The 'I' Team - ISKRA Wind Turbines - A case study in Engineering Entrepreneurship

The Idea

From its very inception in The Rose & Crown pub, the ISKRA Wind Turbine company was a team venture.

Mike Wastling, John Balson, Bob Can and David Irving were all former colleagues who had formed the core engineering team at Carter Wind Turbines - a company dedicated to large-scale wind turbines. Despite having a very strong product, the company went into receivership and along with the rest of the company employees, all four colleagues found themselves in a redundancy situation. Initially, they all relied on their diverse backgrounds in Railways, Boat Building, Mining and Consultancy to secure new jobs, but all were left with the feeling that their former company had 'missed a trick' and had suffered from an inappropriate strategic focus. Somehow, they had the feeling that with the right product offered to the right market, electrical energy from wind power could form the basis of a worthwhile enterprise, be it a social or commercial one.

During their regular Thursday evening get-togethers at the Rose & Crown, the group quickly decided on a name for this venture – Iskra, which means spark in Czech – but very little else was so clear-cut. For example, what size of turbine should the team focus on? At that time most conventional wind farms were on a large scale, designed to provide electricity-generating plant at the lowest possible cost per kilowatt hour (kWh). At the other end of the scale, DC (direct current) wind generators for the boat and caravan market were also well provided for, and so the team decided against joining this established, highly competitive, mass production market.

However, the team identified a market niche for medium to small-scale wind turbines. After some initial market research and competitor analysis from Bob, the sort of output they wanted to target would provide enough electricity for a typical household. This meant that the owner of their turbine-generator might have an electrical bill of zero, and may even receive payments from their electricity supplier. This wind turbine would be competing in a completely different market to the large wind turbines. The owner would also be the consumer, and the cost benefit would accrue by not buying electricity (at high domestic rates) rather than selling electricity at (lower) wholesale pool prices.

Conceptual Design of the Turbine

Initially the team considered a modular design, hoping to use as many 'off the shelf' pre-engineered products as possible such as generators and gearboxes so that the new company could offer a modular product range relatively quickly and easily. However, the team soon realised that by doing this, far too many compromises would have to be made. In particular, the use of a gearbox that a conventional wind turbine would normally employ, was not desirable because of noise and maintenance concerns. The team then re-focused strategically and started to design their own complete system from scratch. At this point they drew on some outside expertise from a nearby university to help optimise the design of the generator, which helped keep the project moving forward. The team focused on a direct drive solution that would eliminate the need for a gearbox altogether, and thereby increase overall efficiency. Innovatively, the generator was integrated into the structure of the hub to reduce weight and costs.

Another important design consideration is the requirement for a wind generator to be able to shed excessive wind power. Conventional solutions rotate the whole turbine away from the wind at such times with the result that power generation is lost at times of peak wind speeds and the wind turbine can then be subjected to severe yaw loads and can be noisy. Some innovative design work led the Iskra team to design a passive pitch mechanism so that excess wind power could be shed through blade pitching. This would give a very rapid, effective and quiet means of regulating the wind turbines output.

Proving the Concept

At the early stages the team was very constrained financially and also struggled with having to make do make do with John's yard and Bob's garage instead of having proper production facilities. Although the team had to continue without premises for a long time, the financial constraints were eased slightly through John's endeavours to secure a SMART award to help pay for some of the costs of the detailed design and build a prototype wind turbine.

Without the help of the SMART grant, which provided for 75% of the development costs, none of this would have been possible. However the team needed to conserve cash at all times so they employed some older, but reliable CAD (computer aided design) and FE (finite element) computer software packages to realise their designs.

With very limited manufacturing capabilities available within the team, drawings were sent out to local sub-contractors to manufacture the components. The team could not identify anyone capable of producing the special blades designed of composite materials, so they had to do this in house. David took on responsibility for this operation utilising all his skills and experience gained in the boat building and wind turbine industry. The blades were made with a relatively new process for wind turbine blades, called transfer moulding, that involves wrapping glass fibre around a foam core, with resin injection under a vacuum.

In early 2000 the first prototype was ready and the owner of Newhouse Organic Farm donated a corner of one of his fields where the team erected the wind turbine. A shed was also purchased for testing and monitoring equipment.

Initially the controller for this prototype did not function to expectations so the team had to set about re-designing another. Once the functioning working controller was added the first Iskra wind turbine started generating the intended 5kW in just over 10m/s (around 22mph) of wind speed. There followed a great deal of testing to verify the design, but the wind turbine worked well and the prototype continues operating successfully to this day. When the team was satisfied with its performance and reliability, the turbine was connected up to both the farm and the National Grid. It is now both an attraction and an energy provider to the environmentally conscious farm.

Planning and Development

With the first prototype successfully installed and generating power, the team was able to focus more of their time and attention on planning for the future. A detailed business plan was now a necessity, not only to crystallise ideas of where to take this exciting new product but also to attract further investment and potential funding.

The team also realised that in order to attract investors and safeguard their innovative new designs, they needed protection for the intellectual property that was intrinsic to the Iskra wind turbine. Mike recalls that the process of patenting was expensive though not particularly difficult, and so the SMART award proved particularly helpful here. At first he

drafted the applications himself but later made use of patent agents who provided useful expertise in wording the patents to maximise their effectiveness.

In manufacturing the prototype, the team learned that build costs were very sensitive to batch size. At this stage the team were looking for funding to allow some small-scale production, kick off some planned sales and marketing activity and continue with further technical development aimed mainly at cost reductions. Also the company was operating out of four locations (the team's homes) and it was felt some central premises were essential sooner rather than later in order to co-ordinate activities more effectively.

Armed with the business plan the team secured a bank loan under the Small Business Loan Guarantee Scheme, which meant that they could really start to plan ahead. Additionally the business plan helped secure a SMART 2nd stage grant, this time for 25% of costs to allow further product refinements. However, the team found that their cash requirements at that stage were too little for many of the bigger investors to consider and the team could not agree suitable terms with venture capitalist organisations. In the end they turned to a network of associates, who had previously expressed some level of interest, to invest smaller sums in return for equity in the new company. This investment has been sufficient to ensure that ISKRA is sustainable and the new company has seen the strategic environment change in it's favour.

In addition to the growing environmental movement, to which they believe the majority of the initial customers will belong, the UK government has introduced the Clear Skies grant scheme which offers a £5,000 subsidy for the capital purchase of wind turbine of this size. Also power supply companies have been directed by OFGEN to ensure that at least 10% of their output comes from a renewable energy source by 2010.

The UK government has issued new planning guidance that recognises the cumulative contribution that small wind turbines can make and states that applications for small wind turbines should not be disregarded just because the individual contribution is small.

Moreover, the issue of security and continuity of supply has been raised recently with the recent large-scale outages in New York, California and London, which may also prove to be a motivation for Iskra's potential customers.

The team has received a promising quantity of enquires for their flagship product - the Iskra AT5-1 Wind Turbine, and with the first handful of machines now with customers and with a significant number of potential customers having now applied for planning permission to install a wind turbine on their land, the company faces the challenges of growth.

The dilemma for Iskra is how to secure the additional capital that would help grow the business faster. An injection of money at this stage would provide the team with new resources to secure new premises, to increase sales and marketing efforts and to boost manufacturing capability, so that components can be produced at their optimum cost. This would ultimately enable the product to become affordable to a large customer base. Ideally, the team all want to become involved in the business on a full-time basis and create a sustainable future for themselves and their customers.

For more details about this organisation you can visit their website at: www.iskrawind.com

Ideas for use as a teaching resource:

You are in the pub with your former colleagues from the engineering design department of WIND Inc. The company has announced that you will be made redundant in a matter of week. As a group you feel you have the skills to develop you own product but what should it be? What market you would operate in?

You and your team have successfully designed & tested a small scale working prototype wind turbine – what would be your next steps in business?

Related Resources:

The Higher Education Academy Engineering Subject Centre teaching materials:
www.engsc.ac.uk/er/entrepreneurship

All the resources here are specifically enterprise and entrepreneurship teaching materials, you may find the following particularly useful in relation to this case study:

Teachers Notes B3 – Proven Idea – Ideas (in relation to market)

Session B3 - Feasibility Study

This session explores the feasibility of idea in the market place – how can an idea be analysed to see if it is worth pursuing? A range of material is provided here to explore the customer perspective (marketing) and how an idea might be evaluated for customer interest, competition and potential to make an appropriate level of income.

Teachers Notes B4 - Proven Idea - Resources

Section B4 - Market Information

Exploring sources of data for research, particularly for legal requirements (including intellectual property rights) is the focus. Information is provided on how to gain data and information required to develop the business planning process.

Teachers Notes B5 - Proven Ideas - Strategy

Section B5 - Strategy Development

Taking a proven idea towards business start up requires an appreciation of the customer. These slides help identify customer types and profile them using market segmentation techniques to determine if there are enough potential customers in the area.

Teachers Notes B6 - Proven Idea – Planning and Operations (tools)

Section B6 - Techniques

Techniques for proving ideas are drawn from market research and analysis of the new product development process. This session explores how information promotes effective decision making to ensure the development of sustainable new businesses.

Teachers Notes C3 - Planning and Development – Ideas (in relation to market)

Section C3 - Market Analysis

This session introduces analytical tools which explore the market and help determine appropriate strategies. The business planning process demands that ideas are developed against the market realities of customer and market trends, competitors and internal resources and strengths.

Teachers Notes C6 - Planning and Development - Planning & Operations

Session C6 - Business Plan

The research and analysis required for drafting a business plan has been built up through out the previous sections, so this session focuses upon writing the business plan. It contains an active business plan template as well as teaching support for the plan and its elements (finance and accounting). There is also a marking scheme for using the business plan, or its component parts, as an assessment.

Teachers notes D6 - Ready to start up – Planning and operations (tools)

Session D6 - Practicalities

This session looks at the requirements of set up. Slides are provided on sources of finance and a handout regarding practical issues is included – however please ensure that this is updated regularly.

This Case Study was produced by Ted Sarmiento of Olmec Partnerships, for the Higher Education Academy Engineering Subject Centre, 2005.