An interview with:

Paul Falzon, *General Manager,* ***Advanced Composite Structures Australia (ACS-A)***

Scott Edgcumbe, *Lead Engineer and Director,* ***Kinetic NRG***

Martin Nikolas, *CEO,* ***Marky Industries***

"Composite materials are ideally suited to produce such complex shaped parts"

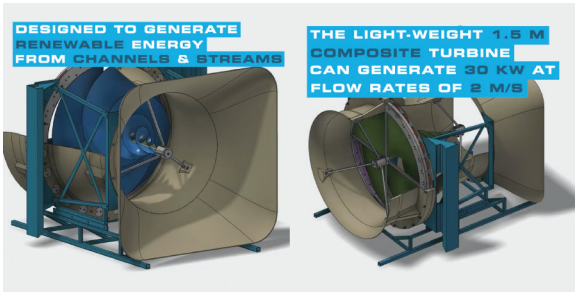
Australia, who harnesses extensively the energy from its largest waterways, innovates with company Kinetic NRG. It has introduced a model for a microturbine that allows weaker energy sources to be exploited. Developed in partnership with Advanced Composite Structures Australia (ACS-A) and Marky Industries, this microturbine model illustrates the potential yet to be harnessed, as well as what composite materials can offer in the race to provision energy.

Paul Falzon of ACS-A, Scott Edgcumbe of Kinetic NRG and Martin Nikolas of Marky Industries return to tell us about this success story.

JEC Group: In just a few words, could you tell us about your respective companies and your expertise in composite materials?

Paul Falzon: *Advanced Composite Structures Australia has over 30 years of experience in advanced composites, with subject matter experts who are known globally for solving challenging problems in novel ways. We are recognised and awarded as one of Australia's leading composites technology organisations, having worked on a wide range of development programs and commercial contracts with major companies, research organisations and government entities. We work in multiple industries, including Aerospace, Automotive, Oil & Gas, Mining, Renewable Energy, Civil Construction, Defence and Maritime. Specialising in design, manufacture and delivery of advanced composite structures and assemblies, conducted under ISO 9001 certification.*

Martin Nikolas: At Marky Industries we have the capabilities to take a project from our clients' concept and design completely through to fully fitted-out and finished. Along the journey, we have a wealth of experienced composite technicians and engineers using their skills to ensure the highest quality parts and components are delivered to our customers. We also work closely with carefully selected and trusted materials suppliers who share our attention to detail and high standards.



You're introducing a new model of a hydro-electric turbine created for Kinetic NRG, made from composite materials. What makes it stand out from earlier models?

Scott Edgcumbe: *I think it's important to look at the bigger picture, food security, energy security and the environment. Kinetic NRG's energy capture is focused on fast flowing streams, irrigation channels and discharge canals, as opposed to traditionally large dammed reservoirs. Our design is for an optimal 20-year design life maximizing durability, with minimal maintenance. The use of composite materials greatly benefits this and offers others, such as weight reduction. The use of lightweight composite materials increases our power to weight ratio, whilst reducing manufacturing, shipping and installation costs. This all has a bearing on our ability to produce energy at competitive prices.*

Therefore, reduced material, labour, and installation costs enable us to firmly target and achieve a competitive energy cost.

> ***"The use of lightweight composite materials increases our power to weight ratio, whilst reducing manufacturing, shipping and installation costs."***

Australia already harnesses the energy of its water sources to generate electricity. How does your solution fit into the market?

S. E.: *Australia has traditional large-scale hydro projects and pumped hydro. Kinetic NRG seeks to utilise discharge channels and irrigation channels which are currently untapped energy resources.*
Globally micro/mini hydro is a growing market; small plants gain a lot more support than large dams which have negative environmental impacts such as land take, flora and fauna.
In Australia, most of the high-head hydro (largely from dammed sources) is already harnessed for power generation. This microturbine solution offers the capability to harness previously untapped low-head hydro from streams and channels, for example irrigation canals, to power micro-grids in remote areas.

How are composite materials crucial to producing this new turbine? How do they improve its performance (with respect to a metals-based solution, for example)? Can you tell us specifically which materials have been used?

P. F.: *The turbine is operating in a submerged environment and so the use of composite materials makes them ideal for such an environment. The corrosion resistant properties make them attractive compared to stainless steel, which is the alternate metal option.*
The shape complexity of some of the components, in particular the turbine blade, make it impossible to fabricate cost-effectively using metals. Composite materials are ideally suited to produce such complex shaped parts.
Weight is also an important parameter. The composite blade was found to be 70% lighter than the original steel blade design. The reduced weight has significant advantages with regards to efficiencies in the system.

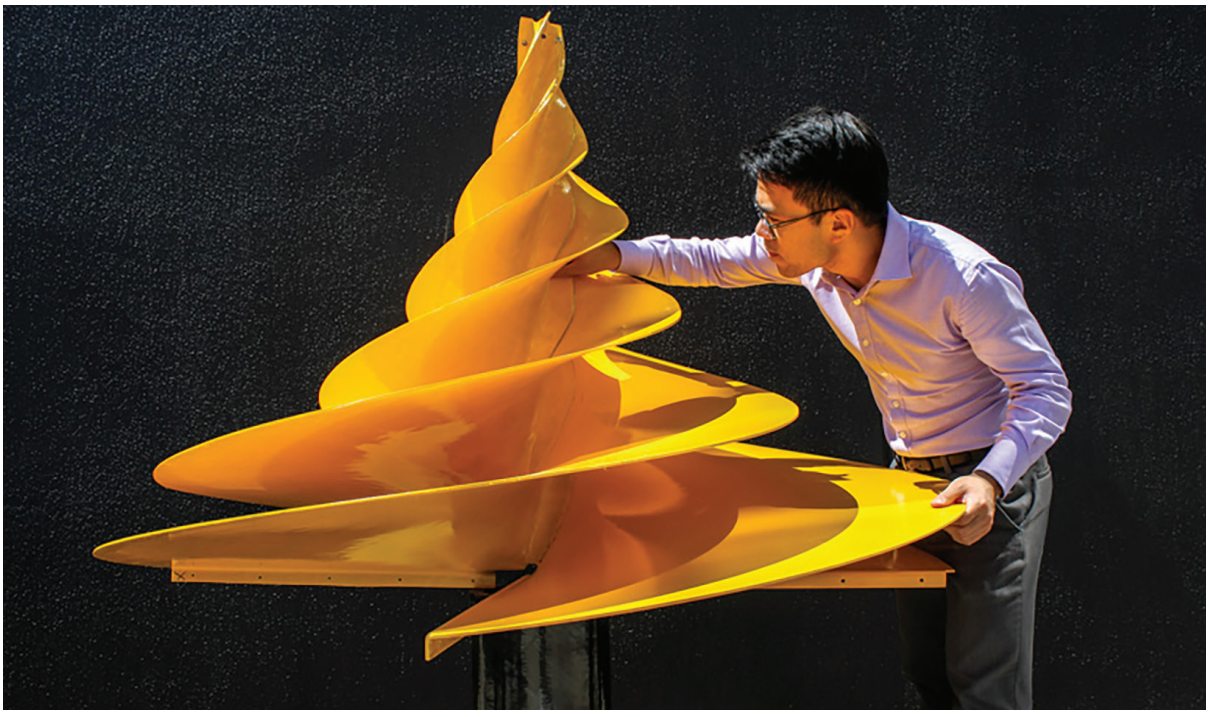


Fig. 2: ACS-A developed a method to manufacture the complex turbine assembly, along with a light-weight structural design that could be integrated into the turbine assembly

V. Applications

The current blades are made from epoxy resin and glass fibre non-crimp materials. Carbon fibre is being considered in other parts of the system for further weight reduction opportunities.
Kinetic NRG needs to achieve a competitive cost point both for this technology and competing technologies, the US DOE has a target LCOE,
and, with the assistance of ACS-A and Marky Industries we have a clear pathway utilising composite materials.
Composite materials allow us to modularise our components, facilitating local assembly and boosting local economies.

> ***"Composite materials allow us to modularise our components, facilitating local assembly and boosting local economies."***

How did you develop the complex design of the final part?

P. F.: *Would you believe scissors and sticky tape...? in all seriousness, Kinetic NRG had a design, in stainless steel, which we couldn't fabricate using traditional methods. After several months of trying, their turbine blade manufacturer put their hands up, and said, sorry, we thought we could and couldn't. This resulted in the need to think differently as to material selection and methodology.*
Kinetic NRG had a hydro-dynamically design blade shape which we needed to work with. Using the surface geometry, we developed a manufacturing strategy that could allow the 4-blade assembly to be produced. The data provided by Kinetic NRG was transferred into our CAD/CAE software and tool
designs were developed from which low-cost moulds could be machined. The structural design was developed by reverse engineering the steel design and coming up with a glass fibre laminate design of equivalent stiffness and strength. This was modelled using finite element software

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More information: **www.acs-aus.com**
www.kineticnrg.com.au
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