

***IP4 Workshop, Tuesday 31 August 1.00pm-4.00pm***

**Description:** This inter-disciplinary workshop will focus on emerging disruptive technologies and their implications with regards to seismic resilience. Topics covered will include grand challenges in: 1) renewable distributed energy, particularly the declining costs combined with climate change adaptation and increasing digitalisation leading to rapid adoption of renewable distributed energy; 2) smart cities which are increasingly dependent on complex utility networks driven through sensors and the IoT, but also have increased vulnerability through increasingly complex interdependencies; and 3) modelling of multi-scale socio-economic wellbeing business cases for disruptive technologies that meet the needs of a diverse set of decision-makers.

***IP4 Plenary Session 5 Title: Existing, emergent, and future harnessing of disruptive technologies for transformative seismic resilience, Thursday 2 September, 1.15pm-2.45pm***

**Description:** This inter-disciplinary plenary session will focus on existing, emergent, and future disruptive technologies that may become prevalent over the next 10-50 years and their implications to seismic resilience. On the one hand, the risk associated earthquakes is increasing due factors such as population growth, our tendency to locate in coastal communities, and the growing interconnectivity of our infrastructure systems. On the other hand, emerging disruptive technologies have the potential to partially mitigate or facilitate adaptation to seismic challenges. Key questions however exist concerning these technologies under seismic events – Will they exacerbate or abate societal tipping points? Will their adoption benefit a few or all? Could they result in a false sense of security? How do we evaluate their resilience building capability? Using renewable distributed energy and sensing cities as exemplars we discuss the above questions. We also investigate multiscale socio-economic evaluation of disruptive technologies to meet the needs of an increasingly diverse set of decision-makers. (155 Words).

**Plenary 1: Andrew Renton, Senior Principal Engineer, Transpower: “Grid resilience in a de-carbonised future”.**

**Biography:** A Qualified Electrical Engineer, a Fellow of Engineering NZ and with more than 28 years of technical and managerial experience in the New Zealand and Australian Oil, Gas and electricity sectors, Andrew has worked for essential lifeline utilities, consultants and government agencies in a variety of technically, planning, regulatory, and advisory roles. Career highlights include NEMA electricity sector lifeline liaison, governance roles with Treasury overseeing the development of a cross sector macroeconomic risk modelling tool (MERIT), working with Airways Corporation and providing oversight for a UAV sector management portal, and leading the development and implementation of a high voltage busbar system deployed across the National Grid. Mentoring less experienced professionals is one of the most rewarding aspects of my career, while in 2018, presenting to the MIT Cambridge Massachusetts Energy Group on New Zealand’s power system was an enduring highpoint and great privilege.

**Summary:** In a de-carbonised future renewable intermittently sourced electricity is set to play a greater role in the economy from process heat to transport. So, what seismic resilience challenges are posed by this transition to one energy vector playing a more dominant role in the economy? Does this disruptive technology, which enables this decarbonisation, actually contribute to a more diversified and resilient electricity system? This presentation seeks to outline the shift in energy use, the possible sources of it and discuss from a seismic resilience perspective the advantages and disadvantages of the various technology options that could provide it.

**Plenary 2: Hamish Avery, Research Engineer, EPECentre: “Horses, water, but drinking? My experience in introducing disruptive technology”.**

**Biography:** Hamish Avery is an inquisitive and outgoing engineer with a passion for listening, learning, and linking ideas and people across disciplines. During his time as Chief Technology Officer at Canterbury Seismic, Hamish developed the Sentinel platform that quantifies the effects of earthquakes to decision makers across a wide range of stakeholders from government to individuals. He has now transitioned to a research role at Electric Power Engineering Centre (EPECentre) where he continues to follow his passion for resilience.

**Summary:** Disruptive technologies can offer transformative new opportunities. However, even with breath-taking benefits, change is often resisted, and uptake of new technology is vulnerable to the politics, economics and even superstitions of the time. This talk will look at some examples from the past, and then take you through my own experiences with Sentinel, a resilience technology designed to change how we respond to earthquakes as a nation, a city, a building, and as an individual. I will go through the motivations, how we achieved the ‘disruptive’ aspect, the successes and challenges to date, and my hopes for the future. The talk will conclude with a cautionary tale about the importance of diversity when looking to the future.

**Plenary 3: Robert Cardwell, Research Consultant, MEResearch: “Creating impact-based investment cases for resilience: Next generation socio-economic evaluation using integrated, spatially-explicit and dynamic modelling of seismic events”.**

**Biography:** Robert has worked at Market Economics since 2011, while also undertaking a PhD at the school of Civil and Environmental Engineering at the University of Auckland from 2017 to 2021. During this time, the primary area of expertise Robert has developed is in the building and application of integrated models, particularly economic models, land use change, and transportation models. Robert also has a wide background in engineering, having completed degrees in mechatronics and engineering management. Robert is also a co-founder, and current Chair of the board of Engineers Without Borders New Zealand. Robert’s research interests cover development of integrated decision-support simulation tools designed to inform users about the impacts to society of emerging technologies, climate change, and acute natural disasters and associated opportunities and challenges.

**Summary:** With an increasingly disruptive world ahead of us new methods are required to assess the resilience of our infrastructure investments – particularly as they apply to seismic events. Impact-based investment is an emerging evaluation method that provides a multi-capital lens (recognising not only economic, but also social, environment and cultural dimensions) to investment focused on mitigating seismic events. This talk showcases state-of-the-art spatially explicit and dynamic simulation impact-based investing work. This work recognises that resilience is best built by taking an all-of-infrastructure approach, based on multiple wellbeings, is critical prioritising and scheduling infrastructure planning. I highlight some of the challenges and opportunities of this approach and provide a crude research agenda to stimulate future thinking.