ARC Advisory Group

vision experience answers FOR INDUSTRY

Energy Managmenet: Experiences, Framework, and Outlook

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- What is Energy Management?

- ARC's Energy Management Model

- The State of Energy Management

- Industry Examples

- Outlook

- … and what about Sustainability?


What is Energy Management

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What is Energy Management?

- **Energy Management:**

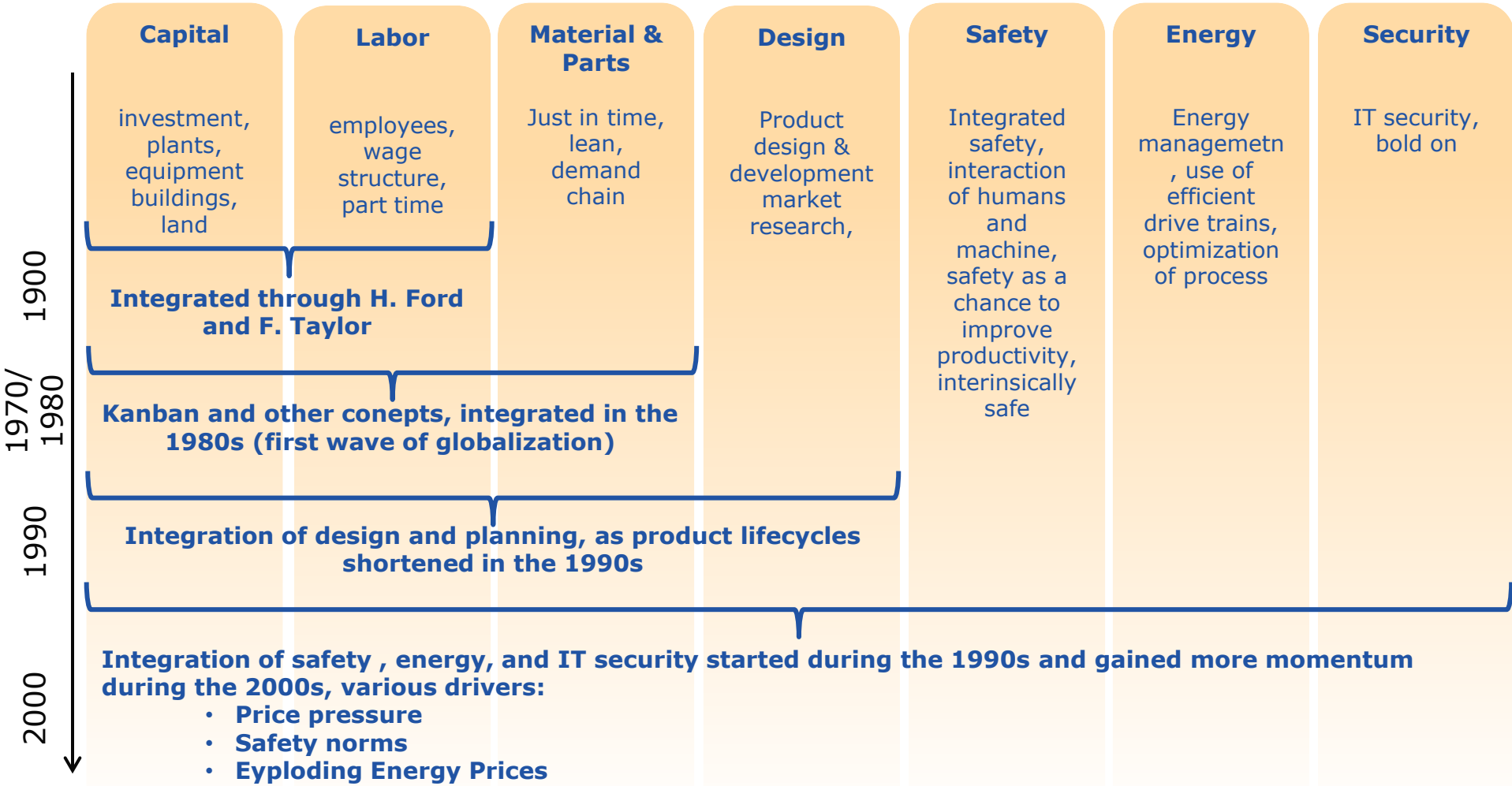
  Control of Energy Costs in dependency of output.

- **What is needed:**
  - Monitoring:

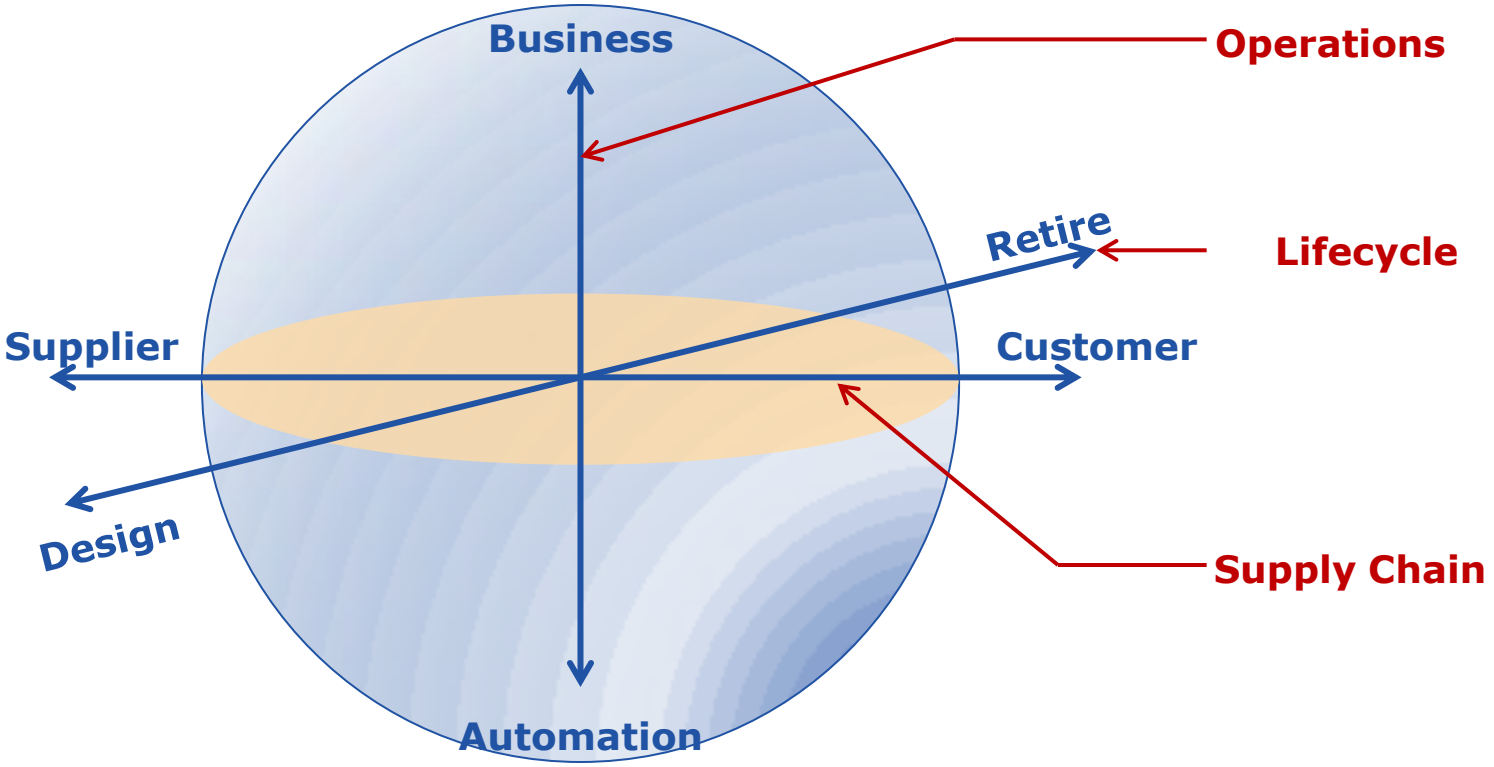
    KPIs: Energy units (kW/BTU) per time, Energy cost per output, benchmark, history, …
  - Control: Lower costs, lower usage, change process

What is Energy Management? Just another column

Integrating different input/cost factors in manufacturing



What is Energy Management?
The production Floor



The different columns have to be merged at the plant floor, this requires:

- **Powerful Hardware**
- **Powerful Software**
- **Process and production know-how**
- **Energy Management can include all aspects of the the CMM**



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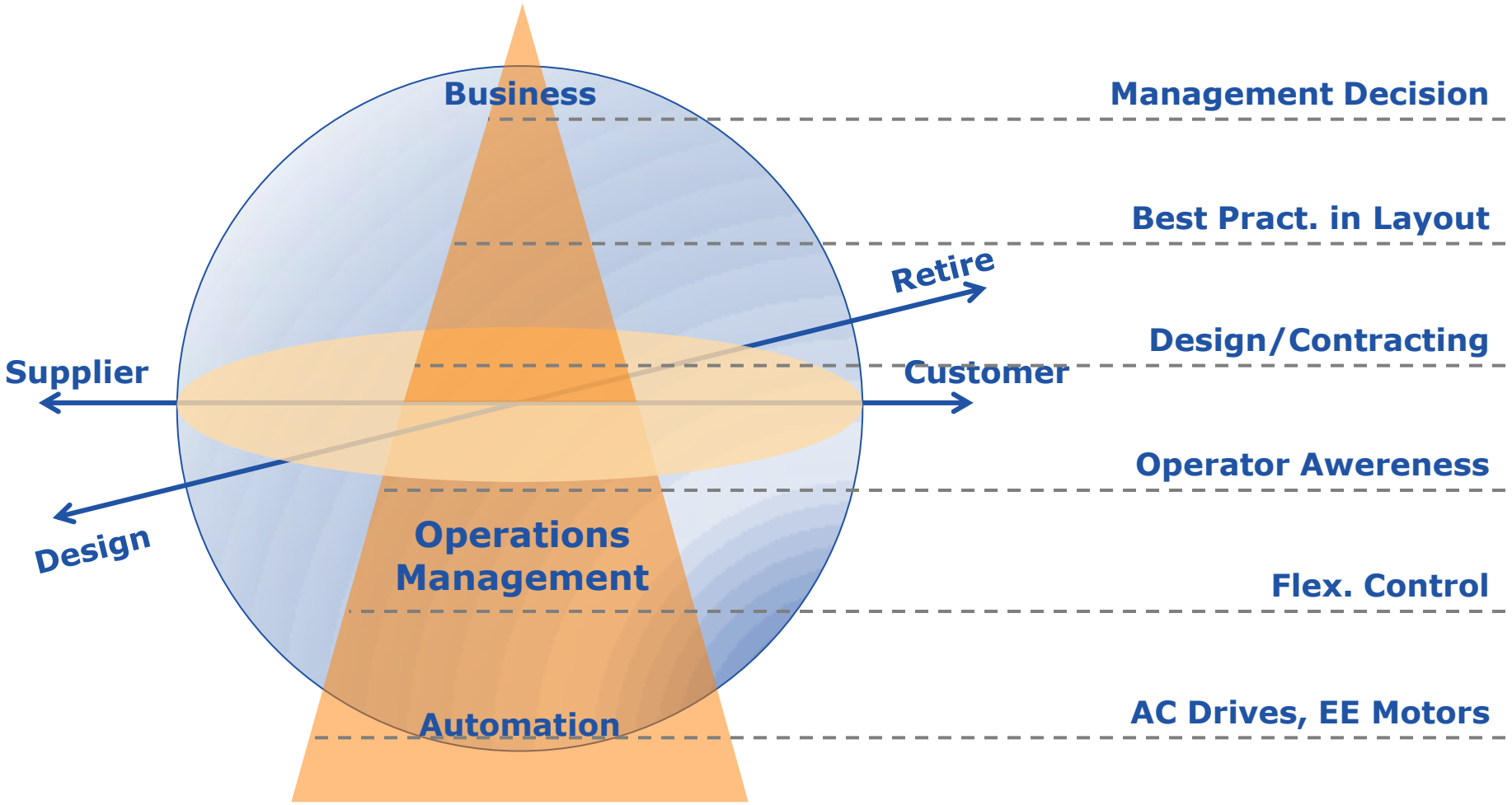
ARC's Energy Management Model
Energy Management in Operations

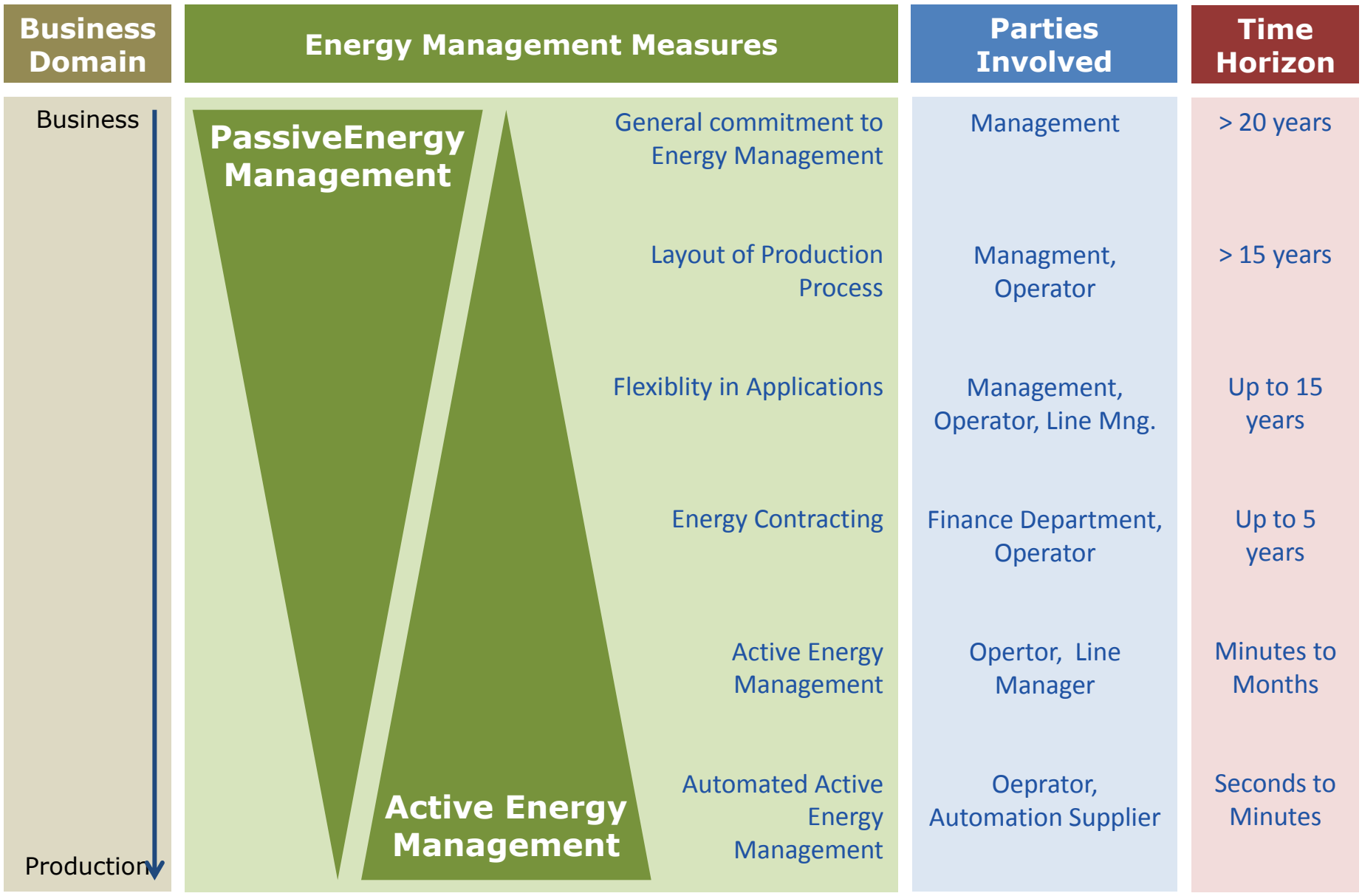
- **Passive Energy Management:**
  - Measures are taken that do not impact the produciton process itself
  - Example:
    - Use of AC Drives
    - Better isolation, leakage control
    - Electrical actuators vs. pneumatics
- **Active Energy Management:**
  - The production process itself changes
    - Integrating into control architecture
    - Change of Production Layout
    - Profi Energy
    - Advanced process Control

ARC's Energy Management Model
Energy Management in Operations

Main Focus of Energy Management is the production floor:



ARC's Energy Management Model
Energy Management in Operatoins



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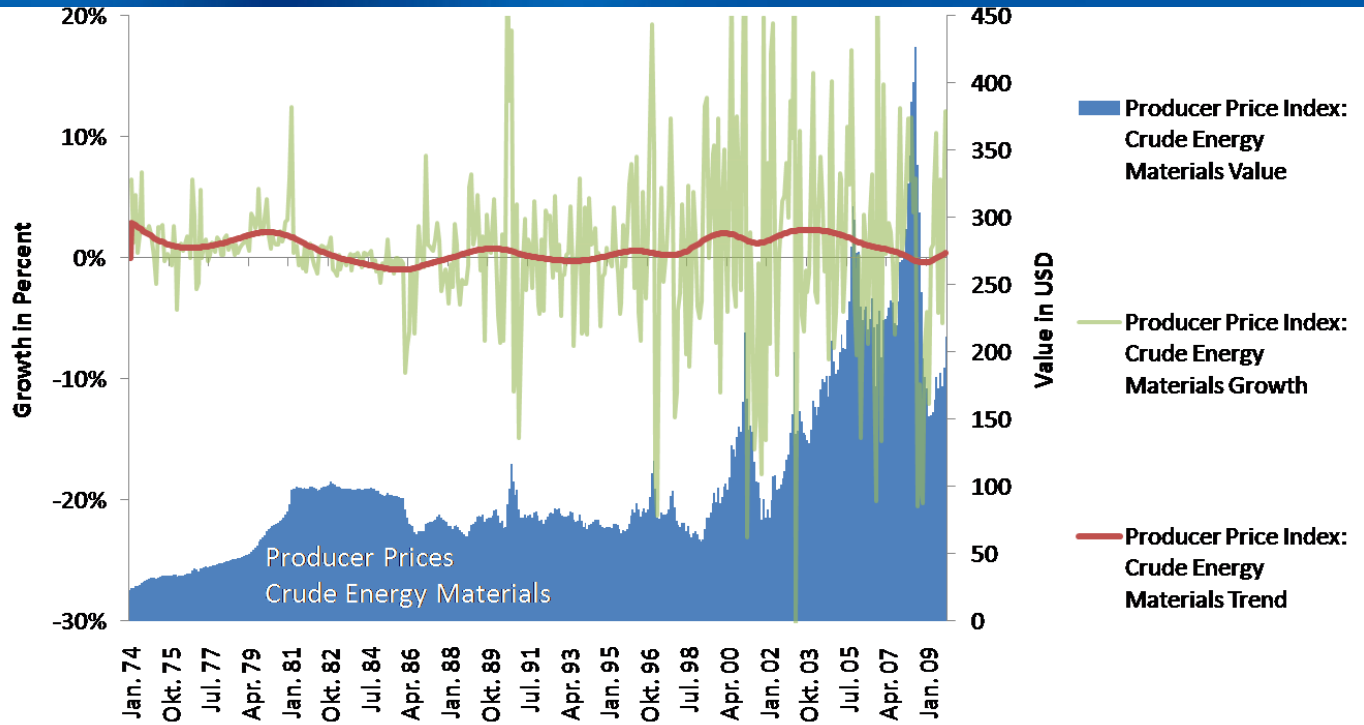
The State of Energy Management: How do we got here?



Source: Federal Reserve Bank of St. Louis

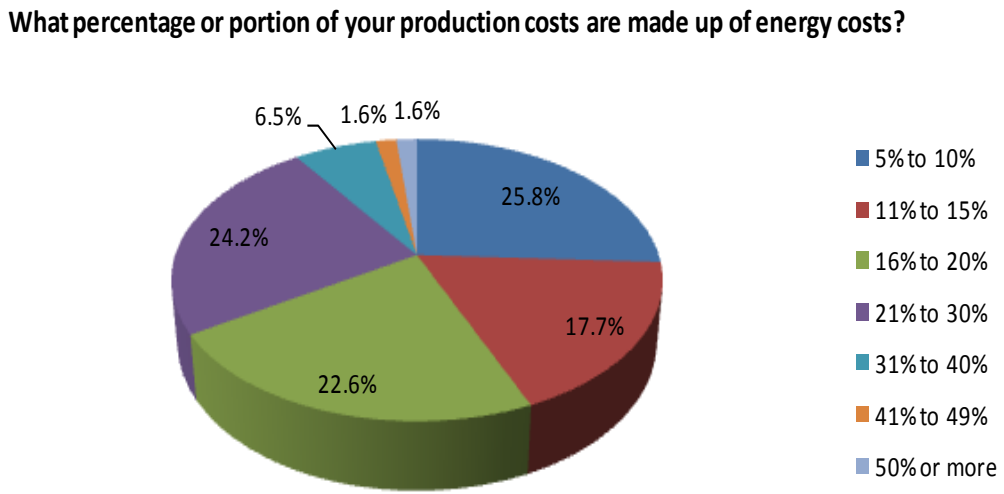
- **Prices increased drastically**

„We have no problem with rising prices across the board, it doesn't not diminish our competitiveness …"

- **Price volatility increased drastically**

„…what really hurts us now is the volatility!"

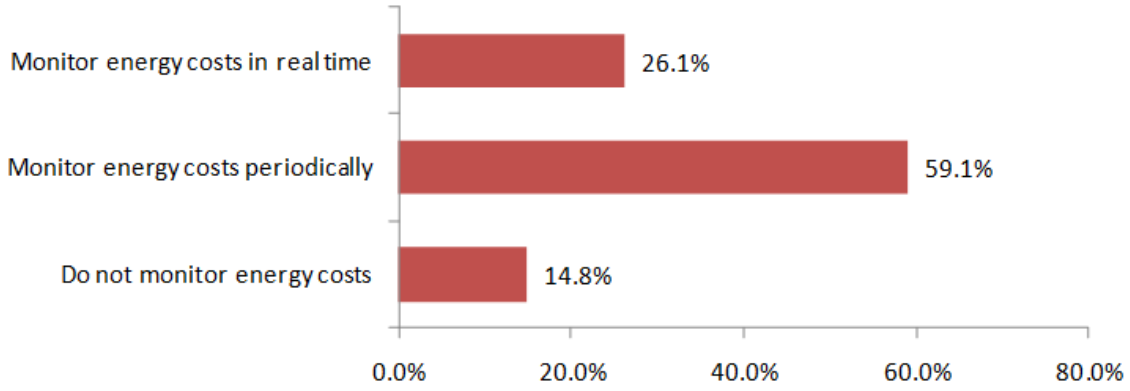
The State of Energy Management: Energy as a Cost Factor



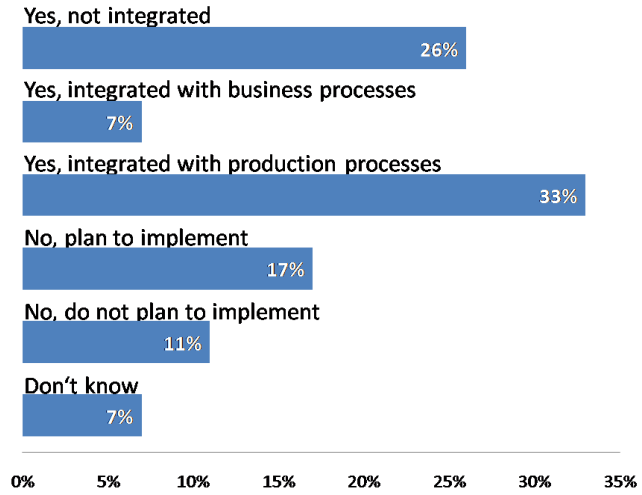
- **Energy Efficiency is a Mega Trend**
- **Energy reduction initiatives date back to the early 1990s**
- **carbon foot print reduction are tied to the Kyoto Protocol**
- **Sustainable manufacturing embodies three principle concepts:**
  - Design and produce environment- and resource-friendly products;
  - environment- and resource-friendly plants
  - environment- and resource-friendly (supply chain) networks

The State of Energy Management: How End Users deal with it

Do you monitor your energy costs?



Does your company have an energy management system?



Source: ARC Survey

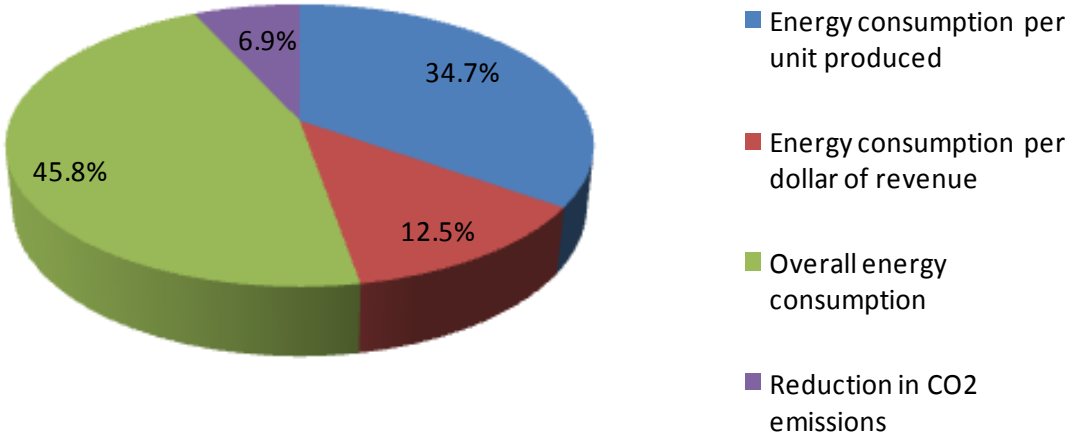
Though Energy makes up a significant portion of production costs,

- Few end users monitor energy costs in real time.
- Over 50 % evaluate energy costs periodically (cost allocation, accounting)
- Fifteen percent of respondents do not monitor their production energy costs at all

The State of Energy Management: How End Users deal with it

A large share of end users does not monitor energy consumption at all but with their monthly bill.

KPIs for Plant Energy Consumption



- Nearly 46% sill monitor overall energy consumption
- Consumption is more important than costs
- Per Unit is currently more populat than per revenue
- Reduction in CO2 emission is the smallest share





What is Energy Management

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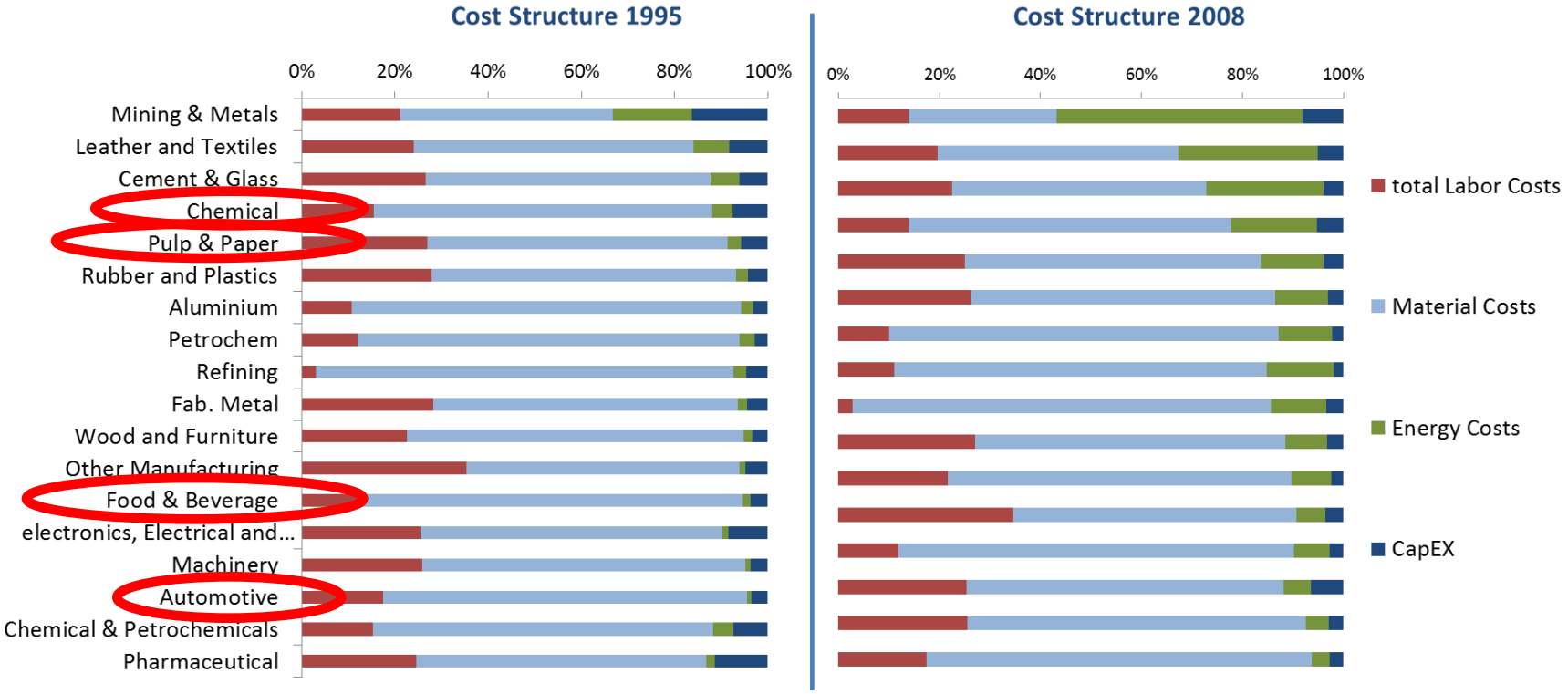
Industry Examples



Outlook

... and what about Sustainability?

Industry Examples: Different Indsutries Different Needs!

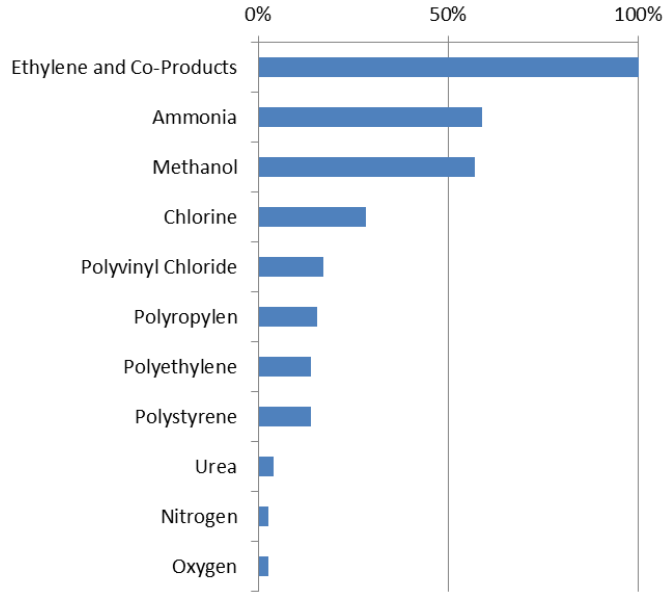


- **Metals and Mining:** High Share, but product price increase as input prices increase
- **Glas and Cement:** high pressure, partly local monopolies
- **Chemical:** High Energy costs of all kinds (WAGES)
- **P&P:** All about Water and Wood. Industries shifted from Northern Europe and Canada to Brazil and China
- **Aluminium:** High material costs, but energy costs are also very high in absolute values
- **Food&Bev:** All Water is important as well as electricity
- **Electronics & Electrical:** Energy costs are hardly discussed
- **Automotive:** Constant price pressure (-5%)

Industry Examples: the Chemical Indutry

Up to 25% of the total costs in the chemical industry is energy!

Energy Intensity by Product



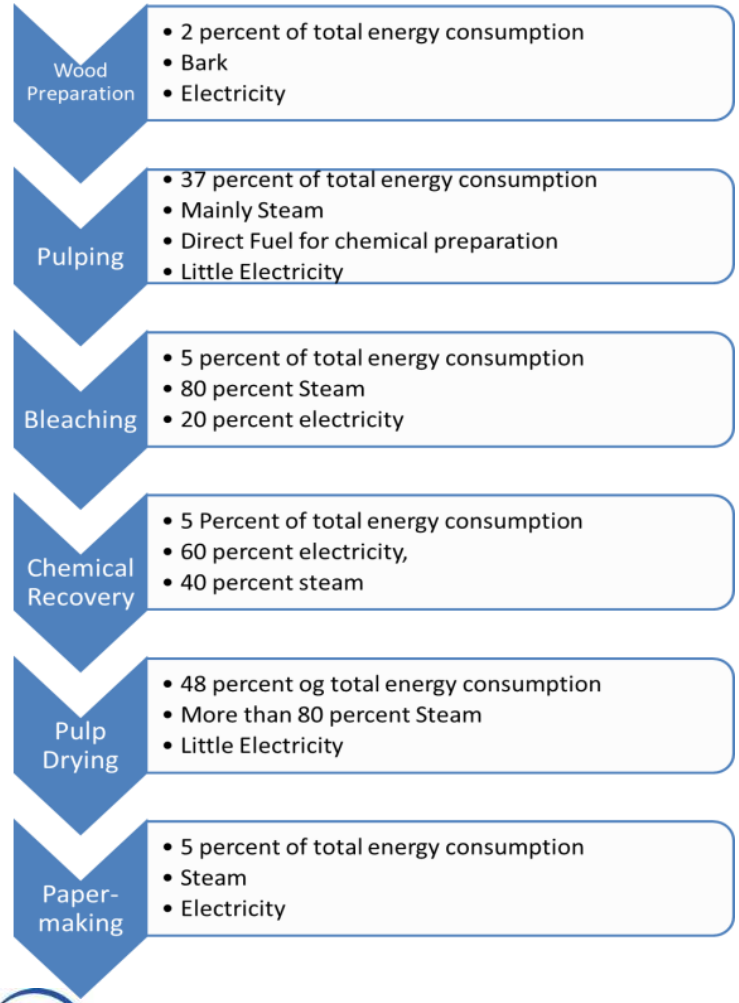
Energy Intensity by Process

			Share in Energy Consumption
Cracker			47%
	Heat of Reaction		23%
	Dilution Steam		6%
	Heating and Losses		18%
Compression			22%
Separation			31%
	Chiller		21%
		Condensator	16%
		Ethan Seperator	5%
	Steam		10%
		Acetylene Removal	3%
		Heavy Separation	7%

- **The European chemical industry continuously works on its competitiveness**
- **Typical initiatives (level of automation, predictive maintenance, OPEX) have long ROI time combined and a high risk level.**
- **Small and medium investments in energy efficiency:**
  - low initial investment
  - Small risk if process itself is not changed
  - short project time frame and often ROI within months
  - Improve company image

Industry Examples: Pulp & Paper

The share in variable costs is around 17 percent



- **Environmental laws affect the pulp & paper industry heavily (GHG emissions, water treatment, forest)**
- **Industry is under reconstruction due to the development in China and Brazil. Often new plants in Brazil and China are more efficient than old plants in the west**
- **Industry optimizes energy consumption to a very deep level and has applied a lot of measures (integration of heat, black liquor usage)**
- **There is a clear correlation between a stable and an efficient process**

Industry Examples
Food & Beverage

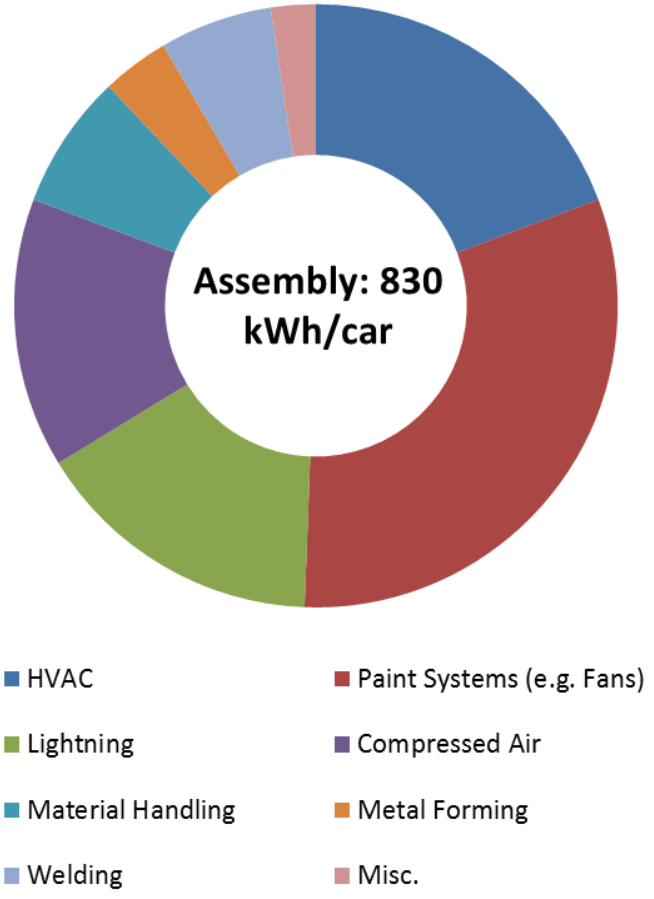
On average energy represents 10 % of variable costs.

Energy use within the Food & Beverage Industry	Primary Energy Source	Secondary Energy Source
1. Heating / Cooking / Concentration	Steam / Gas	Electricity
2. Washing / Peeling/ Blanching	Water / Steam	Electricity
3. Heat Sterilization / Pasteurization	Steam	Electricity
4. Conveying	Electricity	
5. Drying / Evaporation	Steam	Electricity
6. Cooling	Electricity	
7. Frying	Gas	

- Divers industry: From Refining sugar to packaging Lollipops
- Usage of water and energy to process, handle, and clean.
- Competition is driving margins down – investment in new energy savings will increase
- Strict regulations (ingredients, etc.), requirements for hygiene set strong framework
- Investment cycles vary from e.g. corn mills to food packaging
- Power quality can cause production machinery to lose temporary control of processes resulting

Industry Examples
Automotive

On average energy represents 5% of variable costs.



- Large amount of energy used is electricity
- Currently pneumatic and hydraulic actuators are replaced with electrical systems (better control, higher flexibility (hydraulics), use less energy (pneumatics))
- ProfiEnergy was pushed by AIDA
- Car manufacturers aim to make sustainable products (70% fuel, 30% production, 10% fuel supply)
- Paint shops consume up to 60 percent of the energy purchased for assembly.
- Motor manufacturing is electricity intensive and electricity can account for up to 40 to 50 percent of costs
- Investment cycles are short
- price pressure is high and plants are constantly benchmarked









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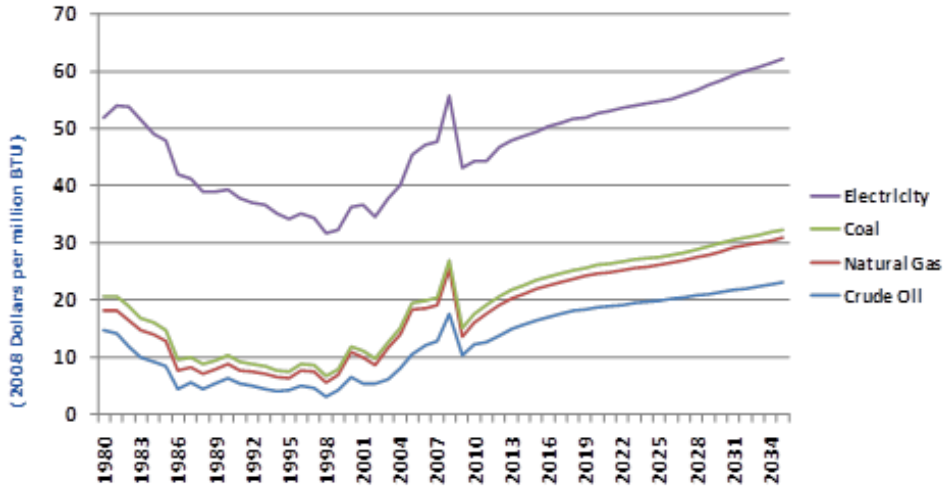
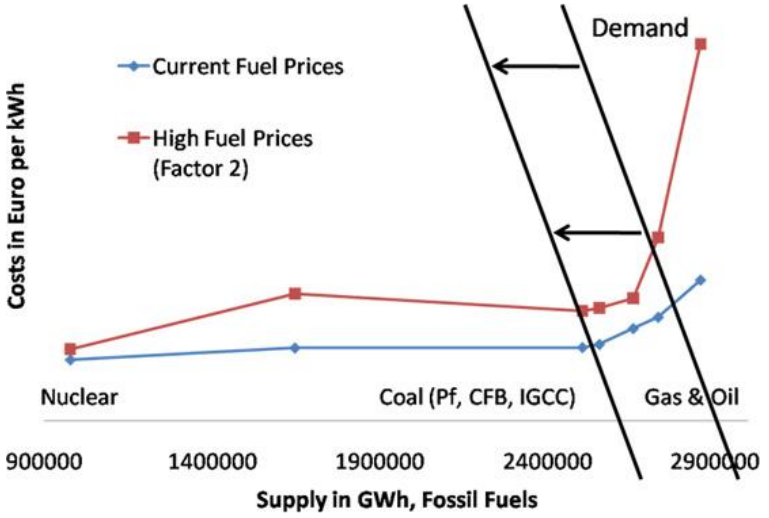
… and what about Sustainability?

Outlook:
Will the pressure get lower?

Price development of Primary Energy and Electricity:



Price development of electricity, the impact of renewable energy sources:

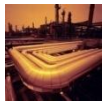


- Commodity Prices will continue to rise
- Commodity prices will continue to be an ongoing subject of speculations and a bubbles, which will induce volatility
- Electricity prices are regionally determined. Especially in Europe the price volatility will increase as the share of renewables rises

Outlook:
Road Blocks

- Lack of awereness (measuring first)
- Machine builders as middle man
- Automation suppliers do not fully address and understand problems
- Process is IP of plant operator
- SI benefit from proprietary solutions
- Energy prices rise for all market participants
- Costs can be passed on to consumers / suppliers



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… and what about Sustainability?

Sustainability is the pattern of resource use, that aims to meet human needs while preserving the environment so that these needs can be met not in the present and future.

- **Global and Holistic approach.**
- **Energy Management can be the visible part of a sustainability culture in a company**
- **For business success we need a more concrete concept: Energy Management**

Event Recommendation:

ARC‘s Process Management Academay (PMA)

- **Antwerp, March 2012**
- **Workshop on energy Efficiency**
  - Audience: End users, system integrators, and automatino suppliers, focus on process and discrete industries
  - Together with Automa and other media partners

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Thank You.