Ipswich Hospital

Energy Efficiency Project
Solar Cooling System
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March 2011
Background

- Queensland Health is undertaking state wide approach to reducing energy
- Criteria: include all forms of energy
  - electricity
  - gas
  - water
  - renewable energy

Ipswich Hospital historical energy usage

Total annual electricity usage = 12,100,000 kWh
Guaranteed Savings

- Electricity savings = 3,872,700 kWh per annum
- Gas savings = 830 Gj per annum
- Water Savings = 23,400,000 Litres per annum
- Greenhouse Savings = 4,154 tonnes of CO2

⇒ the equivalent of taking approx 1,025 cars off the roads

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Investment and breakdown

Investment cost for the complete project: $2.4 million

- Solar assisted cooling system ($1.06) 44.4 %
- Heating, ventilation and air conditioning 17.3 %
- Lighting 15.6 %
- BMS 9.6 %
- Water re-use and rain water 6.2 %
- Domestic hot water 5.3 %
- Water management systems 1.5 %
- Hydrotherapy pool heating 0.8 %

Contracted project outcome: 12% energy savings per annum, recovery of investment: 10 years

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### Summary of Solar System

- **System components**
  - Chiller Broad Chiller 290 (kW)
  - Vacuum tube Collector Broad of 920 m²
  - Solar field of 225 KW
  - Heat rejection oil
  - Buffer tank size (5500l)
  - Water is the storage media

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Day 2 – Solar Cooling Conference - 16/03/2011
Venue: The Hall, University House (ANU), Canberra
Summary of System

- Schematic flow diagram

Features of the solar collectors

- Solar collectors:
  - 54.4% of investment
  - 7 different fields
- Vacuum tubes
- 43 parabolic troughs
Specifications for the solar field

- Area of 920 sqm
- 255 kW thermal capacity
- 650 liters of oil
- Water temperature: up to 175°C

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Construction costs

- Five different roof inclinations
- Structural support
- 15.2% of investment
- Including: - construction drawings - approvals

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Why are the Structural cost so high?

- Working on an operational car park
- Various alterations
- Construction very fragile

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Why are the Structural cost so high?

- Balancing of pipes is essential
- Storms require massive frame

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Pipe work of the solar cooling project

- 5.8% of investment for pipe work:
  - 160m oil pipe
  - 450m hot water pipe
  - 60m chilled water pipe
  - 75m condenser water pipe

Hot water storage tank

- 1.4% of investment for hot water storage tank:
  - Tank of 8000 l
  - Insulated
  - Pressure tested
  - Certified
  - Includes control system
Solar control box

- 3% of investment for solar control box

Absorption chiller control boxes

- Absorption chiller control
- Connection to the hospital
Pumps of the solar cooling project

- 5% of investment for:
  - pumps
  - valves
  - heat exchanger

Absorption Chiller

- 15.2% of investment for absorption chiller:
  - including plant room
- Chemical process
- Vacuum
- Water heated through absorption chiller to produce cool water
Summary of System

- Chiller strategy
  - The Chiller will be operational when there is black out and the operating theaters will need cooling.
  - The chiller is line with the existing chillers to support the demand of the system

What can we learn from this project?

Where is the energy going?
What can we learn from this project?

Infrared pictures:

Troughs

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What can we learn from this project?

Infrared pictures:
Troughs

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What can we learn from this project?

Infrared pictures:
Storage tank

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Performance

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Can learn from the project?

- Hot oil vs pressurized water?
- Roof vs ground mounting of trough collectors?
- Site impacts/ limitations – layout, pipe runs, integration?
What can we learn from the project?

Conclusion

- First solar cooling project for the company
  - Quality control for vacuum tubes
  - The insulation could be improved
- Very positive reception from Queensland Health
- Positive impact for the hospital

Ipswich Hospital - Solar Cooling Project

Questions?

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