Pacific Institute for the Mathematical Sciences (PIMS)
Workshop on:
Mathematical Sciences and Clean Energy Applications

1 Organizers

1. Bill Aiello, Department of Computer Science, University of British Columbia

2. Richard Karsten, Department of Mathematics and Statistics, Acadia University

3. Brian Marcus, Department of Mathematics, University of British Columbia

4. Vakhtang Putkaradze, Department of Mathematical and Statistical Sciences, University of Alberta

2 Location and dates

UBC, Vancouver, BC, May 21-24, 2019

3 Summary of scientific and other objectives

To avoid the worst consequences of climate change, the energy chain of the global economy must be drastically decarbonized. This exploratory workshop will build a greater dialogue between those in the mathematical sciences and the clean energy sector. The workshop will include: first-hand accounts of mathematical scientists working in clean energy projects, kind and gentle introductions to clean energy systems and mathematical tools, graduate student presentations, and panel discussions on topics such as challenges in clean energy. The goal of the workshop is to inspire interest in further exploration and to nucleate collaborations between mathematical scientists and practitioners in clean energy.

4 Intended audience

The gamut of clean energy issues, from production, storage, transmission, and usage, is vast. The range of possible mathematical analyses that might productively be brought to bear on such issues, from modelling, numerical analysis and differential equations, to optimization, statistics and machine learning, is similarly vast. The workshop will not attempt to be comprehensive. Rather, it will aim to bring together a cross-section of experts from the mathematical sciences, engineering, and energy disciplines from both industry and academia, with the goal of exposing the participants to a range of both challenges and tools, inspiring interest in further exploration. The workshop will have a mix of participants who are currently working on issues related to clean energy, as well

as those who are interested in becoming involved. "All hands on deck" will be needed to address the clean energy needs of our society.

This workshop will bring together mathematics and engineering faculty, postdocs, graduate students and industrial practitioners in a 4-day session for experts and novices. This will be a very diverse audience in terms of background and expertise, including women and under-represented minorities.

5 Workshop activities

Given the centrality of fossil fuels in our energy diet, decarbonizing the global energy chain is among the most important directions for climate change mitigation. In spite of the magnitude of the issue, to the best of our knowledge there appears to be relatively little collaboration between those in the mathematical science community and those in the clean energy sector. The following workshop activities are aimed to help remedy this situation.

- First-hand accounts by mathematical scientists in clean energy research, from doing a deep dive on the application area, to understanding the gaps in current mathematical tools, and finally to research problem formulation and solution

- Kind and gentle tutorials on clean energy systems and mathematical tools

- Graduate student research presentations

- Presentation and problem formulations by industrial practicioners

- Seminars and panel discussion on current technological and policy-related challenges in the clean energy sector, highlighting those that may benefit from advanced mathematical analysis.

More generally, the workshop will aim both to introduce mathematical scientists to a number of rich application domains within the clean energy sector and to provide clean energy practitioners a window into the range and promise of mathematical tools.

Several graduate students will participate directly in the workshop, by giving presentations on their research, and/or becoming involved in collaborations initiated by the workshop.

6 General comments

We anticipate that there will be tremendous educational value for all participants. Those not currently working in the clean energy sector will be introduced to a variety of technologies and technical questions. Participants from the clean energy sector will have the opportunity to highlight technical issues that are not well covered by approaches known to them, and to be introduced to potentially useful advanced techniques by those from the mathematical sciences community. A major goal of the workshop is to inspire further exploration by all participants. Moreover, we expect that the workshop will

initiate a number of collaborations. We anticipate several follow-on workshops over the next several years to support these collaborations and to broaden both the depth and breadth of interaction between the mathematical sciences community and clean energy sector.