

Overview of Building Simulation in Europe

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- Increased use of building simulation: drivers and barriers
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EU Policy

Following Kyoto agreement:

- All cost effective measures add up to a 5-10% CO₂ reduction over the period 2005-2010
- Aim is security of supply and competitiveness, with some environmental considerations added
- Funds redirected from fossil fuel and nuclear power programmes to renewable energy and energy efficiency

Selected EU Programmes

Joule – non-nuclear RD&D

Thermie – promotion and market introduction of energy efficient and environment-protecting technologies in industrial and private sectors

Altener – promoting the use of renewable energy by:

- Harmonised standards for RE products/equipment
- Improved information dissemination

Save - promoting rational use of energy

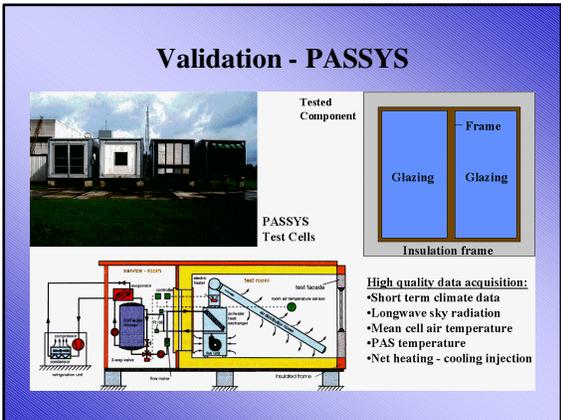
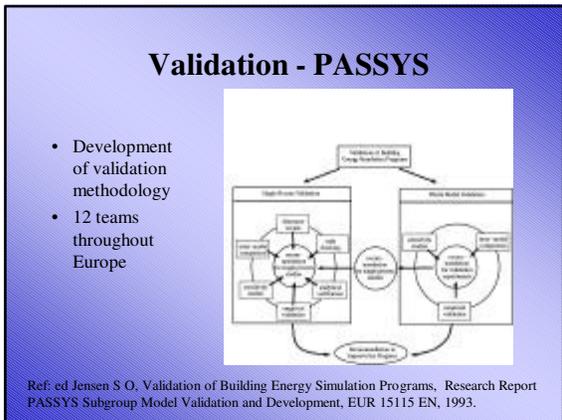
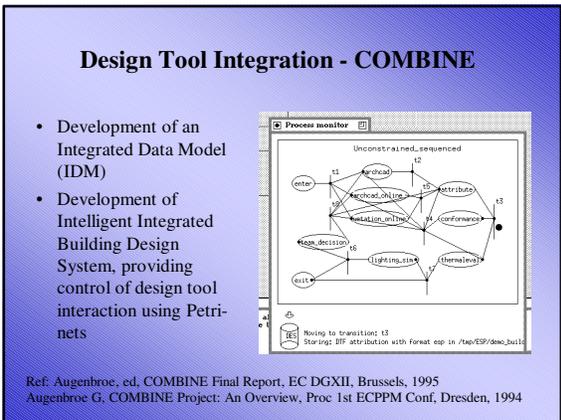
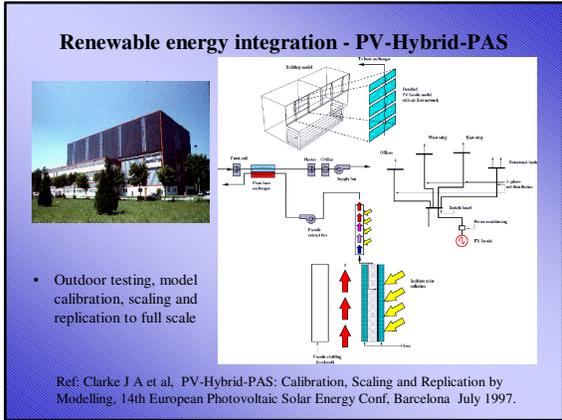
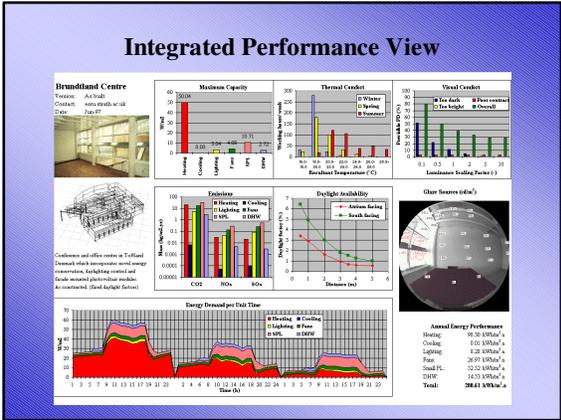
Growth - competitive and sustainable growth

EU 5th framework budget (Million Euros) 1998-2002

Quality of life/management of living resources	2413
User-friendly information society	3600
Competitive and sustainable growth	2705
Energy (non-nuclear)	1042
Environment and sustainable development	1083
Horizontal programmes	2857
Framework total	13700

Other governmental factors - UK example

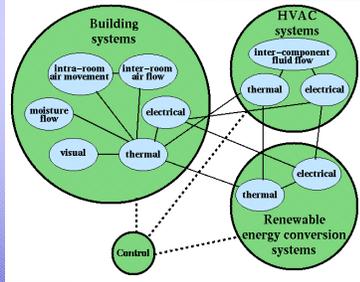
Kyoto Agreement (1997)	Heads of Government commitment to reduce key greenhouse gas emissions in EU by at least 8% by 2008-2012 relative to 1990. This would result in 2010 emission levels that are -29% below what would have been in the absence of the protocol.
Local Agenda 21	Commitment to reduce CO ₂ emissions at the local level.
UK Home Energy Conservation Act (1995)	Local authorities responsible for preparing practical energy conservation plans to achieve 30% reduction over 10 year period.
UK SAP Ratings Initiative	Introduction to the Building Regulations of a Standard Assessment Procedure (SAP) for domestic buildings
UK Clean Technologies Programme	Promotion of waste minimisation, sustainable cities and new technologies (e.g. fuel cells, photovoltaics, efficiency measures).
Electricity market deregulation	Open market puts pressure on all sectors to change current practices, especially in relation to complementary demand- and supply-side partnerships.
Climate change levy	Pressure on industry to reduce energy consumption.
Energy Action Planning	Requires elaboration of a range of appropriate sustainability indicators.



Integration of design tool functionality

Two routes:

- Pragmatic approach: increasing functionality of individual programs
- Formal approach – e.g. COMBINE, LAI

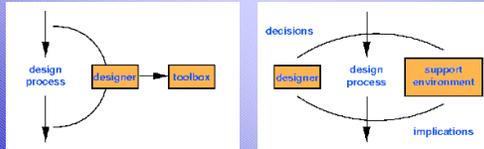


Mapping of Description to Behaviour

Cumulative model description	Typical behaviour enabled
pre-existing databases	simple performance indicators (e.g. material hydrothermal and embodied energy data etc)
+ geometry	visualisation, photomontage, shading, insolation etc
+ constructional attribution	embodied energy, material quantities, time constants etc
+ operational attribution	casual gains, electricity demands etc
+ boundary conditions	photo-realistic imaging, illuminance distribution, no-systems thermal and visual comfort levels etc
+ special materials	electricity generation (photovoltaics), daylight levels (switchable glazings) etc
+ control system	daylight utilisation, energy performance, system response etc
+ flow network	natural/mechanical ventilation, system performance, heat recovery etc
+ HVAC network	psychrometric analysis, component sizing etc
+ CFD domain	indoor air quality
+ electrical power network	renewable energy integration, load control etc
+ enhanced geometrical resolution	thermal bridging
+ moisture network	local condensation, mould growth and health

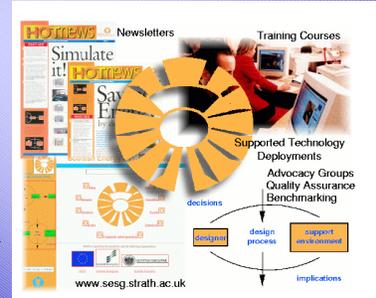
Technology transfer

- In the UK, the Energy Design Advice Scheme provided design advice to architects and engineers through the use of consultants. The Scottish Energy Systems Group is attempting to progress the work by helping to embed simulation in design practice - unique within Europe.



Technology transfer

SESG aims to transfer simulation to energy sector companies particularly through specialist staff secondments. The intention is to demonstrate that simulation-based design can yield results, quicker, cheaper and better than conventional methods. The SESG is a joint Scottish Office, Industry, Scottish Enterprise venture.



Conclusions

What building simulation software tools are commonly used by design professionals (architects/engineers)?

- Use of simulation increasing, particularly for prestige projects, but a long way to go for routine use.
- Biggest factor is move towards performance-based standards.
- Tools:
 - highly variable within Europe
 - more advanced applications

Conclusions

What are the major barriers to further adoption of simulation by designers?

- Capital cost driven design
- Cost of modelling
- Lack of awareness of capabilities by managers
- Poor ease of use/ need for training
- Need to set up QA procedures
- Skills shortage

Conclusions

Who is doing software development: universities, government agencies or private companies?

- Diverse in Europe:
 - utilities
 - companies
 - universities
- Proprietary software in most cases

Conclusions

What government and energy utility initiatives encourage the use of building simulation?

- Explicit:
 - technology transfer initiatives
- Implicit:
 - stricter building codes
 - performance-based standards
 - Kyoto etc....