

Catherine Tanna: Well, hello everybody and let me also begin by acknowledging the traditional owners of the land upon which we meet. The Wurundjeri people of the Kulin Nation and I pay my respect to all of their elders, as Ron encouraged us to say.

Catherine Tanna: So to tonight, to the president of the academy, professor Hugh Bradlow, members of the board who are here tonight, new fellows. What an exciting evening for all of you and to existing fellows and guests. Thank you very much for the invitation to speak. It really is a great honor. But it's also pretty daunting given the experience and expertise that's assembled in this room. But I do hope that the subject of my talk this evening will be familiar to all of us because this evening I want to talk to you about certainty and about doubt.

Catherine Tanna: Before we start, I should make an admission, perhaps born of fundamental optimism. I believe that the problems that we face today can be fixed. I believe that we're driven by altruism or profit. We can raise standards of living, we can live healthier lives, we can reduce poverty and we can lessen inequality, we can make Australia better for everyone. I also believe that in my industry, energy, we can deliver affordable, reliable and cleaner supplies of power to Australian families and businesses wherever they live and no matter how much they earn. We can address climate change.

Catherine Tanna: So why don't we do these things? Great question. Unfortunately, I am beginning to doubt our generation will be the one to do it. What concerns me has less to do with the technology and invention we use to address the challenges we face. I worry more about how the technology and invention is applied. Let me explain. Most ways of describing or defining technology refer to the application of knowledge, the application of knowledge. Often there's more than one viable solution to a given problem, particularly, a societal problem, but there are almost always multiple competing views on which approach is best or more likely to succeed.

Catherine Tanna: How do we resolve those views so we can move forward? The most effective system yet created by humans for resolving argument was developed thousands of years ago. It is reasoned discussion underpinned by thoughtful and objective consideration of the facts. With a peer review or political debate truth should be the aim. That means the human sciences and the technical sciences are intertwined. Unless both are working effectively, a society leaves its advancement to chance, but there's something standing in the way.

Catherine Tanna: Today, our system for applying knowledge is faltering, maybe even broken. We're risking that vested interests or those possessed by ideology will steer us towards second rate outcomes. That's certainly true in energy. Here's a favorite quote of mine and it sums up where we are going wrong. One of the painful things about our time is that those who feel certainty are stupid and those with any imagination and understanding are filled with doubt and indecision.

- Catherine Tanna: If that sounds familiar, it's because Bertrand Russell wrote it more than 80 years ago and it feels like it was written for today. A time when there was no longer room for doubt in public debate, only the certain prevail. How we view, discuss and debate problems has become about personal victory, rather than a triumph of ideas and we are losing perspective as the rhetoric escalates and becomes more strident, insistent and certain.
- Catherine Tanna: How many of us ever reflect on the great advances of the past few hundred years? Progress in health, poverty and equality, which depending on your point in history, would seem truly miraculous. Yet we're fed a narrative of doom and we are certain that the world has gone badly wrong. Without perspective, everything becomes a problem.
- Catherine Tanna: Recently, I participated in a panel discussion about Australia's economy where the conversation adopted a tone of despair, but let's take stock. Australia's economic growth in the June quarter was 3.4%. Our unemployment rate is around 5%. Inflation is modest, around the 2% mark and Australia is one of the richest nations on Earth per capita. By any measure, they are good numbers.
- Catherine Tanna: In many countries, they would win the next election and likely the one after that. Yet our politicians and commentators have persuaded Australians that the country is in dire straights. They're being taken advantage of every way they turn where one misstep away from ruin and the proponents of fear are positioning themselves as saviors. The only ones capable of lifting that fear. We are in a sea of madness.
- Catherine Tanna: That's true in energy and you may recognize that tendency in your own sectors or even more generally. It's not that certainty is bad, but devoid of doubt and perspective, it becomes fanaticism and phonetics aren't known for compromising or for solving problems. For the past decade, energy policy in Australia has been mired in a climate war. There's no national framework and families have paid a heavy price. Customers have been shocked by electricity bills. Their suppliers of power are less reliable and a transition to a zero emissions future is still in debate.
- Catherine Tanna: So let's agree what we're solving for today. In Australia we get around 70% or more of our electricity from coal fired generation. We want that eventually to be 0%. Generating energy for millions of households and businesses around the country produces some 180 million tons of carbon dioxide equivalent each year.
- Catherine Tanna: We also want that eventually to be zero. Depending on your assumptions about economic growth and industry transformation, the market operator, AEMO, estimates, it will cost between 8 billion and \$27 billion to replace retiring generation and meet consumer demand. Well, that's a long way from \$0 and that's just over the next two decades.

Catherine Tanna: So the challenge is to cut millions of tons of carbon emissions to make energy affordable while investing billions of dollars and to keep the lights on is the equivalent of 14 Hazelwood power stations are withdrawn from the energy system.

Catherine Tanna: In 2017, Victorian customers got firsthand experience of what happens when the retirement of just one of those plants is mismanaged. The lessons of the recent past have been hard earned, yet our rule makers are forgetting what they already know. In energy, we have an ambition we call the trilemma, affordable, reliable, and clean energy. It's like a three-legged stool, balance on just one of those legs for too long and eventually, the stool topples over. The energy system breaks and it breaks badly.

Catherine Tanna: For much of the past decade, the wholesale electricity market was chronically oversupplied and prices were very low, around 30 to \$40 a megawatt hour. From 2006 to 2014, my company Energy Australia lost around \$200 million and had to write off some \$1.9 billion from the value of its assets. So it's just as well, we have very patient owners.

Catherine Tanna: A depressed wholesale market meant companies struggled to make a case for investing in reliability. Either in maintaining existing base load generation or planning for how the system would cope with the flood of intermittent solar and wind energy. With prices low and seemingly under control, emissions became the consuming goal. Then, old coal plants shot at short notice. The shock was felt all around the country in the quarterly bills of customers from Ceduna in South Australia to Cannes in Queensland. Remember South Australia, in 2016 the nation watched in disbelief as an entire state's energy system went black.

Catherine Tanna: Every method we have of generating energy has its own distinct impacts on people and the environment, advantages and drawbacks to be debated and managed. But once an electron is in the system, it's the same, whether it was produced by a wind turbine or by a coal plant. However, there is a world of consequences between having a thoughtful national energy framework and not.

Catherine Tanna: Today, affordability has cycled around to top of mind. Think what might happen if we balance our stool on that one leg to the exclusion of reliability and emissions. In Australia, it took 20 years for the installed capacity of renewable energy to reach five gigawatts. It will take less than two years for the next five gigawatts. By around 2021, it's possible renewable energy, including solar PV might supply half the market demand when the sun is shining. Eventually, it becomes cheaper to keep building solar systems and spill what can't be used, rather than store the excess.

Catherine Tanna: The market operator, AEMO, points to the possibility that slabs of renewable power won't be dispatched to safeguard system reliability. If left unmitigated, it's possible energy will have zero market value for large parts of the day. We are already seeing this phenomenon in California. Free electricity, you might

think, "That sounds great." And then, the sun goes down. Now you're buying electricity from the grid, assuming dispatchable generation hasn't been forced from the market. Storage has a critical role in a modern energy system, but it won't have scale by 2021. At night, you're paying far more than you used to. That's because the fixed costs of the energy system, including networks and generators, must be recovered in a lot fewer hours.

Catherine Tanna: If you own a solar PV system, you're exporting power during the day at \$0 and you're buying it at much higher rates in the morning and evening. Your system may never pay for itself. That's the path we're on. Even now, the market operator intervenes almost every day in South Australia to turn off renewable generation and keep dispatchable power stations operating.

Catherine Tanna: Here's the truth. We have all the existing and planned capacity the system needs. The national market has around 50,000 megawatts of installed capacity. Average demand is around 22,000 megawatts. Yet more than 37,000 megawatts of renewable generation are proposed beyond the 11,300 megawatts already built or committed. So our exam question for the next decade is not building more generation. It's getting it all to work seamlessly.

Catherine Tanna: What we lack is a national framework to guide emissions reduction and make the grid stable. Human innovation has already provided all the pieces of the puzzle. We can stabilize our system by integrating wind and solar power with flexible generation, like pumped hydro and flexible fast start gas plants. The question is, how do we get there? How soon and at what cost? It's in the application of technology. It's in the application of knowledge where we're failing. We can't agree on how the puzzle goes together.

Catherine Tanna: It's frustrating. There are viewpoints on the extremes, but most sides do agree, Australia is making the transition to a cleaner energy future. Rather than informed discussion, the complex story of electricity and gas in Australia is too often reduced to a soundbite. Public Debate is less about rational argument and interrogating a proposal. It's about assuming your adversary is motivated by the very worst of intentions and dismissing them with a label or the flourish of a big stick.

Catherine Tanna: Gouging fat cat energy companies, it's a phrase that's repeated so often you'd be forgiven for asking if there's any other kind of energy company. Lazy techs and bandits are made for hashtags. Last month, news leaked that the Business Council of Australia was exploring with members and approach where industry would take responsibility for reducing emissions. The government responded by accusing business of lacking humility and implying the proposal was an attack on democracy.

Catherine Tanna: Energy companies aren't blameless, so permit me a soundbite of my own. Politics is making it very hard for good politicians to do the right thing. The entire electricity supply chain, including retailers, is culpable in a failure to

provide affordable, reliable, and cleaner energy. We've let down families and businesses across the country.

Catherine Tanna: However, the Australian competition and consumer commission makes no reference to gouging in its recent 400 page assessment of what went wrong. It starts by castigating federal and state governments for an inability or unwillingness to agree a workable, national policy. My point is, no one's hands are clean. There is more than enough blame to go around.

Catherine Tanna: So what's to be done? The trouble is it's very hard to reason your way out of a problem you didn't reason yourself into and that's where we are today. More recently, the English comedian, actor and activist, Stephen Fry said this, "One of the greatest human failings is to prefer to be right, rather than to be effective." I love that.

Catherine Tanna: For me, it speaks to resisting the temptation to rush to certainty, to having the conviction to ask questions with an open mind and having the courage to risk being wrong. It's about being humble and listening to our experts, whether that's in science, technology, engineering and mathematics generally, or in energy, specifically. The Australian Academy of Technology and Engineering, our academy is needed more than ever in the public debate. Otherwise, we risk solutions which feel right, rather than what is the right thing to do. It's a bleak picture and scare mongering is not what we want to be known for. We want to be known for fixing things. We do believe energy is solvable.

Catherine Tanna: Australians live in the greatest country on Earth. In more 60,000 years, people have spent on this continent, our home has been harsh on us. That's made us smart, inventive, and tough. We are used to tackling challenges and I'm convinced that it's possible to deliver affordable, reliable, and cleaner energy for families and businesses no matter where they are or how much they make.

Catherine Tanna: The first step is for our experts and our business leaders to speak up, ask questions. If not us, then who? Be brave and test the arguments and not the individual. In other words, play the ball, not the person. Let's remember, the proven route to advancing scientific understanding and public debate is constantly challenging what we think we know. The world is not flat, and some of the systems we created thousands of years ago are as vital today as they ever were. If only occasionally, have some doubt, try it. It's good for the soul and it's good for people. Thank you for listening.