

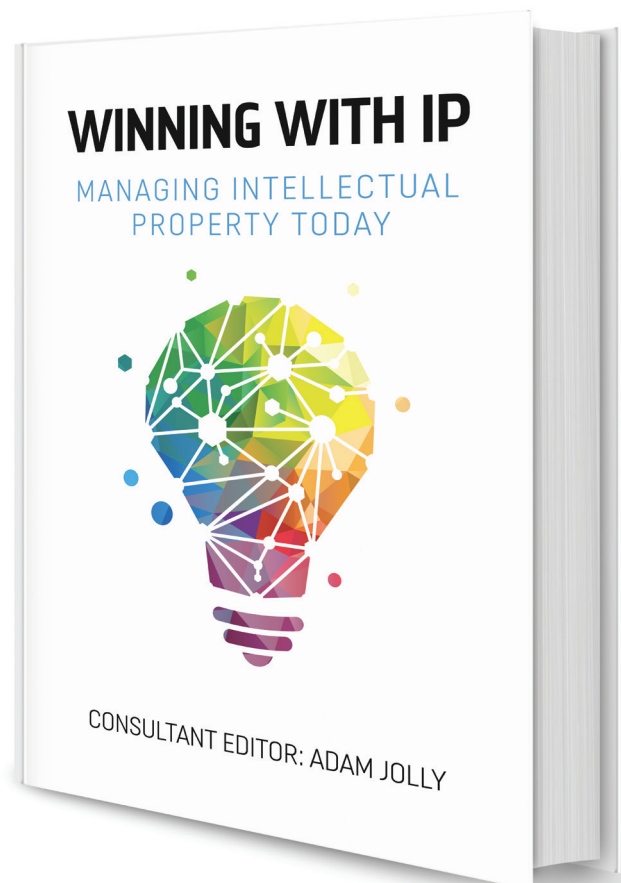
FROM SPIN-OUT TO INTERNATIONAL PLAYER

CHRISTIAN HACKL, TUM-TECH AND
THOMAS BEREUTER, EPO

In a book about how today's winners are lining up their IP, Christian Hackl at TUM-Tech and Thomas Bereuter at the EPO discuss the role that IP played in the dynamic growth of Orcan, an innovator in generating power from waste heat

Renewable energy company Orcan Energy AG¹ is a former university spin-out that commercializes innovative waste-heat power generators comprising standard components and designed for a broad range of applications. Due to market entry barriers, the company had to make an early pivot from a technology provider to a business model oriented towards product sales, taking the arduous path of developing and installing standalone² products by themselves. The focus moved to fully integrating Orcan's products into the installations of large players. Sales developed dynamically, resulting in solid growth rates, although many generators in Europe still had to be sold one by one, limiting growth rates. As its technology has a much larger market potential, Orcan decided to enter the Asian market. After about three years, Orcan managed to set up a joint venture with a Chinese partner and investment fund. Large volume sales were triggered, initiating the dynamic growth Orcan was intent on achieving to help reduce CO₂ emissions and fight global warming. Its patent portfolio, acquired from TUM (Technical University of Munich in Germany) and then dynamically expanded, has proved crucial at all stages of the evolving business model, in particular when:

- obtaining funding;
- communicating the company's technical advantage and innovation skills in order to build up its trade mark;



NOVARO
PUBLISHING


Newsdesk Global
Independent Book Publishers

Drawing on the knowledge and experience of 24 top-level IP performers, including the innovation support team at the European Patent Office, this book reports on how IP is being used to create tech solutions, pick up the latest thinking, take a competitive lead, negotiate the best deal, knock back any challengers and open up a path to breakthrough growth. It gives a series of lessons and insights about how today's winners are lining up their IP to transform early-stage ideas and technologies into assets around which competitive business models can be designed.

- partnering with suppliers and R&D partners;
- keeping copycats at bay;
- maintaining freedom to operate;
- and founding a joint venture to enter Asian markets.

Orcan uses standard industry components to design and construct its power generators that recycle waste heat by converting it into electricity, using the Organic Rankine Cycle (ORC), a process similar to that used in steam engines. Having started as a spin-out from TUM in 2008, Orcan now has 60 employees. Patents are important, particularly because Orcan's use of standard components means its power generators are at high risk of being copied. Eight early patents filed by TUM were subsequently acquired by Orcan. Ownership of these patents was vital in attracting funding.

Technology

The ORC is similar to a conventional steam power plant, in which the energy of heat (in the form of steam) is converted into electrical energy. However, as the name implies, it uses an organic fluid instead of water as the working fluid in the cycle. Due to the higher vapour pressure of the organic fluid the engine can be operated at a lower temperature than with water.

The organic fluid (or water in the case of a conventional steam power plant) is pumped to a boiler, where it evaporates. The resulting vapour powers a turbine (the expander), where the rotational energy is converted into mechanical and then electrical energy. The vapour then passes through a condenser (heat exchanger) and is converted back into the original fluid, which is then pumped to the beginning of the cycle, where it absorbs the heat from the heat source and the whole cycle starts over again.

Business case development

Neither the ORC concept nor its application in recovering energy from waste heat sources is new as such. However, Orcan has changed the ORC business in several respects:

- It has moved away from a commissioned installation service to a standardized product business, thereby

eliminating the high engineering workload for each individual installation and the associated high cost.

- It uses standard industrial components, thereby reducing the cost and complexity, improving reliability and allowing for easier maintenance.
- It offers an operator model for customers who choose not to be involved in the technical operation or maintenance of their installations.

Developing a standardized product business means that instead of unique customization of each installation (with the necessary high engineering workload) there is a defined standard product: in Orcan's case it is the efficiency PACK eP 20.30 (Figure 1), which produces up to 30 kWe (kilowatt electric). If the customer has a higher waste energy load, stacks of two or more efficiency PACKs will be combined in a modular approach. For much higher waste energy loads, the efficiency PACK eP 50.100 offers electrical power up to 100 kWe.

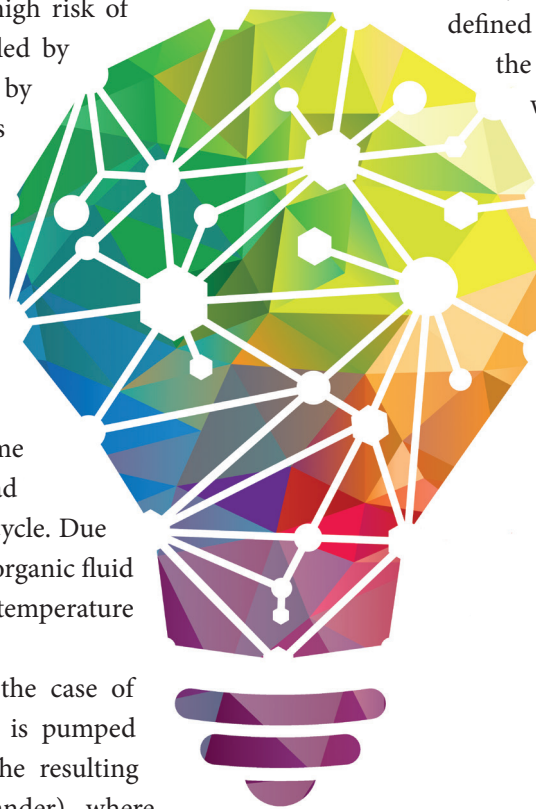


Figure 1: efficiency PACK eP 20.30 (20 to 30 kW), which is also protected by a registered design right.

There are many advantages to using standard industrial components versus tailor-made components but the three main ones are:

- Standard components use a proven technology with high reliability (they have been thoroughly tested and have a known life expectancy, which is important for their longevity), whereas individual components need to be thoroughly tested for life expectancy with a higher associated cost.

- The lower cost of standard components is due to a higher volume of sales compared to individually manufactured parts.
- Spare parts are widely available all around the world.

Technology improvement

The use of standard industrial components used in other applications sounds rather trivial. However, a lot of R&D was required to redesign the process and its control. One challenge was to avoid cavitation, which occurs when liquid suddenly evaporates and collapses again while in the inlet of a pump, where the pressure declines and becomes lower than the saturation pressure of the liquid.

Cavitation can cause two problems: the vapour created blocks the pumping effect; and the rotor can be damaged by extremely high local temperatures and pressures that can arise due to sudden condensation of vapour.

These two problems are well known but the solutions usually applied to prevent them (eg, large head height or subcooling) are disproportionate in terms of cost and complexity if applied in a small installation such as Orcan's.

Orcan managed to solve these problems by adding a precise amount of a special non-condensing auxiliary gas (like nitrogen) to the liquid working fluid. Its partial pressure increases that of the system, so helping to eliminate cavitation. The related invention is protected by EP 2499343 B1 and other international patents.

Patent protection

The company has its origins in a research project at TUM resulting in core patents for the basic technologies, eg, for avoiding cavitation and some others for protecting more specific aspects. The project results demonstrated that the use of standard industrial components is possible for the specific challenges faced by the ORC. In total, eight patent families resulted from the research work while the founders were still working at the university. Orcan acquired the patents from the university to bring its investors on board. Since then Orcan has invested heavily in further R&D, increasing its portfolio to 27 patent families. Using the EP and PCT systems, around 180 patent applications have been filed (including validations) and about 130 were granted.

The geographical scope of the patent protection depends on the importance of the invention to the company: for key patents covering the basic technology, broader geographical

protection is sought than for more incremental patents covering detailed aspects of an already patented application. Countries are also ranked in terms of where the majority of customers and competitors' production sites are located.

IP at the different stages of company development

Founding

At the founding stage, it was important for Orcan to quickly acquire the patents held by the university. That early-stage technology companies own patents is crucial for venture capitalists wishing to invest in them. Owning them rather than just exclusively licensing them has certain advantages. Firstly, the company can minimize complexity and reduce costs by managing patent issues related to their key assets directly. If a university were to act as the middleman in dealings with patent attorneys and litigators, there is the risk that decision-making will be delayed and deadlines at patent offices and courts missed, that instructions will be misinterpreted, that the company will lose full cost control and that changes at the university will adversely affect its ability to offer professional patent management. Avoiding such risks was especially important for Orcan's investors. Secondly, patents enable backers to create a return on their investments even if the young company initially fails and a turnaround or a trade sale is required. This would be extremely difficult if the patents were just licensed. Last but not least, the fact that a technology-driven start-up has its own patent portfolio is good for its reputation as it helps to communicate its technical advantage and innovation skills. Patent rights underline that the invention is not just the crazy idea of some inventors, but that the technology has been thoroughly scrutinized in the search and examination process prior to grant of a high-quality patent, resulting in a lasting competitive advantage.

Partnering

As Orcan does not produce the pump or other main components but instead uses standard industrial components, partnering with a large and well-established manufacturer of such components was required. In order to convince this potential partner of the technical feasibility, some know-how had to be transferred. It was important to obtain its operating consent for the use of its components in a new setting. Moreover, the partner had to agree to start with relatively small production numbers, but at the same time commit to producing larger volumes if successful,

which meant taking a risk. In this set-up, patents helped the young start-up to meet the challenge of convincing the big player that something totally new and unexpected could lead to success. IP rights can abolish the small firm's typical dependency on the large firm and facilitate the establishment of a partnership on fair terms that results in a win-win relationship.

Scaling

Patents were especially important for Orcan as a means of preserving exclusivity at the scaling stage, given that it was entering the market without a secured position in the form of owning relevant market shares or production of essential parts. Orcan is instead combining standard industrial components, which facilitates re-engineering by copycats. This underlines that Orcan requires a strong patent base to position itself sustainably on the market. In addition, patenting incremental improvements leaves fewer chances for competitors to obtain patent protection potentially limiting Orcan's freedom to operate.

Integrated business model

Orcan considered two basic options for marketing their products:

- The first option was to position standalone products for longlasting installations with waste heat that can be used for electricity production. Applications are based on retrofitting of existing installations, eg, biogas plants. In order to scale with this approach, a huge sales force is required, since the owner of every relevant source of waste heat has to be contacted and convinced on an individual basis.
- The second option was a full integration of Orcan's products into a newly produced combustion engine (as used, for example, on ships), a genset (equipment converting heat capacity into mechanical energy and then into electrical energy) or a cogeneration unit (combination of engine and generator, producing both heat and electrical power). In order to realize this approach, Orcan had to co-operate with partners who were willing and able to integrate its ORC into their powertrain. The big advantage for Orcan is the reduced dependency on a large sales force, as the main responsibility for sales lies with the genset producer who has an established presence in the market.

The second approach has proved to be by far the more successful one, as more and larger installations are being requested.

Although strong IP protection is an advantage for both approaches, it is even more essential for the second one as know-how transfer is inevitable. In addition, alignment of the combined products may give rise to new IP of mutual benefit.

One such example is the cooler. When the ORC is integrated into a genset, it would be beneficial if the cooler of the genset could also be used for the ORC instead of installing a second cooler for the ORC. The challenge here was the different temperature levels needed for cooling the genset (75°C–90°C) and the ORC (35°C–40°C). Orcan was able to modify the cooler in such a way that it can be used for shared cooling of the genset and the ORC. Orcan achieved this by a typical start-up way of thinking: it started its own R&D project, modifying the cooler at its own risk and expense (since the established genset manufacturer was reluctant to become involved in such a project). The result was a new technical solution for shared usage of cooling devices for which Orcan was granted a patent (EP 3163036B1).

International activities

As mentioned above, sales resources are the limiting factor for Orcan's growth in both business models. Reaching out to international markets was particularly challenging or almost impossible through Orcan's own sales force, especially in the context of the first business model. The second business model offers significant advantages in this respect.

For Orcan, it was important to develop a strategy for accessing the main international markets efficiently. The dynamic markets in the United States were less attractive due to low energy prices and low regulatory incentives for buyers to invest in green technology.

China looked challenging too for cultural and legal reasons, but at the same time highly rewarding. China is a huge and dynamically growing market with high dedication to triggering dynamic changes to tackle its huge environmental challenges and limit the dependency on oil imports.

In addition, Asia is an attractive market for Orcan's product, particularly as it is a perfect fit for the many generators running on diesel or natural gas used there for electricity production. In Germany, this market is almost

non-existent. Although there are diesel generators installed as back-up in case of power failures, it would not make sense to install an ORC due to the limited operating hours.

At first, it seemed nearly impossible for a European small company with no track record in Asia to start doing business in China. Orcan had to develop a strategy for dealing with the Chinese market, which included teaming up with an experienced partner in China. Some European companies are reluctant to work with Chinese partners, fearing that, because they will have to provide them with technology and know-how, they risk diminishing or even losing their competitive advantage. Orcan therefore carefully evaluated the possible countermeasures, as well as the pros and cons of various cooperation options, such as licensing to an existing player, a share deal or starting a joint venture with a partner who had existing access to relevant markets. Delaying market entry was not an option since time to market is an important factor for somewhere that is evolving so rapidly.

In the end, Orcan decided to enter into a joint venture with a Chinese partner with a strong track record of doing business in Asia. The joint venture obtained a licence for production, sales and operation for the product (including product parts). For the time being, these product parts will not include core technology, as these are still produced and supplied by Orcan in Germany. However, it is planned that in the long run the joint venture will purchase more and more components and build more complex ones itself. In addition, the licence is limited to China, all other Asian countries and Africa, reflecting the partner's strong presence in those markets.

According to the literature³, various market approach strategies are possible for a Western company wishing to sell its products in China:

1. exporting to China through an agent or a distributor;
2. exporting to China via online sales;
3. exporting to China via franchise or licensing;
4. investment via a representative office;
5. investment via a joint venture with a Chinese partner;
6. investment via a wholly foreign-owned enterprise.

As mentioned above, Orcan needed a local partner with good connections with the market, as well as a partner who could add local content to its core product, which is initially produced in Germany and then shipped to China. In the case of options 1 and 4, the partner (agent

/ distributor or representative office) would not have been able to provide local content, so a second entity would be needed (eg, a contract manufacturer), making such a solution unattractive. Option 2 (online sales) would not be feasible either, since qualified experts would be needed to develop a concept for a potential customer and to install the final product; the same applies to option 6 (own company), which would not have had any connections with the local market. That's why Orcan decided to go for a joint venture with a Chinese partner in combination with a licensing deal (options 3 and 5).

Selection of partner

Identifying and selecting a suitable partner is challenging. Orcan participated in an economic delegation to China organized by the German government, which enabled it to make valuable contacts. In addition, it teamed up with a consultant who specialized in facilitating German-Chinese business relationships.⁴

Once initial contacts with several possible partners had been made, there was a phase of individual visits to China and return visits to Germany. This helped generally to build up trust through closer personal relationships. In particular, visits to potential installation sites helped to create a better understanding of the technology and market needs. The time such a phase can take is well invested. Visits included invitations to dinners at which business might not be discussed and also to other events, such as sports.⁵

The partner finally selected by Orcan is in the rental business for electricity production offering the whole range of services including financing, building and operating these installations. It took roughly three years from the first contact to the signing of the contract with the selected partner, which might seem long, but was necessary and worthwhile. Orcan did not have the required power range in its product portfolio at the beginning of the partnering process, for example, and it developed the required installations, such as a 100 kW efficiency Pack, in parallel to the discussions.

Co-operation model

In all, three legal entities are involved in the co-operation: the Chinese partner, Tamar VPower Energy Fund I, the newly founded joint venture, and Orcan itself.

Tamar VPower Energy Fund I was set up and is managed jointly by CITIC Pacific and VPower Group. It targets high-growth investment opportunities in the energy sector. Both

stakeholders are well established players in the energy business.

The joint effort to deploy an installation is shared as follows:

- The Chinese partner in charge of planning, producing and installing a generator will do all the necessary groundwork, including all pipes and tubes, the hydraulic module, control unit, safety features and so on, as well as providing the interface with the ORC.
- The ORC as such is put into operation and tested on site by the joint venture.
- The core module of the ORC itself is manufactured, assembled and tested by Orcan in Germany, then shipped to Asia.
- Some additional, less critical components of the ORC are provided by the joint venture.
- The ORC is fully assembled and tested for faults, such as leaks, by the joint venture (after thorough training and supervision by Orcan) on-site in Asia to ensure it meets the quality standards essential to pass the factory acceptance test.
- The completed and tested ORC is shipped from the joint venture to the customer site where it is installed by the Chinese partner.

This work-sharing allows for both efficiency and risk mitigation. It has, for example, the advantage that the local partner is familiar with and can manage any specific local requirements, such as feeding electrical energy into the local or national grid.

At the beginning, there was also the idea that Orcan could provide the Chinese partner with design drawings and all manufacturing would take place in China, making use of the cheap labour force. It would have meant a complete transfer of know-how to the joint venture and the Chinese partner, as well as some delays due to the training required. As it turned out, it was not feasible for quality assurance and risk management reasons.

The opposite option would have been for Orcan to build the entire ORC (including the container) and then ship it to Asia. It would have resulted in a non-competitive price

for the overall installation. So the final hybrid solution was found to be the ideal compromise between competitive pricing, quality assurance and long-term risk management. The co-operation with the established Chinese partner ensures that a high enough number of units are sold for economies of scale to contribute to the competitive pricing.

As mentioned, Orcan provided an exclusive licence for the manufacturing, marketing, sales and maintenance of the patentprotected products in Asia and Africa. Consequently, Orcan is not allowed to sell its products to customers in either of these regions directly. However, in line with its pre-existing business model, Orcan's products can still be sold in Asia or Africa if a third party purchases Orcan's products to combine it with their own products (eg, diesel generators) and sell the resulting combinations in these regions. Therefore, Orcan can still build new strategic partnerships, for example, with manufacturers of engines.

Both partners contributed valuable and essential assets to the joint venture: the Chinese partner invested money, while Orcan provided the access to the innovative technology. The joint venture purchases the core components from Orcan (made in Germany), organizes the addition of the local content, including the parts additionally manufactured in China, and sells the final product in Asia. Transparency in the joint venture is mainly achieved by the price at which it buys from Orcan and sells to the customer in Asia, providing a sales margin and in certain cases an additional licence fee for Orcan. The joint venture also yields a margin for the value-added contributions to the sold installation.

The joint venture's profits are distributed among the partners according to their shares, but will be reinvested in the company for the first years. During this investment period, Orcan is not receiving dividends but the intrinsic value of its share in the joint venture will increase by the reinvested profits.

Efficiency gains for electricity production

Having announced the formation of the joint venture with the Chinese partner in October 2018, Orcan was able to place over 80 orders for its efficiency packs within just a few weeks⁶, which is more in sales volume than the biggest European countries achieve in a year. But how were these initial results achieved so fast?

Orcan's technology and products make use of waste heat as an energy source for producing electricity. This electricity may be a by product of a different basic process, such as chemical production, or it may add to that generated by a

main electricity production process. If the waste heat comes from a (diesel or natural gas) generator, it raises the overall efficiency of its electricity generation of the generator by 6–9 percent. In both cases the value of the additional energy produced over an acceptable amortization period is higher than the cost of Orcan's product. For each installation there will be a business case calculating the possible income from electricity generation out of waste heat versus the cost for the installation. If the time span needed to breakeven is short enough, the operator or investor will spend the money on Orcan's product. The payback period for typical installations is between two to four years, making Orcan's products highly attractive to potential buyers in both Europe and Asia.

Soon after the joint venture was launched, several business cases were drawn up for several possible sites. A special case was the tender for a large installation of natural gas generators for electricity production in Myanmar. The special feature of this tender was that, in addition to the usual parameters such as speed of realization and price, the generators' overall efficiency was also specified as an essential criterion. So the additional efficiency generated by Orcan was suddenly no longer just a nice-to-have optimisation; with the award decision being based on the calculated amortization period, it became a must-have for awarding the contract. Typical diesel or natural gas generators thus had a hard time competing with the overall efficiency offered by the joint venture. If other tenders follow this example of setting the overall efficiency as a strict award criterion, it will open up a huge market for Orcan and its partners.

The joint venture and the resulting project for Myanmar has developed quite quickly:

- Spring 2018: the joint venture in China was established.
- April 2018: only a pre-series of relevant products existed.
- April to September 2018: ramping up production capacity to 70 units.
- October 2018: shipment of containers to Myanmar.
- November 2018: start of installation in Myanmar.
- January 2019: start of initial operation.
- February 2019: trial run.

- March 2019: inauguration of the power generation installation.



Figure 2: aerial view of the installation in Myanmar: with 90 MW electricity produced by 70 gas engines each combined with an ORC from Orcan.



Figure 3: close-up of the installation in Myanmar. Each of the 70 units consists of a 1.5 MW gas engine (right-hand side with six cooling funnels on top). The component in the middle is the heat exchanger that transfers heat from the exhaust of the gas engine to the ORC on the left-hand side. This Myanmar installation comprises 70 gas engines producing 90 MW electricity from natural gas. The heat of the exhaust gas (approximately 400°C) is transferred to an intermediate water circuit (150°C), which then goes into the ORC (indirect system). Orcan's generators can produce an additional 5 MW, saving 8–9 million m3 of natural gas per year and contributing to emission-free electricity for around 120,000 people.

It was quite a journey for Orcan from the small early efficiency Pack (20-30kW), individually sold and installed on single sites, to these large energy parks that have a significant economic and ecological impact.

Conclusions

Home markets are often important test markets. If they lack the dynamics of other markets, growth-oriented companies need to start considering accessing those more dynamic markets at an early stage of their development. For that, they need to show some foresight to ensure sound IP protection for the main technologies and derived products that covers the right countries and regions for their customers and

competitors. Developing a sound IP protection strategy therefore means thinking about the development of the business in the medium and long term.

Searching for a partner that has the know-how and the network to access the relevant target markets is a critical process which needs sound preparation and considerable resources. The company needs to define the framework for a possible win-win co-operation. On the one hand, this means identifying which intellectual assets it is willing to provide to its partners and which it wants to keep, eg, by providing selfproduced components. On the other hand, it also means identifying what is needed from the partner to ensure the synergy results in corresponding technical and/or economic advantages.

If it comes to actual negotiations, it is essential to keep the co-operation as a whole in mind, so as not to reach a deadlock over details, while remaining realistic as to what is needed and what are merely desirables. It is important to be well prepared for the negotiations and seek professional support, such as market experts, lawyers and patent attorneys, and last, but not least, to keep all decision-makers, such as the company's own supervisory board, in a position to take decisions quickly whenever required.

■ *Disclaimer: any opinions expressed in this article are those of the authors or the company and not necessarily those of the EPO.*



Christian Hackl is managing director, TUM-Tech GmbH, Munich, Germany and Thomas Bereuter is innovation support programme area manager, European Patent Academy, EPO, Munich, Germany. For further details, e: christian.hackl@tumtech.de or e: tbereuter@epo.org.

Notes

¹ 'Orcan Energy: recycling waste heat to cool down the planet', *Unlocking untapped value, EPO SME case studies on IP strategy and IP management*, Christian Hackl (author), Thomas Bereuter, Yann Ménière and Ilja Rudyk (editors), EPO 2017, Munich, Germany, epo.org/sme, ISBN 978-3-89605-188-2.

² 'Challenges for a start-up company when commercializing a new technology and extending its business model', Christian Hackl, *les Nouvelles*, The Journal of the Licensing Executives Society, Dec 2017.

³ <http://invest-export.brussels/documents/16349/1682518/China-2017-ENG.pdf/d4565d97-0a9e-4131-9443-819057786ee7>

⁴ 'The role of culture in business transactions and protection of intellectual property rights within Asian countries such as China and Japan', *les Nouvelles*, The Journal of the Licensing Executives Society, Part 1: <https://www.lesi.org/les-nouvelles/les-nouvelles-article-of-the-month/les-nouvelles-article-of-the-month-archives/les-nouvelles-article-of-the-month-september-2012>.

⁵ <https://www.forbes.com/sites/insead/2012/03/06/the-ten-principles-for-doing-business-inchina>

⁶ <https://www.orcan-energy.com/en/details/orcan-energy-secures-market-entry-into-asia-andafrica-with-joint-venture-for-energy-efficient-solutions.html>

Winning with IP: managing intellectual property today

Published November 2019, 202 pages, paperback,
229mm x 152mm, ISBN 978-1-9998329-6-4

**NOVARO
PUBLISHING**


Newsdesk Global
Independent Book Publishers