

# EQUINOX COMMUNIQUÉ

## OVERVIEW

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Energy is humanity's largest contributor to greenhouse gas emissions, and our appetite for electricity is growing faster than for any other form of energy. Transforming the ways we generate, distribute and store electricity is among the most pressing challenges facing society today.

Over the next four decades, global energy demand is expected to almost double from 16.5 terawatts to 30 terawatts. If we want to stabilize CO<sub>2</sub> levels in our atmosphere at 550 parts per million, all of that growth needs to be met by non-carbon forms of energy.

Reducing the amount of fossil fuel we burn to generate electricity would make a substantial contribution to the goal of addressing climate change. In the wider context of peak oil and the rapidly growing global population, there is an urgent need for action.

The Waterloo Global Science Initiative (WGSII) was established to help bring science to bear on the most difficult problems facing our world. Over the past week, 36 scientists, engineers, entrepreneurs and future leaders from around the world came together to explore how science and technology might serve as a catalyst for the urgent change that is needed.

## VISION FOR 2030

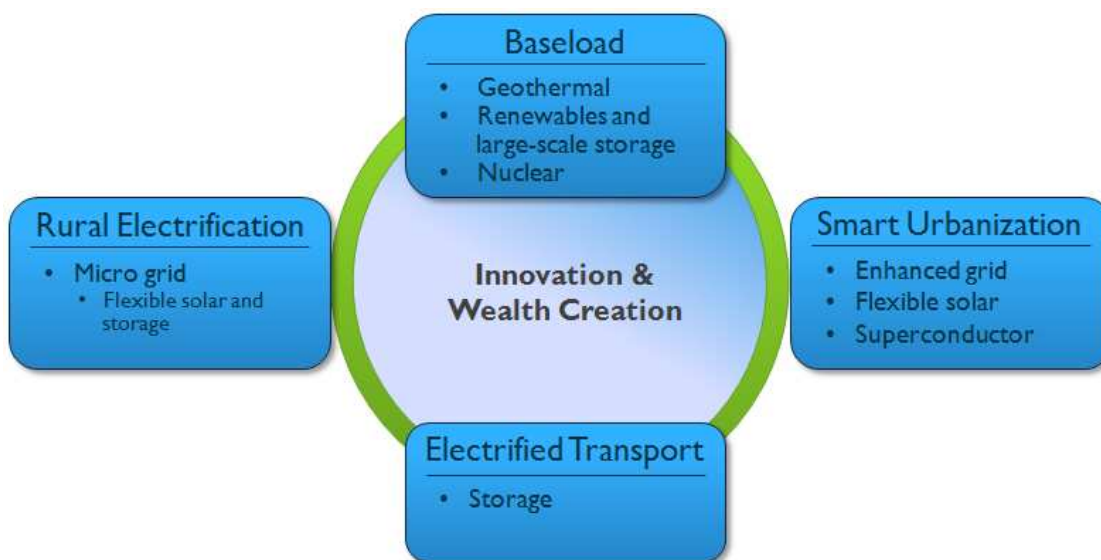
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This *Communiqué* identifies a group of technological approaches and implementation steps that have the potential over coming decades to accelerate the transition of our energy systems toward electrification and in the longer term toward an energy future where our dependence on fossil fuels is greatly reduced.

Given the right support, the six priority actions identified below can catalyze change on a global scale, from the cities of the developed world, to the billions of people who live in towns and villages that lack adequate access to electricity.

# LOW CARBON ELECTRICITY ECOSYSTEM

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## PRIORITIES

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### REPLACING COAL FOR BASELOAD POWER

Many of the world's towns, cities and industries rely on a consistent supply of "baseload" power, most of which is currently generated through the burning of fossil fuels. Among a range of options, the Summit has identified three alternative means of providing that power that have the potential to significantly reduce greenhouse gas emissions.

#### GEOHERMAL POWER

- Geothermal energy is a large resource capable of providing a significant proportion of the global energy demand. Costs for geothermal electricity generation can be a competitive resource if deployed on a large scale.
- The fundamental challenge is that subsurface resources can only truly be understood by undertaking major drilling programs.
- Several large demonstration projects would be required to deliver certainty about the exploration techniques, and engender confidence in production costs, potentially advancing geopower to the terawatt scale.

## **RENEWABLES ENABLED BY STORAGE**

- The world needs its sources of power to be reliable and efficient. But wind, waves and sunshine do not always meet these criteria. We could change that by turning our attention to a long-neglected aspect of the power system: storage.
- Electrochemical batteries, including vanadium redox flow batteries, have proven utility in a limited number of real-world situations, but substantial initial investment is needed to reduce costs and commercialize a range of these technologies.
- Large-scale demonstration projects in countries with high penetrations of renewable energy sources are recommended.

## **ADVANCED NUCLEAR POWER TO CLOSE THE FUEL CYCLE**

- Nuclear energy has proven capacity to deliver, on a large scale, low-carbon baseload power, but there are still concerns regarding safety and radioactive waste.
- Accelerating the development of forms of nuclear power that close the nuclear fuel cycle, including an effective solution for managing long-lived nuclear waste, and a widely available fuel supply, would be transformative.
- To achieve significant and timely uptake of these technologies, we propose international collaborations to develop the first commercial demonstration of the integral fast reactor with a fully closed fuel cycle (full recycling of uranium and plutonium), and experimental demonstration of novel accelerator-driven thorium-based systems.

## **URBAN ELECTRIC MOBILITY**

- As countries become more urbanized, demand for transportation will increase. Transportation contributes 40% of humanity's global greenhouse gas emissions currently, a problem only likely to worsen as these cities grow.
- Replacing gasoline-fuelled vehicles with electric ones has the potential to reduce emissions significantly. We could amplify this benefit by designing transit and vehicle-sharing schemes that integrate information and communication technologies to enable a shift in focus from ownership of vehicles to access to mobility.
- Within a short time it could be possible to demonstrate the benefits of combining ICT and battery-powered electric vehicles in a small number of representative cities around the world.

## **MAKING CITIES ENERGY-SMART**

- Expanding, dense urban areas have an unsustainably high carbon footprint. The world is becoming increasingly urbanized, with predictions that by 2040, more than 60% of the world's population will live in cities.

- Our buildings and infrastructure in cities need to be smart enough to incorporate renewable energy solutions such as innovative quantum-based solar technology, smart metering, superconducting conduits and systems for intelligent data collection about building performance and behaviour.
- Pilot demonstrations in carefully selected neighbourhoods that combine these technologies could provide the knowledge needed for the developing world to leap-frog the inefficient and unsustainable designs of the past.

## RURAL ELECTRIFICATION WITH FLEXIBLE SOLAR CELLS

- Approximately 2 billion people around the world have no, or very limited, access to electricity or other modern energy services. The negative consequences for their human rights, including health, education, and economic development, have been recognized as a significant barrier to achieving the United Nations Millennium Development Goals.
- Although many options to alleviate poverty exist, lightweight, durable and flexible photovoltaic technologies that are currently being developed offer a technologically and economically feasible solution for remote, off-grid deployment. Both the photovoltaic and battery storage technologies needed for these applications are three to four years from commercialization, and still searching for markets.
- Creating partnerships locally and internationally could facilitate the roll-out of integrated micro-grid systems based on renewable resources to provide basic energy needs such as lighting, communications and medical refrigeration.

## WHAT'S NEXT

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The ideas outlined in this *Communiqué* will form the basis of a detailed document that will be produced in coming months – the *Equinox Blueprint: Energy 2030*.

*Equinox Blueprint: Energy 2030* will paint a picture of the challenges faced by society in energy, detail forecasts from various global and national agencies for the likely state of affairs in 2030, and list the Equinox Summit's recommendations and proposals to address these.

*Equinox Blueprint: Energy 2030* will be aimed at informing, advising and inspiring science and technology influencers, government and industry leaders globally. It will focus on how science and technology can contribute to the challenges faced. It will offer practical, real-world solutions – based on the latest scientific thinking – and offer recommendations for investment and focus, and for the coordination of national and international scientific and engineering efforts which may, over the next 20 years, help address energy challenges in a meaningful way.

## MILESTONE EVENTS

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The mission of the Waterloo Global Science Initiative (WGSi) is not just to create and host each Equinox Summit, but to also share its recommendations and advance them in various forums, public and private. Consequently, a year-long campaign will highlight the results of Equinox Summit: Energy 2030 and seek to inform political, business and opinion leaders in its ideas and proposals.

This will include presentations at policy, scientific and public events in various countries, as well as webcasts, television packages and articles in the global media.

Among the meetings already slated for presentation of the Equinox Summit are the Canadian Science Writers Association annual meeting and the World Conference of Science Journalists in Doha in June 2011.

Under consideration is the Annual Meeting of the American Association for the Advancement of Science in Vancouver in February 2012, the Science and Technology in Society Forum in Kyoto in October 2011, the World Future Energy Summit in Abu Dhabi and World Economic Forum in Davos in January 2012, and the U.N. Conference on Sustainable Development in Rio de Janeiro in May 2012.



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