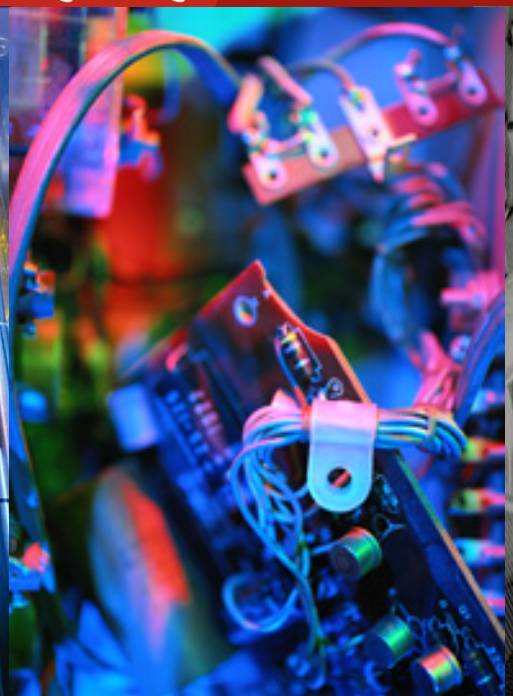


UNSW Nuclear Engineering

Professor John Fletcher

Never Stand Still

Engineering


‘Housekeeping’

Energy Portfolio at UNSW

Energy research and education is a cornerstone of UNSW activity.

- Oil and gas engineering
- Electrical power networks and technologies
- Mining: operations, safety, and sustainability
- Wind and photovoltaic generation
- Energy economics and markets
- Energy in transportation

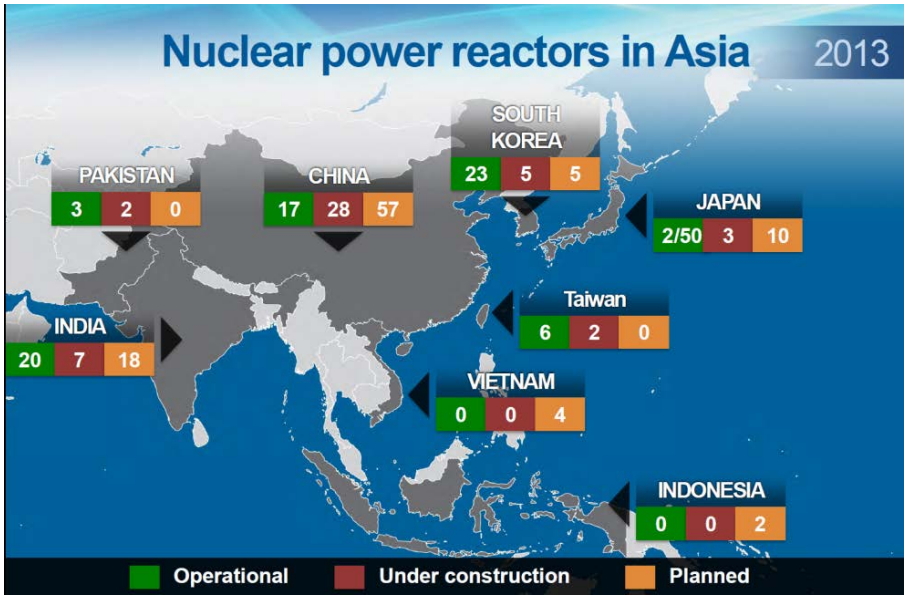
UNSW Nuclear: Aims

- Establish UNSW as an Australian leader in nuclear engineering education and research.
- Harness the distributed nature of UNSW expertise in nuclear-relevant areas and strengthen links with ANSTO.
- Foster international collaborations with leading nuclear engineering research centres.
- Contribute to international nuclear engineering research and the nuclear debate.
- Access new income streams from countries with developing nuclear programmes.

The Need for Nuclear Engineers

Where is the ‘pull’?

- Global need for low-carbon energy sources
- Nuclear engineers: an ageing workforce and long-term engineering commitments
- New nuclear commitments: UAE, Turkey, Vietnam, etc.
- Life cycle management: existing Generation II and III plant
- National needs: proliferation monitoring, IAEA activities
- Support of ANSTO activities: materials, life sciences, minerals, environment



UNSW Nuclear Engineering Research

Nuclear Engineering research activity at UNSW

Nuclear Fuel

- Accident tolerant fuels (Dr. Obbard)
- Atomistic modelling of Zr nuclear fuel cladding (Dr. Burr)

Reactor Design and Engineering

- Investigation and development of molten salt reactor designs (Prof Yeoh)
- High entropy alloys for structural nuclear materials (Mr. King, Dr. Obbard, Dr. Burr)

Reactor Modelling and Operation

- Modelling load following in small modular reactors (Dr. Obbard, Prof. Fletcher)
- Neutronics characterisation of Fluoride-salt-cooled high-temperature reactors (Prof Yeoh)

Fuel Reprocessing

- Potential wasteforms for waste from advanced reprocessing (Prof. Waite)

Recent $1.5M investment from ANSTO, Sir William Tyree Foundation and UNSW for staff and resources (with thanks!)

Example International Collaborations

KTH (Sweden), Westinghouse (Sweden) and ANSTO to investigate accident tolerant fuels (ATF) based on uranium nitride/uranium silicide composites.

ANSTO and Materion (USA) to investigate beryllides for fusion applications.

Imperial College London (UK), University of Manchester (UK), University of Oxford (UK) and ANSTO to investigate “Late Blooming Phases” in reactor pressure vessel steels.

- EPSRC (UK) Responsive mode grant submitted (Feb 2016)
- Atomic scale modelling (ICL and UNSW)

University of Illinois (USA) and University of Huddersfield/NNL (UK) to investigate radiation effects on zirconium nuclear fuel cladding.

University of Cambridge and ANSTO to investigate ordering and diffusivity of High Entropy Alloys

Institute of Metal Research (China) and Peter the Great St. Petersburg Polytechnic University researching elasticity in titanium alloys

UNSW Masters in Nuclear Engineering

Aim: broad-based approach, not only power generation

Themes: Uranium mining, electrical power, energy economics, materials, medical

Designed to allow graduate access from engineering disciplines

- Core Nuclear topics delivered in ‘intensive’ and ‘weekly’ modes
  - Fundamentals of nuclear engineering (Intensive mode)

Commonwealth Supported Places Available!

- Nuclear engineering research project (9-12 months)
- Engineering and technical management (1-2 courses)

Australian challenges for nuclear energy

The Grid

- Integration of large scale nuclear plant may require a rethink of the way the grid is operated e.g. contingencies. This presents opportunities for small, modular reactors.

The Investment Environment

- Who would invest $1-10B in an energy generation station in the current investment climate? Small, modular is an alternative with a lower capital cost.

The Community

- Is there support? Does the community understand the alternatives and their pros/cons?

The Government

- Will there be a government capable of making such a bold decision?

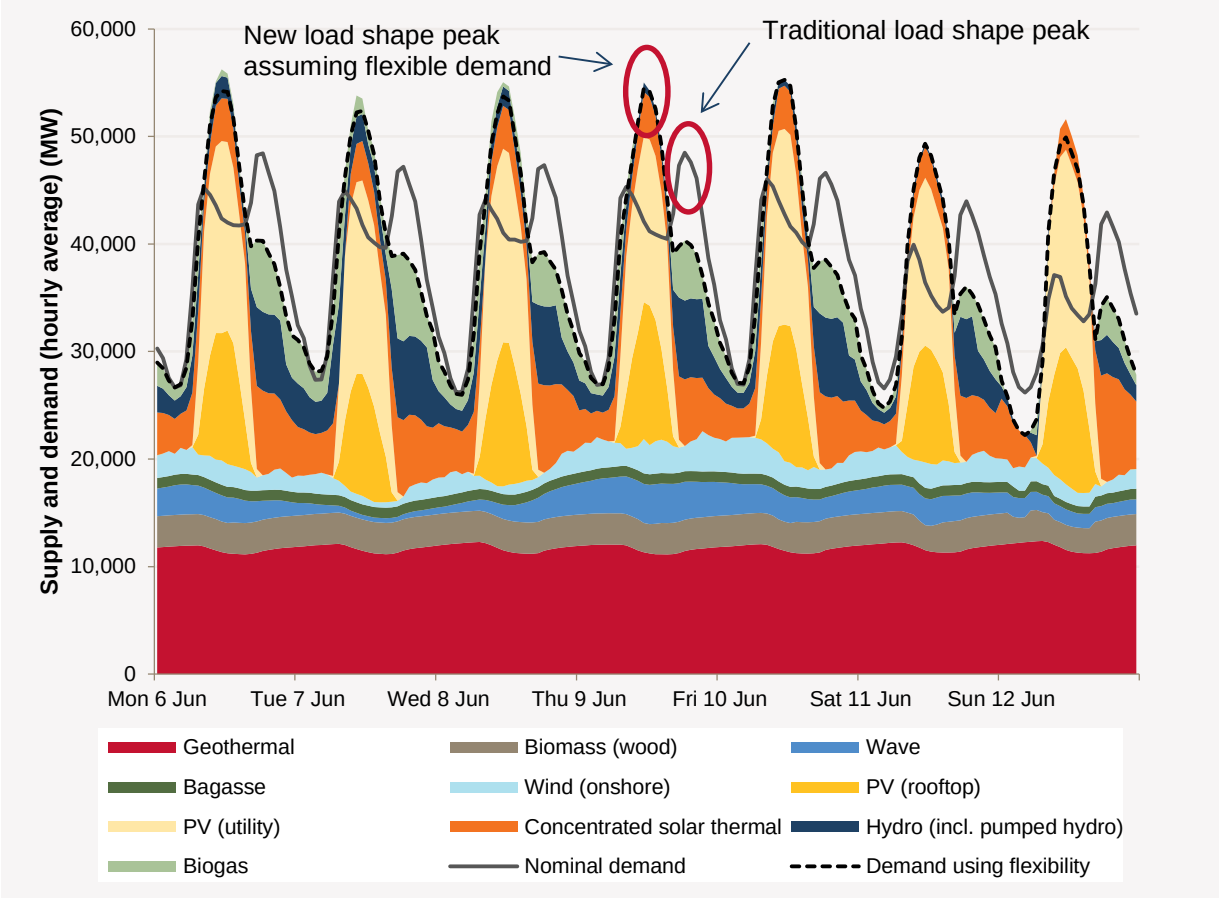
Advantages and Disadvantages of Nuclear

Nuclear offers:

- Baseload generation
- Only small volumes of fuel
- Low carbon generation

Disadvantages:

- Limited load following
- Need for nuclear infrastructure
- Need for a nuclear regulator
- Lack of Australian experience
- Waste management



Current Electricity Issues worth contemplating

- Basslink subsea cable
- UK experience - Hinkley Point ‘C’ - trials and tribulations
- German experience
  - pre ’84 reactors shutdown 2011 (~10GW)
  - post ’84 reactors shutdown 2020-22 (~10 GW)

Thank you

Questions