



NEWCASTLE  
INNOVATION™

## Introducing Professor Behdad Moghtaderi:

### an interview with Amy Sanders

#### Can you please give us a brief introduction to yourself and your background?

I did my undergraduate studies in Iran in the area of mechanical engineering. Then, I migrated to Australia and did my Masters and PhD studies at the University of Sydney. The Masters was in mechanical engineering while the PhD was a joint project between chemical and mechanical engineering.

#### What is your main area of research?

My research area is “Thermofluid Engineering,” which underpinned by thermodynamics and heat transfer. I am especially interested in any application relating to energy

“I’m always trying to invent things that have real application in the outside world. I like people to benefit from what I do”

and the reduction of greenhouse gas emissions.

The application areas that I’m working on at the moment are low-emission coal technologies, renewable energy systems, hydrogen-powered micro energy units or systems, as well as energy efficiency in process industries and buildings.

#### What other research areas have you worked in?

Aside from energy, I have done some collaboration with people from medical faculties, working on mathematical modeling of human coronary systems. That was interesting; it is quite out of the ordinary of what I do.

#### What do you consider to be your greatest achievement in your career so far?

I cannot pinpoint a single greatest achievement, but having my papers and books published, seeing students who have worked with me and now have PhDs being recognised for their own achievements, and seeing some of the ideas that we’ve had here in the centre [ATC] now in the process of commercialization -like GRANEX for example- this gives me great enjoyment.

#### You recently took first place in an episode on the New Inventors. What was that like?

That was really fun, quite a new experience. It gave me an appreciation for how much work goes on behind the scenes. They worked on it for several weeks, and all up they probably spent about 40- 50 hours of solid work that goes towards a half hour program.

#### What motivates you in your work?

At the end of the day it boils down to curiosity to find answers to unknowns. But the biggest motivation for me is that I’m not just interested in pure science, I’d prefer to see a clear application for what I do. I’m always trying to invent things that have real application in the outside world. I like people to benefit from what I do.

#### How do you prefer to spend your spare time?

I’ve been making model aircraft for over 30 years, and I have a huge collection at home, probably over 300 models. I’m running out of space!

#### What is the next step for you?

I’m pretty happy with what I’m doing. My goal is to keep myself interested. I don’t want to become stagnant so I’m always coming up with new ideas and new projects, and I think that is important.

## You mentioned the GRANEX technology earlier; can you provide some more information on this technology?

It came about from a small consulting project that I took with Proactive Energy Limited, which is now Granite Power Limited. In 2006 they approached me with an interest in geothermal power generation. We looked at conventional geothermal technologies and systems, and began the development of a new and more efficient concept for power generation from low-grade heat sources.

That concept became what is now commercially referred to as GRANEX. We successfully applied for external funding in collaboration with Granite Power Limited, and received \$2.5 million in 2007, which we put towards the development of a 1 kW prototype and a 100 kW pilot plant, which was officially opened by Ministers Jodi Mackay and Peter Primrose in November 2009. We were able to gather a lot of data from these two units, essentially verifying our initial concept, which gave us the confidence to commercialise our product, which we are in the process of doing now.



Professor Behdad showing the GRANEX technology to Ministers Jodi Mackay and Peter Primrose in November 2009.

## How does GRANEX differ from other technologies? How will these features support its successful commercialisation?

There are two major differences between GRANEX and conventional systems for electricity generation from low-grade heats. The first is the working fluid that we use in GRANEX is a supercritical fluid. The second difference is the incorporation of a heat re-generator or a heat

recuperater into our system.

The combination of these two factors means we can deliver 40% more thermal efficiency, and as a result, 40% more electricity than conventional systems, which is huge as far as industry is concerned.

## What have been your greatest challenges in developing the GRANEX technology and how were these overcome?

The design part was quite challenging, given that there was no similar technology that we could rely on, so

“It was like designing a computer program, where you have to systematically go through and debug all problems one by one, which we did, and we learnt a lot”

everything was done from the scratch. Then once the design was completed and the units were made, there were a lot of small technical problems that you would encounter in technologies like that.

It was like designing a computer program, where you have to systematically go through and debug all problems one by one which we did, and we learnt a lot.

## What are the core capabilities within your research team that allow you to work successfully in the energy research field?

Within my research group, we build on our understanding of the fundamental sciences of thermodynamics and heat transfer. We are able to apply our knowledge to a lot of different applications. Heat Exchanger design is just one example where this approach to Thermofluid Engineering has led to innovative breakthroughs in power generation technology.

## How important is collaboration, with both your research collaborators and industry partners, in ensuring that the industry accepts new innovations?

In a nutshell, it's probably the most important thing in what we do. If you don't have collaboration, you won't get anywhere.

**Contact details:** Professor Behdad Moghtaderi  
ATC (Advanced Technology Centre) Building  
T: (02) 4985 4411  
E: Behdad.Moghtaderi@newcastle.edu.au

David Fleming - Senior Business Development Manager  
Newcastle Innovation  
P: +61 2 4921 8777  
E: david.fleming@newcastle.edu.au