• Energy Efficiency – ‘low hanging fruit’
• Decentralised (on-site) energy generation
• Low-e buildings - Tamm*
• Urban regeneration + Retrofitting

*Targts, Analysis, Measurement and Monitoring
Critical timeframe

Urgent - act NOW!


2007-2015
Building Energy Efficiency

20-30% efficiency increase NOW

• Upgrade building services technology
  – Motors, drivers & ballast
  – Sensors and control systems

• Dynamic (AI + NN) BEMS (Building Energy Management Systems)

• ~3yr Pay-back on ESCO’s (Energy Service Companies)

• Retro-fit

• Future innovations + technology upgrades
Decentralised energy

• Localised energy generation
  – Make it where its used & needed
  – Avoid T&D losses (7-10%)

• Local DC grid (mini-grid)
  – Most equipment & electronics (semi-conductors) operate on Direct Current (DC)
  – Avoid conversion losses (DC-AC-DC) (10-20%)

• CHP (Combined Heat & Power) + Cooling (Tri-generation) achieves ~80%+ efficiency (best available centralised electricity plant = 52%)

On-site generation

Building integrated:
- Solar electric (PV) - electricity
- Vertical axis wind turbines (VAWT) – electricity
- Solar thermal – hot water/air conditioning
- Ground source cooling – air conditioning
- Wastewater recycling (generates biogas)
- Waste-to-energy (organic waste to biogas)
- CHP - Gas/LNG/Biogas (links intermittent RETs)

Available + cost effective NOW
- Fuel cells (also CHP) – natural gas/biogas/hydrogen

Promotes better energy supply security
1 Deck-shading (CIS)
2 Rooflight (Poly-si)
3 S.SE facing Canopy (A-si)
4 Vertical façade (omitted)

View from residential tower (south)

40kW PV array (~ 65% roof cover) generates 9% annual electricity need, (target 10%) PV system costs within standard government budget for schools.

School design by Architectural Services Department, HK Government;
PV systems design, installation supervision, monitoring & data acquisition by HKU PV Research
Cost Analysis by DLS Management International.

HK Office Tower

PV-generated electricity powers window shades to prevent interior heat build-up (not grid-tie application)

One Peking Road, Hong Kong
Rocco Design & Partners for Glorious Sun

Wal-Mart Store, Aurora, Colorado, USA Reported (February 2006)

• 3-on-site generation technologies
  – 50kW wind turbine
  – 134kW solar electric installation
  – 60kW gas-fired micro-turbines

• Evaporative cooling including
  – Low-flow displacement ventilation

• Energy-saving:
  – Daylighting and EE lighting technologies
  – Solar wall pre-heats ventilation air
  – Waste-oil boilers heat water for underfloor heating
Property

Responsible for ~70%* of total energy use
60+ years operational life
A project developed today will impact well into 2080

But

Property developers have short-term focus

*Normally referenced as 40-50% but higher when embodied energy included
See Building Energy Efficiency, Asian Business Council, October 2007

Energy Life-cycle Analysis

Developers’ perspective

Initial Land Cost       Design Costs       Construction Costs

Building Energy Use & Maintenance Cost

Demolition Cost

LCC

energy use post build

Low-e

Conventional

Building Energy Performance

- BECS (Building Energy Codes & Standards) government tools
- Assessment tools (construction industry) adopted by governments
  - US Green Buildings Council (LEED) widely applied
  - UK BREEAM
  - Japan CASBEE
  - Australia Green Star

Benchmark building sectors, certification & labelling
- peer pressure + market leadership

Mandatory/Voluntary

- Enforcement
  - Government or self-assessment

- Market forces
  - easy finance, faster sales, leverage on price

- Non-fiscal tools/CSR
  - awards, publicity, prestige, share value

*Targets, Analysis, Measurement & Monitoring

Urban regeneration

Developers, Design Professionals & Clients

– Raised awareness (Building Performance Assessment tools)
– Corporate Social Responsibility
– Don’t knock down – retro-fit
– Appreciative of $ savings (time)
– Market advantage in ‘green’ features
  (Green Roof [HSBC] + Planted Walls)

Retro-fitting

– Saves embodied energy
– Cultural heritage
– Saves construction time($)
– Retrofit with RETs
  • PV installation
  • Ground source cooling
  • Ground source heating
New-build on ‘brown sites’:  
- Passive design principles – climate responsive  
- ‘Long-life, low-energy, loose-fit’ for future adaptability  
  (Note bedroom-size restricts Hotel upgrade results in demolition)  
- Integrated RETs – on-site generation for energy security  
- Recycling waste-water (irrigation/flushing) + MSW on-site (biogas)  
- EE awareness raised with localised generation
Shanghai’s Dongtan Eco-city (Zero carbon emissions) city of the future : Arups
Conclusion

- **Energy efficiency**
  - Targets and goals for EE + RETs
  - Building design from passive design principles
  - Design quality + time on system analysis & sizing

- **On site generation + energy efficiency**
  - CHP + RETs with BEMS
  - Savings from fossil fuel costs + energy security

- **Benchmarks through Green Buildings ratings**
  - Market forces + peer pressure
  - Building performance rating against competitors
  - Maximum advantages – CSR, sales, awards, publicity
Domestic solid waste + anaerobic digester = Biogas
Thank you

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