The Necessity of Nuclear Power:

A Global Human & Environmental Imperative

John Ritch
Director General
The Atmosphere

350 miles thick
The Troposphere & The Stratosphere

99% of the Atmosphere’s molecules

30 miles thick
The Troposphere & The Stratosphere

99% of the Atmosphere's molecules

30 miles thick
The Biosphere
All life on Earth
12 miles thick
Catastrophic Climate Change

- Radical temperature changes & violent weather events
- Widespread drought, flooding, wildfires
- Famine
- Accelerating loss of biodiversity
- Rising sea levels & sudden changes in ocean currents
- Mass migration & epidemics of pestilence and disease
- In consequence, a fundamental disruption of human civilisation
Earth and Humanity

• The Universe was created 12 -15 billion years ago.
• Life on Earth began nearly 4 billion years ago.
• Hominids appeared 7 million years ago.
• Homo erectus mastered fire 400,000 years ago.
• Homo sapiens developed 50,000-100,000 years ago.
• All told, some 60-100 billion people have lived on Earth.
• For most of human history, global population did not exceed 10 million.
Global Population through 50 Millennia
Global Population through 50 Millennia
Global Population in the Last Two Millennia
Global Population in the Last Two Millennia
Global Population in the Industrial Age
Global Population in the Industrial Age
1,000 years ago

300 million
1800

1 billion
1960

3 billion
1987

5 billion
1999

6 billion
2,000 years ago

10 million
1,000 years ago

300 million
1800

1 billion
1927

2 billion
1960

3 billion
A World of Extremes

6,400,000,000 people

Global Population (billion)
A World of Extremes

Global Population (billion)

EXTREME POVERTY: 1.1 Billion

OECD: 1.1 billion
A World of Extremes

- **EXTREME POVERTY**
  - Malnutrition
  - No Clean Water
  - 1.1 Billion

- **OECD**
  - 1.1 billion
A World of Extremes

Global Population (billion)

- **EXTREME POVERTY**
  - Malnutrition
  - No Clean Water
  - Under $1 per day
  - 1.1 Billion

- **OECD**
  - 1.1 billion
A World of Extremes

EXTREME POVERTY
- Malnutrition
- No Clean Water
- Under $1 per day
- 30,000 Children die each day
- 1.1 Billion

OECD
- 1.1 billion
A World of Extremes

EXTREME POVERTY
- Malnutrition
- No Clean Water
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- 30,000 Children die each day
- 1.1 Billion

OECD
- 300 million
- 1.1 billion

Global Population (billion)
A World of Extremes

EXTREME POVERTY
- Malnutrition
- No Clean Water
- Under $1 per day
- 30,000 Children die each day
- 1.1 Billion

80% of Global Consumption

FORMER SOVIET BLOC
- 300 million

OECD
- 1.1 billion

Global Population (billion)
A World of Extremes

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
- Malnutrition
- No Clean Water
- Under $1 per day
- 30,000 Children die each day
- 1.1 Billion

OECD
- Former Soviet Bloc
- 300 million
- 1.1 billion

Global Population (billion)
A World of Extremes

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
- Malnutrition
- No Clean Water
- Under $1 per day
- 30,000 Children die each day
- 1.1 Billion

'MODERATE' POVERTY
- 1.6 Billion

OECD
- 300 million
- 1.1 billion

80% of Global Consumption
A World of Extremes

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
Malnutrition
No Clean Water
Under $1 per day
30,000 Children die each day
1.1 Billion

'MODERATE' POVERTY
Little or No Sanitation
1.6 Billion

FORMER SOVIET BLOC
300 million

OECD
1.1 billion

Global Population (billion)
A World of Extremes

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
- Malnutrition
- No Clean Water
- Under $1 per day
- 30,000 Children die each day
- 1.1 Billion

'MODERATE' POVERTY
- Little or No Sanitation
- Under $2 per day
- 1.6 Billion

OECD
- Former Soviet Bloc
- 300 million

- 1.1 billion

Global Population (billion)
A World of Extremes

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
- Malnutrition
- No Clean Water
- Under $1 per day
- 30,000 Children die each day
- 1.1 Billion

'MODERATE' POVERTY
- Little or No Sanitation
- Under $2 per day
- Heavy pollution & disease
- 1.6 Billion

OECD
- Former Soviet Bloc
- 300 million
- 1.1 billion

Global Population (billion)
A World of Extremes

Poorest Nations

- Extreme Poverty: 1.1 Billion
- Moderate Poverty: 1.6 Billion

80% of Global Consumption

OECD

- Former Soviet Bloc: 300 million
- 1.1 billion

Global Population (billion)
A World of Extremes

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
1.1 Billion

‘MODERATE’ POVERTY
1.6 Billion

80% of Global Consumption

FORMER SOVIET BLOC
300 million

OECD
1.1 billion

Global Population (billion)
A World of Extremes

- No Electricity
- Scarce Electricity
- Vulnerable to Water Shortages
- Future Water Vulnerability

Poorest 80% of Global Consumption
- 75 million more people each year

Poor & Developing Nations
- Extreme Poverty: 1.1 Billion
- Moderate Poverty: 1.6 Billion

OECD
- Former Soviet Bloc: 300 million
- 1.1 Billion
A World of Extremes

- No Electricity
- Scarce Electricity
- Vulnerable to Water Shortages
- Future Water Vulnerability

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
1.1 Billion

'MODERATE' POVERTY
1.6 Billion

Advanced Sector
FORMER SOVIET BLOC
300 million

OECD
1.1 billion

80% of Global Consumption

Global Population (billion)
A World of Extremes

- No Electricity
- Scarce Electricity
- Vulnerable to Water Shortages
- Future Water Vulnerability

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
1.1 Billion

'MODERATE' POVERTY
1.6 Billion

Advanced Sector

FORMER SOVIET BLOC
300 million

OECD
1.1 billion

Global Population (billion)
A World of Extremes

No Electricity
Scarce Electricity
Vulnerable to Water Shortages
Future Water Vulnerability

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
1.1 Billion

'MODERATE' POVERTY
1.6 Billion

Advanced Sector

FORMER SOVIET BLOC
300 million

OECD
1.1 billion

80% of Global Consumption

ONGOING DEMAND

Global Population (billion)
A World of Extremes

- No Electricity
- Scarce Electricity
- Vulnerable to Water Shortages
- Future Water Vulnerability

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
1.1 Billion

'MODERATE' POVERTY
1.6 Billion

DESPERATE ENERGY NEED

80% of Global Consumption

Advanced Sector
FORMER SOVIET BLOC

OECD
300 million
1.1 billion

ONGOING DEMAND

Global Population (billion)
A World of Extremes

- No Electricity
- Scarce Electricity
- Vulnerable to Water Shortages
- Future Water Vulnerability

POOR & DEVELOPING NATIONS
75 million more people each year

EXTREME POVERTY
1.1 Billion

'MODERATE' POVERTY
1.6 Billion

DESPERATE ENERGY NEED

ACCELERATING GROWTH

80% of Global Consumption

FORMER SOVIET BLOC
300 million

Advanced Sector

OECD
1.1 billion

ONGOING DEMAND

Global Population (billion)
The Crucial Premise for Action

Humankind cannot conceivably achieve a global clean-energy revolution without a huge expansion of nuclear power -

• to generate electricity
• to produce battery power and possibly hydrogen for tomorrow’s vehicles
• to desalinate seawater in response to the world’s rapidly emerging fresh-water crisis
Characteristics of Nuclear Power

The Quintessential Sustainable Development Technology:

- Its fuel will be readily available for multiple centuries
- Its presence confers energy autonomy
- Its safety record is superior among major energy sources
- Its consumption causes virtually no pollution or greenhouse gases
- Its use preserves fossil resources for future generations
- Its capacities are scalable, from small reactors to large
- Its costs are competitive and declining
- Its waste can be secured over the long-term
- Its operations are manageable in developed & developing nations
Nuclear Renaissance: A Global Reality

- Continuing evolutionary advance in reactor technology
- Multinational research to produce quantum leaps in technology
- Unprecedented levels of efficiency & capacity utilisation in key countries
- A robust and accumulating record of operational safety, backed by a global nuclear safety culture
- Political progress in implementing the scientifically sound concept of waste disposal using deep geological repositories
- The truest barometer: expansive growth plans for nuclear power in major nations in both the developed and developing worlds
A Fading Resistance to Reality

Anti-nuclear convictions can still be found:

- In the mythologies that motivate many environmental groups
- In the assumptions of environmental journalists, bureaucrats and think-tanks
- In the rhetoric of small countries like Denmark and Austria that are not inhibited by the hypocrisy of importing nuclear electricity
- In the case of Germany, in the declaratory policy of a major country where parliamentary coalition-building has prevented the ascendancy of a pro-nuclear party from breaking the hold of outdated ideology
The New Realism

All around the world, old-school anti-nuclear environmentalism is being eclipsed by a widening recognition of nuclear energy’s essential virtue:

Its capacity to deliver cleanly generated power safely, reliably, and on a massive scale
The True Environmental Problem

Nuclear power is not yet growing fast enough ......

to play its full role in the clean-energy revolution.
The Two Essential Questions

1) Public Concerns: Where do industry and government stand in meeting legitimate public concerns about nuclear energy?

2) Acceleration: What must now be done to accelerate the nuclear renaissance?
Public Concern #1: Proliferation

• Joint Responsibility (Industry & Government)
  - Cooperate to develop a system that denies rationale for any spread of weapons-usable facilities

• Government
  - Continue to strengthen a global safeguards system that has de-linked military and civil programmes
  - Act against proliferators
Public Concern #1: Proliferation

Proliferation Risk
- Depends mainly on the potentially illicit intent of a few states
- Largely independent of the number of worldwide facilities

The Nuclear Renaissance is itself a top-priority global security measure
- Efforts to strengthen the NPT regime should not delay civil nuclear energy development
Public Concern #2: Operational Safety

• **Industry**
  - **ITS GREATEST RESPONSIBILITY:**
    Continue to build the global nuclear safety culture and a robust record in safe reactor operation

• **Government**
  - Ensure that safety oversight supports, rather than impedes, excellence in industry efficiency and plant management
Public Concern #3: Cost

• **Industry**
  - Continue to lower operational and capital costs (emphasising simplified, standardised reactor designs)

• **Government**
  - **A MAJOR RESPONSIBILITY:** Impose serious cost on environmental and health effects of emissions via trading or taxes
Public Concern #4: Waste Management

• Joint Responsibility (Industry & Government)
  - Build public understanding that waste -- minimal and manageable -- is nuclear power’s greatest asset

• Industry
  - Continue safe disposal of LLW and safe interim storage of ILW, HLW, and used nuclear fuel
  - Continue record of safe transport of nuclear materials

• Government
  - A MAJOR RESPONSIBILITY: Implement deep geological repositories
A New Public Concern: Terrorism

- Radiological Devices
  - Almost surely from other sources

- Nuclear Power Plants
  - Immense difficulty of penetration by air or land
  - Extreme low probability of harmful radiological release
  - Low-priority target in any modern industrial society
New Red Herrings: Pervasive Shortages

• Shortage of Nuclear Fuel
• Shortage of People
• Shortage of Fabrication Capacity
The Global Imperative

Governments must:

- Recognize that nuclear technology is mature and capable of massive expansion
- Take decisive action to accelerate the renaissance of an industry and profession primed for major worldwide expansion to meet the clean-energy crisis
Accelerating the Nuclear Renaissance

1) Construct a Comprehensive Global Regime
   - Must employ “contraction & convergence” concept

2) Elevate Nuclear Investment to a National and International Priority
   - Temporary pump-priming at the national level
   - Focus UN development agencies on nuclear energy

3) Build the Nuclear Profession
The World Nuclear University
World Nuclear University

A Global Partnership committed to enhancing education and leadership in nuclear science and technology

The WNU is animated by a small multinational secretariat at the WNU Coordinating Centre (WNUCC) in London

The WNUCC fosters cooperation among the WNU’s worldwide partners:

• Global organizations of the nuclear industry (WNA and WANO)
• Inter-governmental nuclear agencies (IAEA and NEA-OECD)
• Leading institutions of nuclear learning in some 30 nations
World Nuclear University

WNU activities underway or in preparation:

- Leader-building Summer Institute for young professionals
- Executive-level seminars on the future of nuclear energy
- Policy forums for nuclear policy-makers and leaders
- Training in key professional skills (pilot: WNU School on Uranium Production)
- Scientific seminars on policy-relevant topics
- Projects to improve education in nuclear-related disciplines
2006 WNU Fellows
Accelerating the Nuclear Renaissance

1) Construct a Comprehensive Global Regime
   - Must employ “contraction & convergence” concept

2) Elevate Nuclear Investment to a National and International Priority
   - Temporary pump-priming at the national level
   - Focus UN development agencies on nuclear energy

3) Globalize the Nuclear Profession
   - Build leadership
   - Develop massive scholarship support
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A Global Human & Environmental Imperative

John Ritch
Director General

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Washington & Lee University
Council on Foreign Relations
Lexington
20 June 2007
A Human & Environmental Imperative: An Expansive Nuclear Renaissance

The 21st Century

Global Nuclear Gigawatts

ENVIRONMENTAL NECESSITY

FAILURE
Meeting History’s Greatest Challenge

Never has so blessed and so fertile an insurance been procurable so cheaply.

Winston Churchill, 1934
Meeting History’s Greatest Challenge

Life is a race between education and catastrophe.

- H.G. Wells