social behaviour and attitudes (e.g., in consumption, communication, mobility, work, etc.)

  (Rydin et al, 2007; Nye and Burgess, 2008; Hondo and Baba, 2009; Fragniere et al, 2009)

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## Context

- Consumption increase due to IT: linked to social change aspects rather than technological issues
- It would be irrelevant to address the issue of IT appliances in Markal solely based on technological views
- Hence our interest in Operating Modes.
- Now, how to analyse operating modes? Why do we include this in Socio Markal scenarios?

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## Operating modes

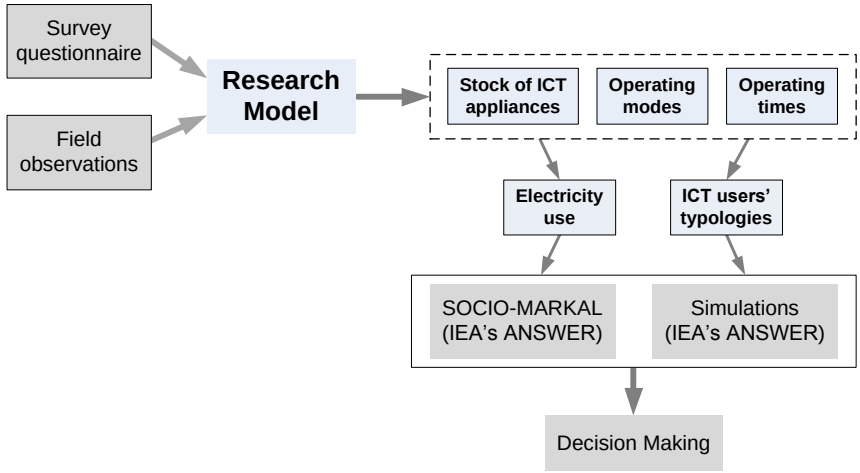
- Show/indicate the power level of appliances during use
- Allow users to « select » the type (s) of advanced functions he uses, **e.g.** a given power level or function of the appliance
- Exemple: active, low power, intermediate, stand-by, off, etc.
- Ultimately, a credible indicator of consumers' behaviour

## Operating modes & Socio-MARKAL

- Embed both technological and behavioral contributions
- Evaluated: habits, willingness / resistance to change, environmental awareness / sensitivity
  - Data (parameters) collected through surveys and sociological experiments
  - Behavioural contributions modelled through *virtual technologies*

References:
(1) Paper presented at the IEW 2010, Stockholm
(2) In Fragniere et al (2010), Low Carbon Economy Journal 2010, «Behavioural and technological changes regarding lighting consumption: A MARKAL case study»

## Operating modes & Socio MARKAL




Adapted from Fragniere et al (2010)

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## Case study on administration staff at the HEG

- HEG: School of Business Administration
- ~100 administration staff, ~ 1000 students
- 5 departments: reception, IT, HR, Library, students union
- Appliances:
  - ✓ **desk computers** ($P_{on}$ = 100W, $P_{sb}$ = 30W)
  - ✓ servers (P = 11 kW)
  - ✓ printers (P = 1 kW)
  - ✓ wireline telephone (P = 7 W)

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## Case study

- Empirical methods: mixed qualitative/quantitative research
  - **Questionnaires** administered to 30 administration staff members equally distributed across the 5 departments
  - **Field observations** in a limited but relevant period of time

    Goal: assess the reliability of responses from the questionnaire
  - A**nalysis**

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## Case study

- **Questionnaire**
  - *Data collection:* opinions of people about how they use their appliances,
  - Sociological data, i.e., related to the behaviour of users, e.g., operating mode frequently used, operating times and users typology
  - 12 questions (available upon request)

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## Case study

- **Field observations**
  - 1 to 2 representative staff members are selected per department
  - Observation: 1 week = 5 working days, 8 hours per day, incl. breaks
  - Selected appliances: desk computer (and many more IT appliances)
  - Equipment power levels
    - ✓ *Active mode*: power of appliance when it is in operation
    - ✓ *Standby mode*: state which recovers power with instant recovery
    - ✓ *Off mode*: when the device is off
  - Power level data supplied by the maintenance department

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## Case study

- **Field observations**
  - Monitoring operating modes: 2 observers per selected staff
    - ✓ Screening of individual behaviour minute by minute
    - ✓ Time spent at each operating mode (operating time) is reported
    - ✓ Seasonal differentiation: the observation took place in winter

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## Case study: interim results

- **Typology of users**

| | |
|---|---|
| "Normal user" | ■ CTRL+ALT+DEL during breaks<br>■ On-mode upon arrival at desk<br>■ On-mode or Standby & Screen on at the end of the day |
| "Economic user" | ■ Off-mode during long breaks and standby during breaks<br>■ On-mode upon arrival at desk<br>■ Off-mode at the end of the day |
| "Optimal user" | ■ Standby mode during breaks, Screen On/Off;<br>■ On-mode upon arrival at desk;<br>■ Off mode at the end of the day |

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## Case study: interim results

- "Normal" typology: dominant behavior (80%)
- Exception: IT Dept. where behavior is split between "Optimal" and "Economic" (20%)
- Confusion between "CTRL + ALT + DEL" and standby mode
- More energy savings/effective use if there are more users in either "Optimal" and "Economic" and less in "Normal" behavior
- Importance of investments in awareness campaigns to prompt behavioral change ("behavioral switch")
- Behavioral change can help!!!

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## CONCLUSION

- Examples of manual and automatic measures adopted
  - ✓ Posters
  - ✓ Software controlling the operating modes (i.e., On/Off states) of some appliances (e.g., beamer in a room) according to a predetermined plan
  - ✓ PC energy management tool (software) on computers: more effictive control of PCs' energy consumption. Users can select their desired level of efficiency, set the schedule, and then leave the application run in the background while their PC is on.

## CONCLUSION

- Technologies alone cannot be effective in reducing energy consumption
- Huge and untapped energy reduction potential exist: our behaviour (refer to our paper, in Fragniere et al, 2010)
- Using operating modes can also contribute to the reduction of energy consumption, hence to energy supply security
- Just as technology switch in an energy system, behavioural switch/change can also contribute to energy supply security
- Therefore, behavioural change through operating modes should be integrated into Socio-Markal scenarios