Débouchés pour les thésards dans l'industrie

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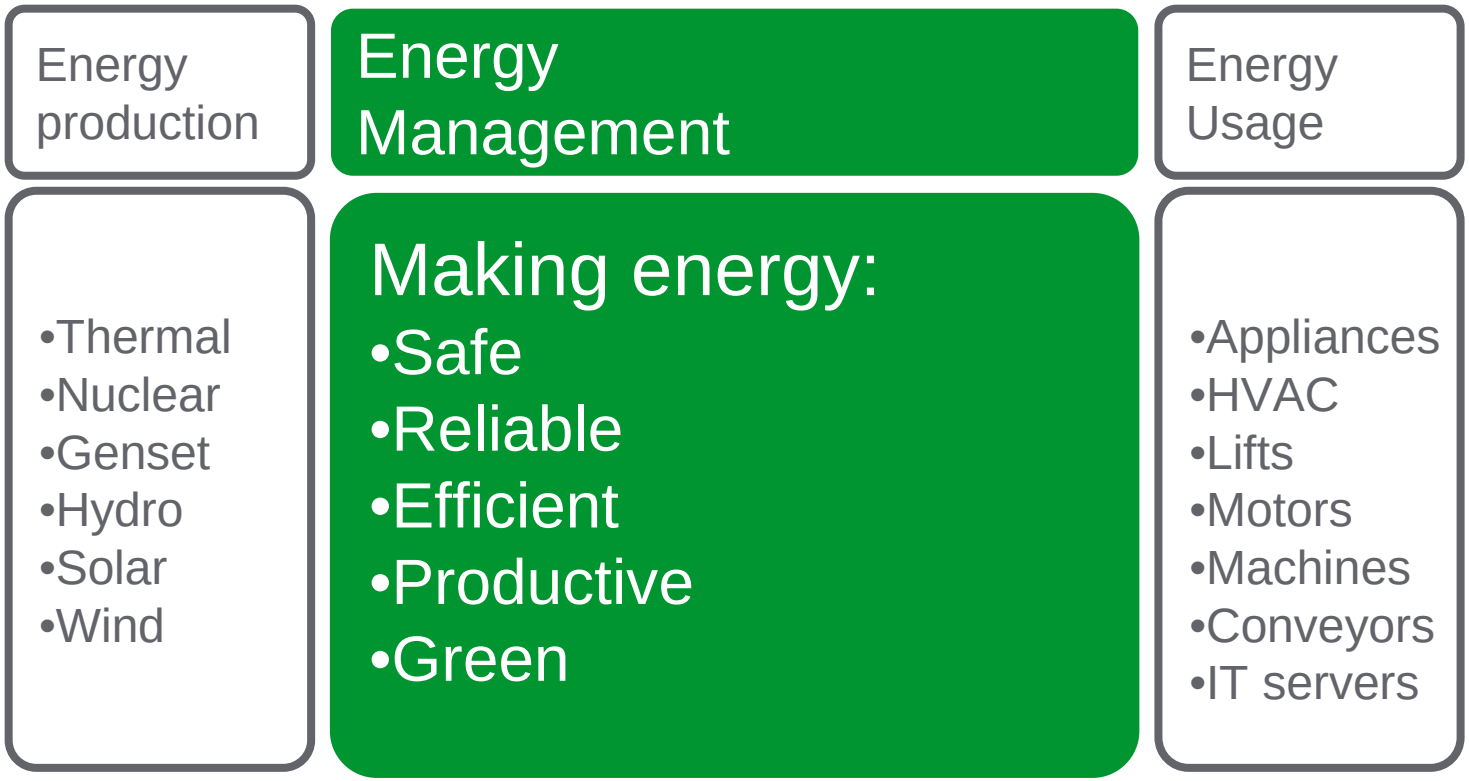
Journée des thésards – 19 Mars 2010

Outline

- **Schneider Electric**
  - **Who we are**
  - **Zoom on energy efficiency solutions**
- Doctoral profiles in companies
  - Technical expertise
  - Research habits
  - Requiring more and more additional skills in a highly evolving context
- Career paths in companies
  - Traditional and diversified
  - An example (myself)

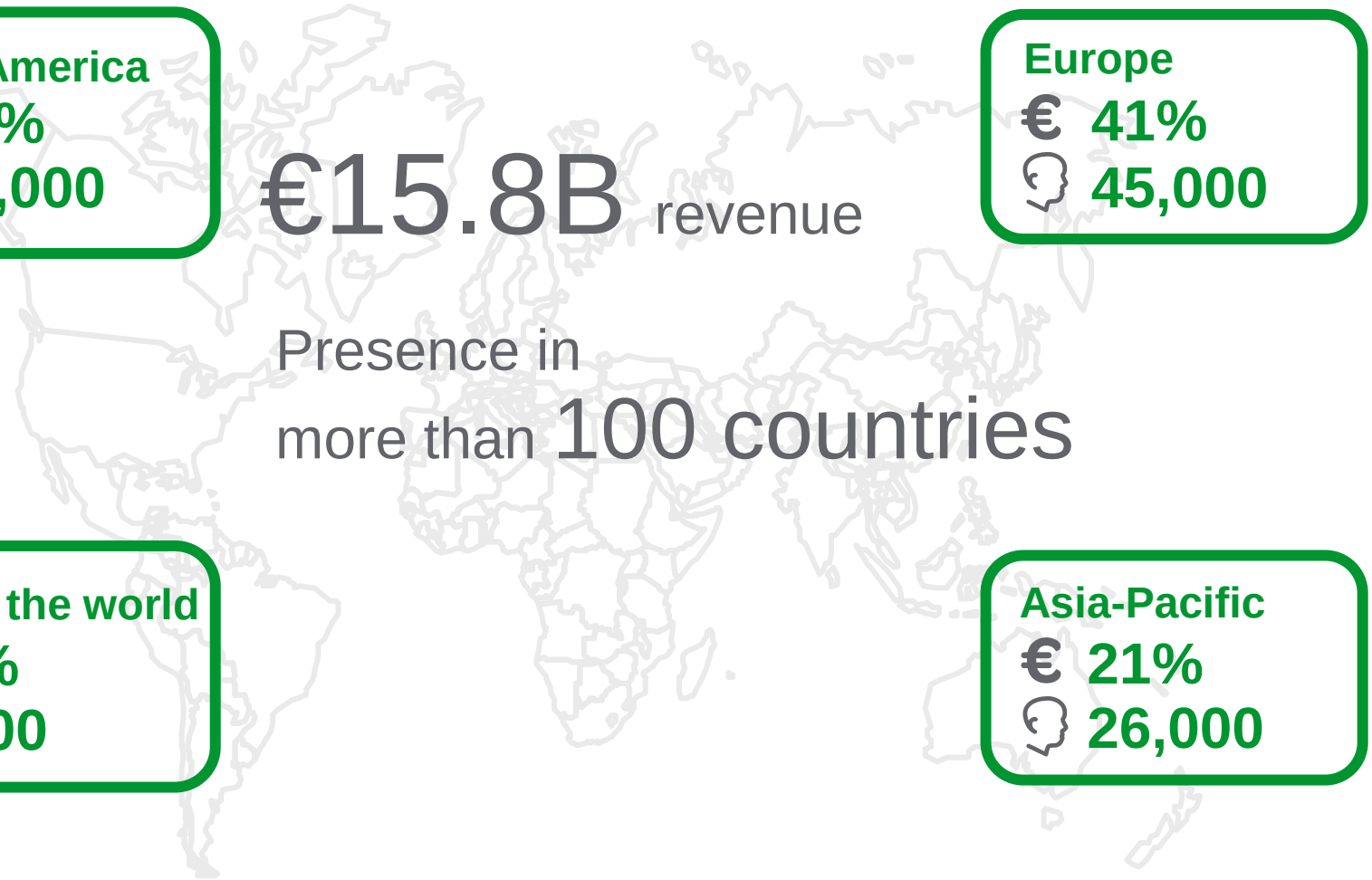
We are the global specialist in energy management



We help our customers making the most of their energy

We are a global company

Data at end 2009



North America
€ 28%
25,000

Europe
€ 41%
45,000

€15.8B revenue

Presence in
more than 100 countries

Rest of the world
€ 11%
9,000

Asia-Pacific
€ 21%
26,000

With a global R&D team

764M€ invested in R&D in 2009

4.8% of Schneider Electric revenues

Around 7,500 employees in R&D and technical engineering

Significant teams in 25 countries, representative in terms of markets and competences

In an open ecosystem: leveraging more than 50 technological partnerships

(industrial partners, public research laboratories, cooperative projects within poles of competitiveness or European)

Leading the *Homes* project for energy savings in buildings

- The largest innovation program ever launched in Europe on energy management in commercial and residential buildings
- 26 work packages, 170 tasks, 287 deliverables, in 4 years

The energy dilemma is here to stay

The facts

×2

Energy demand

By 2050

Source: IEA 2007

vs.

The need

÷2

CO_2 emissions

to avoid dramatic climate changes

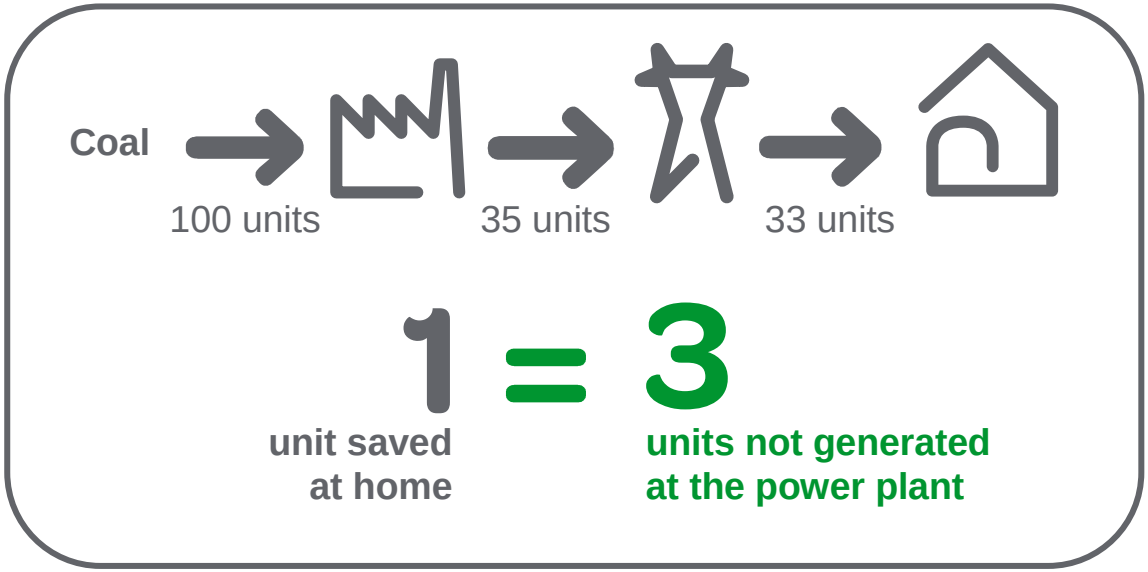
(vs. 1990 level)

Source: IPCC 2007

Energy management is the key to address the dilemma

Solution with energy efficiency benefit is a must have for customers

- Cheaper

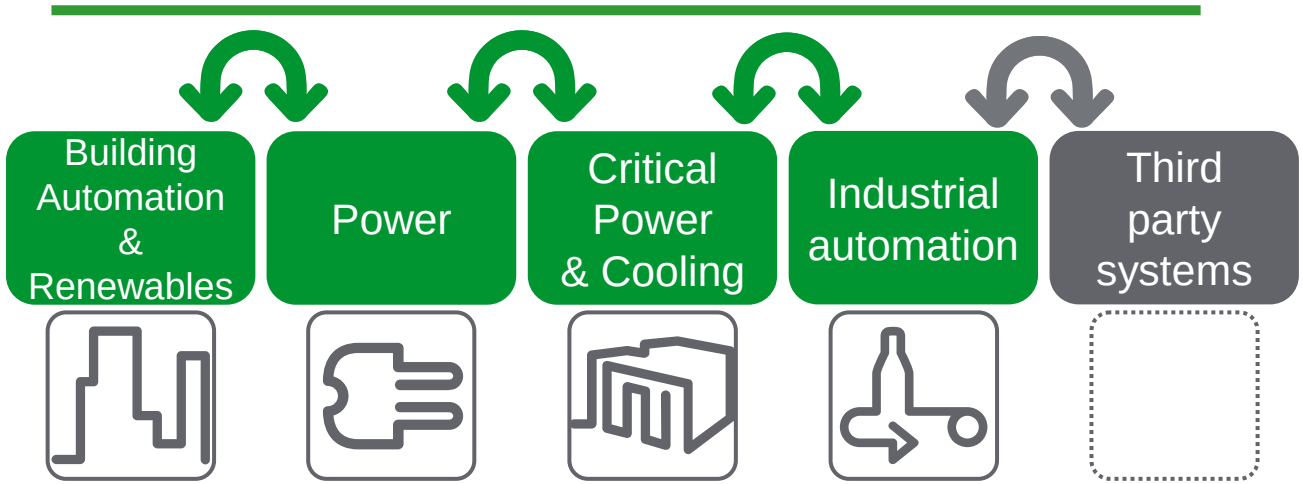


- Quicker
  - Technology is available today with short term results
- Cleaner
  - “Negawatt” produces no environmental footprint
- Enhanced Security
  - EE is homegrown, it reduces dependence on imports

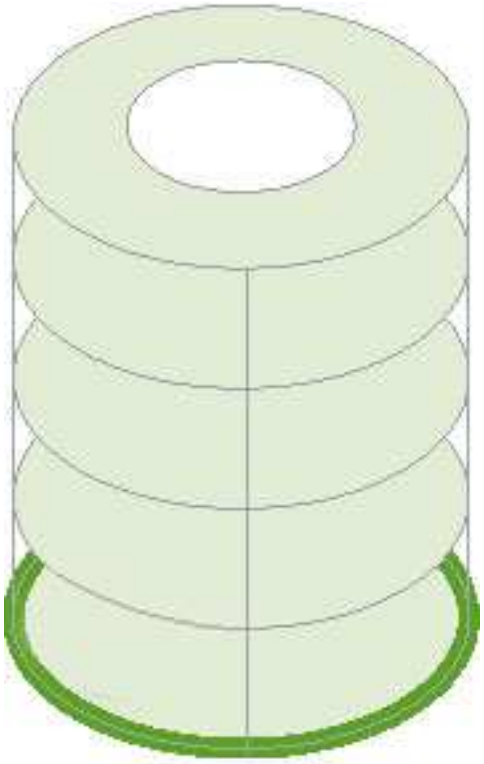
Solution built on a common architecture that bridges fields of expertise

- Provide interoperability and openness to third party systems
- Leverage connecting technologies

  Internet Protocol (IP) – Ethernet, Service Oriented Architecture (SOA) & Web 2.0, Zigbee (wireless)



Example: integrated solutions in buildings



- Building management
- HVAC control
- Lighting control
- Access control
- Security
- Electrical distribution
- Energy monitoring
- Motor control
- Critical power
- Renewable energies

Leading end-user interface

Simple Integration Interoperability and openness to third party systems

Efficiency

- >30% energy saving
- Optimised Capex & Opex

Green

- Connection to renewable energies

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Technical expertise

- By definition, a doctoral thesis represents a unique contribution in a given technical domain
  - If accomplished in the context of an industrial cooperation (e.g., CIFRE, bilateral project, multi-partner cooperative project), it is also aimed as one enabler of identified industrial applications

- Hence a very good starting point to contribute to industrial R&D projects
  - Mastery of a given technical domain
  - With a unique contribution
  - Potentially enabling industrial applications

Research habits

- Good doctoral theses also reflect thorough application of several important good practices
  - Bibliography, and more generally the good practice of looking at what others have been doing rather than redoing the same thing from scratch
  - Ideation, the good practice of brainstorming to invent new product features, new solutions to problems, new methodologies and tools, in particular on the basis of analogies between different domains
  - Hard problem-solving work, the good practice of searching how to overcome difficulties
  - Experimentation, the good practice of designing environments to test ideas, make appropriate measurements to evaluate progress and remaining difficulties, and drawing conclusions from available results
  - Communication, the good practice of presenting ideas and results in limited time and space, both in oral and written forms

Requiring more and more additional skills in a highly evolving context

- From the lab to the real world, a number of additional problematic dimensions emerge
  - Partnerships and “open” innovation
  - Multi-criteria design
  - Uncertainty

➢Cultural evolutions are required

Partnerships and “open” innovation

- Many different elements along the innovation chain, and along the supply chain, are required for an innovation to succeed
- In some cases, responding to the requirements of several applications creates a market, when each sub-market would be “too small”
- In some cases, standards agreed upon between competitors are required for an innovation to take off (no standard, no market)
- …

- Cooperative R&D and open innovation involve many different actors: academia, product and solution end users, technology and material suppliers, actors of the recycling chain, government agencies …
- In international contexts (Europe, North America, Asia-Pacific …)

➢ The young doctor needs to learn to cooperate (and compete at the same time) with others, and must become at ease with cooperation, standardization, and intellectual property strategies

Multi-criteria design

- General move toward multi-criteria design
  - From traditional performance-cost compromises …
  - With a risk management culture in some industries …
    (⇒ safety, security, reliability)
  - To a more complex picture: performance, ease of use, cost, safety, security, reliability, environmental impact, sustainability, user confidence, etc.
- Throughout the life-cycle of a product or solution
  - Manufacturing, shipping, installation
  - Usage
  - Retirement
- Requires the use of reference (Pareto-optimal) points
  - To evaluate progress
  - Maintained to keep up with the state of the art

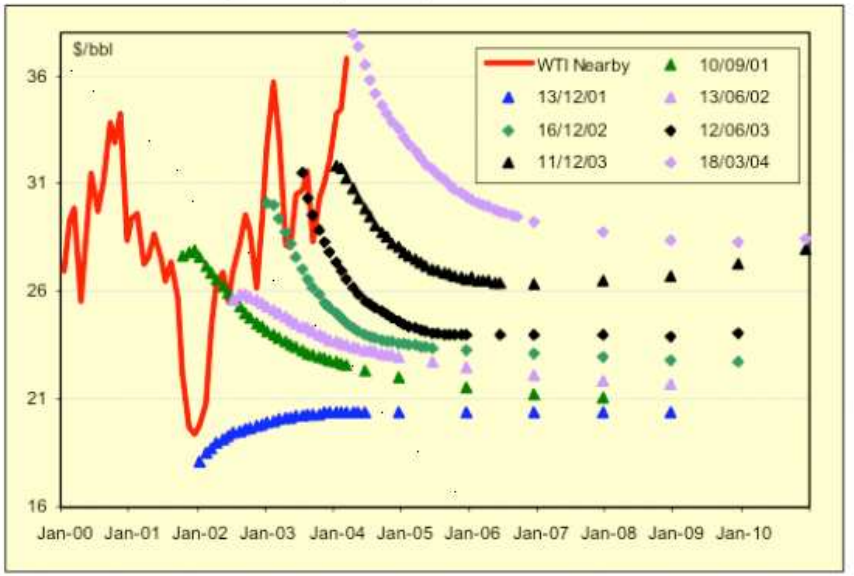
➢Both a methodological and a cultural issue

Uncertainty

- Industrial feasibility of an innovation depends on many factors that are not always mastered locally
  - Process evolutions
  - Strategy of suppliers
  - Market perception
  - …
- In particular on costs, dependent on other innovations, on quantities, or even submitted to “random” fluctuations
- Environmental criteria: the actual environmental impact of an invention is generally difficult to assess (e.g., where does the electricity that is used come from?)

➢The young doctor needs to learn to live in an uncertain world

Figure 1: Oil prices & forward curves 2000-04



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Career paths in companies

- As technical expert in R&D
  - In a domain of interest to the companies
  - Technical expertise is the core competence, but need additional competences for the expertise to get and show high value
  - In the long run, interest in moving between application domains, working in different contexts, etc.
    - Within the same large company (more or less easy depending on the expertise domain)
    - Between companies (frequent)
    - Between companies and academia (much less frequent)

Career paths in companies

- First as technical expert in R&D, and then:
  - Project management
  - Marketing
  - Customer service (in some cases, highly technical)
  - Purchasing
  - Industrialization / Manufacturing
  - Quality assurance
  - Standardization
  - Strategy
  - …
  - Top management
- With possibilities to go back and forth

An example

- Doctoral thesis in computer science (scheduling theory)
  - University Paris XI and Alcatel-Alstom
  - Followed by a post-doctoral period at Stanford University (robotics laboratory)
- Consultant (customer service) for a software editor (ILOG)
  - Highly technical problem solving for customers
  - In various domains: time-constrained mixture design, long-term personnel planning, manufacturing scheduling, etc.
  - Leading after 2 years to the idea of developing a new product for constraint-based scheduling
- R&D for ILOG
  - Development of a new product, first alone, then as head of a small team
  - Guided by the customer concerns met in the previous consulting period
  - First applied in Singapore, UK, USA

An example

- Move to work on practical applications at Bouygues SA
  - Development of applications of the previously developed technological principles
  - Requiring extensions, performed in the context of a European project and thanks to the contribution of a doctoral student (co-managed by University of Compiègne and Bouygues)
  - With both internal applications and publications on the basic technologies (eventually including a reference book in the domain)
- Management of the developing central R&D team at Bouygues Telecom
  - Up to 35 people in various domains: electromagnetism, radio communication protocols, software and service development, mathematical modeling and optimization, ergonomics
  - Important links with the academic community and with governmental organizations (R&D funding)

An example

- Now in Schneider Electric
  - In charge of coordinating the evaluation of new technologies, the recognition of research and development experts, and the management of research and development partnerships
  - International (Europe, Asia-Pacific, America)
  - With important links with the academic community, with Minalogic, and with governmental organizations in France and Europe
- Having the pleasure to be with you today and looking forward to your questions …