**Professor Tatsuya Kodama**

Niigata University

**Collaboration details - A**

**Collaboration name:** Australia Solar Fuels Roadmap

**Type:** Expert review

**Partners:** CSIRO

**Dates:** 2013-2015

**Summary:** This is a project that is looking at what the opportunities are for solar technologies to produce solar fuels in Australia with a focus on liquid fuels for domestic use and transport.

**Outcome:** A roadmap for Australia of what technologies we think can come onto the market, when and demonstration projects to set out the next steps.

**Potential applications:** Produce commercially viable renewable energy sources.

**Collaboration details - B**

**Collaboration name:** Masters Course in engineering with a specialised component (Education Program for NEXT GENERATION SOLAR HYDROGEN ENERGY SYSTEM)

**Type:** Education

**Partners:** Professor Jim Hinkley, CSIRO

**Dates:** 2012-2015

**Summary:** Create a new masters course with students and teachers from mechanical engineering, chemical engineering and materials engineering to work on solar technologies.

**Outcome: E**ngineers who are specialised in solar technologies from three key knowledge areas.

---

*Niigata University's Professor Tatsuya Kodama's work on solar reactors with a beam-down solar concentrating system is a key signpost on the roadmap being developed by Australian researchers on future solar technologies. Professor Kodama is also using Australian expertise to raise a new generation of students with cross-discipline knowledge critical to developing innovative solar technologies.*

"My expertise is in solar chemistry. In particular I am building a beam-down solar concentrating system that collect and concentrate heat from the sun which is fed through a chemical reactor. The high temperature is used to heat and split water or steam to produce the chemical hydrogen. The benefit of hydrogen as a fuel is that it has very few negative characteristics in that it does not produce green house gases and is renewable.

The technology I am working on has an innovation in that the solar reactor has a powder catalyst in fluidized beds. Almost all other foreign countries use a type of catalyst that is coated, that is a fixed structure rather than powder. Powder has a huge amount of surface. This surface reacts with the stream of water more efficiently. In addition, the fluidized beds of power have a greater heat

transfer than fixed structure types. Thus, a more uniform high-temperature distribution can be created in the power fluidized beds than fixed structure types if irradiated by concentrated solar flues. So I like to use the powder in fluidized beds as solar reactors.

We have built a prototype solar collector (or solar concentrating system) and reactor in Miyazaki University in Kyushu where there is more light. If we succeed in the demonstration with Miyazaki University we will then request funding to build a larger system in a country which has more sunshine than we do in Japan. The technology I have developed cannot easily be applied in Japan because sunlight here is very low. But Australia has much solar energy.

At the moment solar hydrogen cannot be produced in commercially viable quantities and my project is looking at ways to do that. I would like to approach Australia and work with Australia to continue to develop this technology and to commercialise it.

My target is to bring the chemical energy produced in foreign sunbelt to Japan. So I think which country is the best for Japan? And one of the main countries that come to mind is Australia. Australia and Japan have had a good relationship for a long time, so we can work with Australians to develop the technology and if we succeed in the production of solar fuels in Australia we can import solar fuel from Australia.

If the prototype is successful we need to invite a company to support our project and we need to convince that company that we this technology has a future.

The other project I am working on with Australia and my colleague Professor Jim Hinkley in particular is a project funded by Australian government (Australian Renewable Energy Agency) to develop a roadmap to outline what the opportunities are for solar technologies to produce solar fuels in Australia with a focus on liquid fuels for domestic use and transport.

The next roadmap meeting will be held in Tokyo soon and I will invite Japanese companies along to show them our solar technology. We need a company that is a pioneer but they are hard to find as this technology has not yet been applied to industry. So the next stage is to request a meeting with the company to get enough research funds to do a demonstration with CSIRO in the field.

In addition to these projects Professor Hinkley is also lecturing students in a master's degree designed to promote research into this type of technology. I've brought together professors in chemical, mechanical and materials engineering to teach ten high performing students. I hope to be able to the students to Australia for up to one year to study and work in the field.

I think students must have this kind of experience to break the barrier with the foreign country researchers when they are young. So I think the masters course is the best season to have such an experience. So I would like to get students in an English language foreign country where they can help mature the technology for example at the CSIRO.

I want to get a collaborative laboratory set up in Australia with the CSIRO and work together with them to do experiments and we can do the research there.

Australians are flexible and they understand Asian thoughts processes. Australia has many relations with Asian countries and they have developed a way to communicate with Japanese people.