



Business Innovation Observatory



Advanced Materials

Aerogels, getting their second wind

Case study 56

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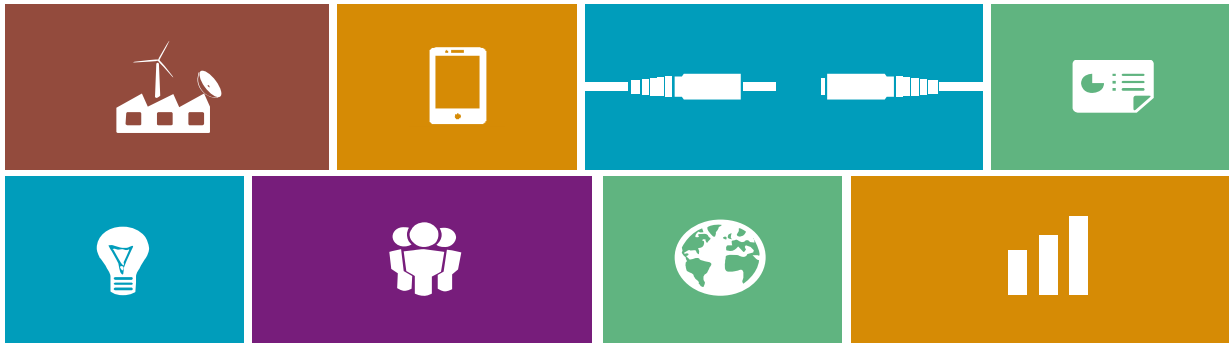
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European Union, August 2015.

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1. Executive summary

Aerogels are a light and highly porous solid that are created by rapidly evaporating the liquid in a solgel mixture and replacing the liquid with air. These materials are notable for their low density and their low thermal conductivity. Because of their unique properties, aerogels are used in chemical adsorption, as lightweight composite materials, in chemical catalysis and in insulating materials. They can also be seen in products such as capacitors, in paints and cosmetics as thickening agents, and chemical absorbers for cleaning chemical spills.

Aerogels were first isolated several decades ago, but never truly took off given their high cost. Today however, this advanced material is experiencing a renaissance following technological developments driving costs down and market factors driving up demand.

To date the global aerogel market accounts for some EUR 250 million with approximately 10,680 metric tons of aerogel was purchased in 2014 with the oil and gas sector accounting for the large majority of the market. The market is predicted to grow, particularly given its future uptake in the insulation market. The growth of the aerogels market would result in the creation of jobs. While the use of aerogels in insulation will help contribute towards improving energy efficiency and help move towards the EU's climate change policy.

The companies showcased in this case study demonstrate the latest trend for aerogels. In that they found an innovative way of addressing the problems facing the aerogels market: cost-effectiveness. Their approaches vary, but they ultimately offer an aerogel product that is superior to competing products, that is now both more affordable and more attractive to consumers.

The market is driven by the ever increasing demand for energy-efficiency to drive down energy bills as well as contribute towards the reduction of greenhouse gas emissions. The cost of producing aerogels, an important blocking point in the past, is set to decrease following recent technological developments and will be further decreased as the market develops. The increased use of novel construction and architecture techniques also presents an opportunity for aerogels. However, the risk-aversion of the construction sector, along with the lack of enthusiasm from the venture capital industry to invest in cleantech, stand as obstacles to the development of the market.

There are several policy options available to help support this market. The first is to ensure that energy-efficiency targets continue beyond 2020 in order to reassure the market that there will continue to be demand for insulating solutions like aerogels, and to do so as soon as possible. In addition, insulation and re-insulation of buildings could be subsidised within member states through national initiatives which could help promote uptake of aerogels. Investment into applied research should continue so as to continue to develop new or improved applications for aerogels, which are bound to have a knock on benefit to the rest of the aerogels market. Finally, the visibility of aerogels as an advanced material experiencing its second wind and able to address problems in the market better than it could before, could be supported in order to raise awareness to both investors and consumers.



2. Aerogels, innovating an old technology

2.1. Trend presentation

Technological advancements in the production and quality of basic materials are a well-known driver of disruptive innovation and growth. A trend that Europe is in a position to capitalise on is that of new advanced materials arising from developments in the material sciences. These advanced materials offer new innovative possibilities for growth through the support of new existing industrial and commercial products and processes.

Within the context of this trend, this case study will present the latest technological developments and new innovative applications of the materials known as “aerogels” and how they stand to benefit Europe.

Aerogels are one of the lightest solid materials known today, and are created through the combination of a polymer with a solvent to form a gel. The liquid, formed at the point where polymers join, is then extracted and replaced with air, resulting in a light solid with a **high porosity**, a **low density** (to the extent a type of aerogel is recognised as the world’s lightest solid¹) and a **very low thermal conductivity** (Figure 1 **Error! Reference source not found.**). They can be made using a variety of different substances including silica, organic polymers and carbon are eco-friendly in that they are recyclable.

Figure 1: Crayons supported on an aerogel over a flame



Source: NASA Jet Propulsion Lab²

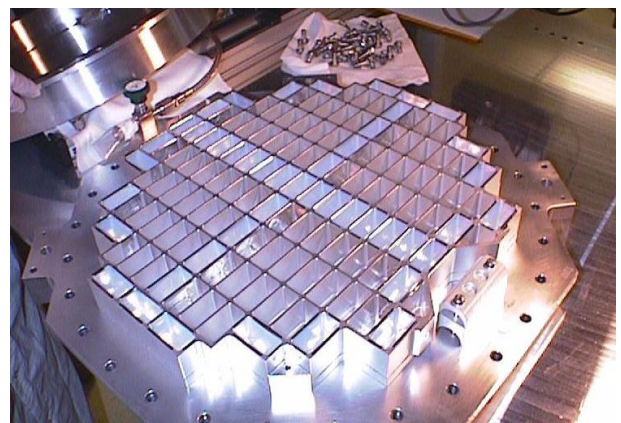
Aerogels can be composed of silica, derived from silica gel, and these are the most common of aerogels found on the market. They can also be made from metal oxides and can be exploited for their conductivity, as catalysts for chemical

reactions, matrices for explosives, or as precursors for other materials like carbon nanotube catalysts. Carbon can also be used as a material to produce aerogels. Aerogels made from aluminium are often found in catalysis when combined with a metal. There are also semiconducting metal chalcogenide aerogels proposing a unique combination of porosity, optical translucency, and photoluminescence, and have potential applications in photovoltaics and as chemical sensors. Finally, there are Metal Aerogels which can be exploited for their high conductivity and surface area³.

The unique properties of aerogels offer a wide variety of market applications, and today aerogels can be found in⁴:

- High-performance insulation, such as the piping to transport oil and gas, in ovens, in vacuum cleaners, or in building walls;
- Optical devices;
- Chemical catalysis, both as catalysts and catalyst supports;
- Acoustics including sound absorption (anechoic chambers) or efficient ultrasonic devices;
- The space industry, again as an insulant, but also in cosmic or cometary dust collection (NASA's Stardust Project in Figure 2 being an example of this);
- Dielectrics for microwave electronics and high voltage insulator
- Electronics given that carbon aerogels are electrically conductive: electrodes for batteries and capacitors. Some metal oxide aerogels are highly conductive as well;
- Filters and absorbing media for desiccation and waste containment.

Figure 2: A space dust collector made of aerogel





Source: NASA Jet Propulsion Lab²

Despite this variety of different potential market applications, to date, the use of aerogels has been limited. This is because of the cost and time in production as well as due to the fact that they are generally uneconomical for businesses.

The trend that has seen aerogels garner interest as a result of innovation in the aerogels market is not from any radical new developments in the technology itself, which has existed for several decades now. Rather more, interest has been generated of late in innovations in the production of aerogels and how market forces are making them more popular as they meet consumer demands for lighter, strong and more environmentally-friendly materials. This is

especially the case in the use of aerogels as a high performance insulating material.

Aerogels are seeing greater importance in exotic sectors such as the space industry, where the minimisation of weight is critical, in which aerogels have been used in insulation and other original applications. Today, market forces are driving demand for new insulating solutions for houses and buildings which aerogels can help meet.

Europe stands to gain from the growth generated by companies that can offer aerogel products to the market that will be cost effective vis-à-vis competing technologies. In addition, new innovative companies are starting to provide new means to produce competitively priced aerogel materials, or new aerogel products to tackle problems in an innovative way.

2.2. Overview of the innovative companies capitalising on this trend

Table 1: Overview of the company cases referred to in this case study

Company	Location	Business innovation	Signals of success
Green Earth Aerogel Technologies	Spain	GEAT is a start-up company that directly produces aerogels using agricultural waste materials from rice as raw materials.	- Finalist in 3 major international business plan competitions.
Svenska Aerogels	Sweden	Svenska Aerogel is a Swedish company that has developed a new production process which is estimated to reduce the cost of producing aerogels by 90% ⁵	- Multiple mentions in the press - Collaborations with several large multinational companies - Classified as a "Climate Solver" by the WWF for its potential to influence the overall insulation market and contribute to global energy savings and reduction of CO2 emissions.
Aerogels Poland Nanotechnology	Poland	Aerogels Poland Nanotechnology is a Polish company created in 2008 and has exclusive rights to sell aerogel products from Aspen Aerogels to the Polish, Czech, Hungarian and Russian markets.	- Exclusive rights to sell aerogel products on behalf of Aspen Aerogels. - Organises one of the biggest conventions for the insulation industry in Poland - Numerous mentions in the press
Separex	France	Separex is a French company originally spun out of academia employing thirty expert employees with unique experience in research and implementation of industrial supercritical fluid applications.	- Member of the AERSUS project geared towards developing aerogel applications for the space industry - Clients include important market players such as Nike - Numerous mentions in the mainstream media

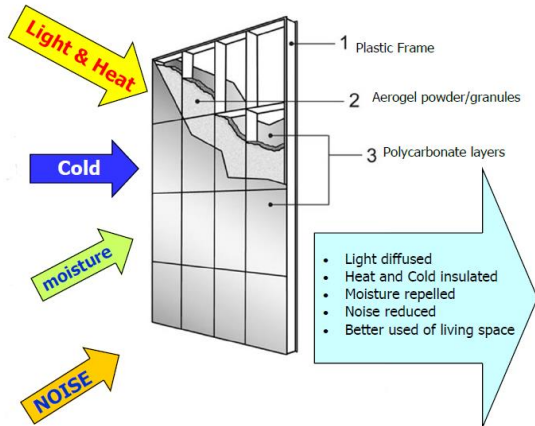
Problem 1 – Aerogels are a better performing insulator than most other technologies. However they have been made using expensive and toxic components which makes them unattractive.

Innovative solution 1 – Green Earth Aerogel Technologies is a Spanish start-up that offers two types of aerogels made from agricultural waste which are cheaper, more environmentally friendly and quicker to produce than other conventional aerogels. The company offers two types of aerogels:



Silica aerogel made from rice husk ash that makes it an excellent insulation material which allows light to pass through, and carbon aerogel, made from broken rice waste that can block infrared. Both of these aerogels are also fireproof.

Translucent fireproof wall insulation made from Green Earth Aerogel Technologies' cost effective insulation which offers dual energy savings in heating and illumination



Source: Green Earth Aerogel Technologies⁶

Problem 2 – The properties of aerogels make them an ideal insulator, a good component of paints, and it allows them to be used in chemical adsorption and filtration. However they are produced using toxic compounds, in a process that is far too costly for them to be a cost-effective solution for businesses.

Innovative solution 2 – Svenska Aerogel has patented a novel production method that has helped reduce the production cost of aerogel by roughly 90 per cent. This new competitive advantage has allowed Svenska Aerogel AB to enter multiple cooperations with leading insulation companies across Europe and the rest of the world and develop products with superior insulation properties at a competitive price. In addition, as opposed to conventional aerogel production processes, their product is produced in an environmentally-friendly way.

Svenska Aerogel AB's patented Quartzene[®] is a fine and porous silica-based powder but can be made in gel and in pellets (as shown in the picture below) to meet the needs of its customers



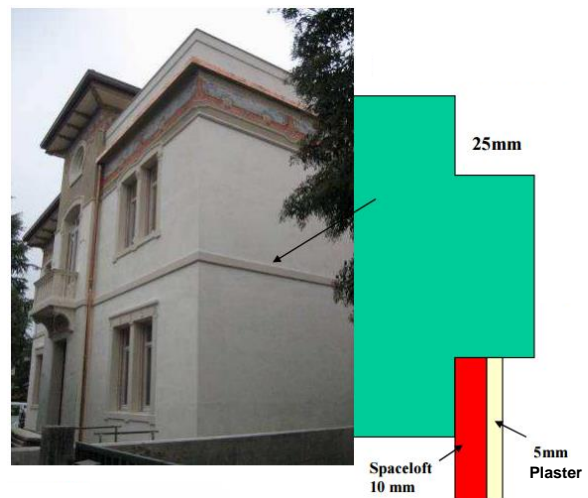
Source: Svenska Aerogel⁷

Problem 3 – Many buildings are going to have to install insulation (or expand upon existing insulation) in order to meet the ever increasing demands set by energy-efficiency regulation. To meet these new energy efficiency standards with conventional insulating materials would require building new layers on the exterior of buildings, which may not be aesthetically pleasing. This is particularly problematic for heritage buildings, where alterations to the exterior are forbidden.

Innovative solution 3 – Aerogels Poland Nanotechnology is a distributor of aerogels products based in Mragowo, Poland. The company caters to the Polish, Czech, Hungarian and Russian markets through the sales of insulating materials to the construction sector.

The aerogel insulators provided by the company are not only better insulators than conventional materials, but resolve the issue faced by the market by providing an insulating material that is both thinner than competing technologies but also, crucially for heritage buildings, can be installed from the inside of a building without requiring resurfacing the exterior with insulation.

Aerogels Poland Nanotechnology's aerogel products offer consumers the means of insulating buildings using thinner insulating layers than conventional materials, offering a more aesthetically-pleasing end result.



Source: Aerogels Poland Nanotechnology promotional material⁸

Problem 4 – The solgel polymerization process to create aerogels is a bulk process that has important restraints. It is difficult to control the size of the sols or the way they come together. As such the structure and density of the final aerogels are influenced by the conditions during polymerisation (e.g. temperature, pH, type of catalyst), because of which, using most production methods, the structure of aerogels cannot be controlled at the molecular level⁹. This makes the uptake of aerogels by clients more difficult because of the lack of a truly standardised product.

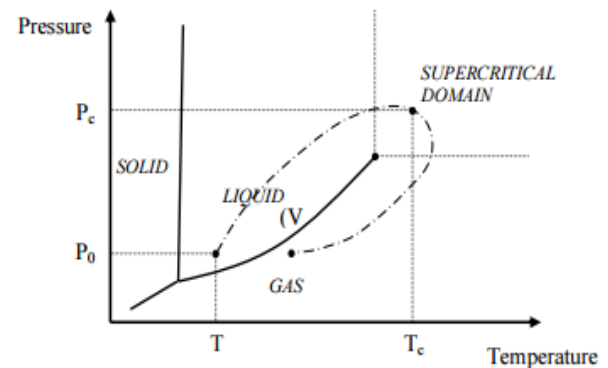


Innovative solution 4 – Separex has developed their own proprietary method for supercritically drying aerogels using supercritical CO₂ (where CO₂ is at a temperature and pressure above its critical point and no longer strictly speaking either a gas or liquid).

This method for producing aerogels benefits their clients in that it helps reducing the distortion of the aerogels in the internal structure. This results in a better quality aerogel in terms of its insulating properties.

In addition the company offers a service for other aerogels company looking to improve the quality of their aerogels by applying their patented supercritical drying method.

Separex's supercritical drying procedure, consists in eliminating the solvent by pressurising the solgel mixture and heating to a supercritical state and then depressurising and cooling to room conditions, producing a superior aerogel.



Source: Separex promotional material¹⁰

3. Impact of the trend

3.1. The market potential of the trend

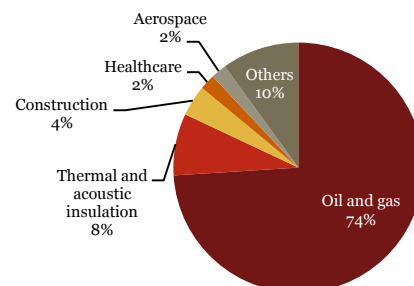
According to market research by Technavio, the global aerogel market currently accounted for some EUR 250 million in 2014 and approximately 10,680 metric tons of aerogel was purchased in 2014¹¹. Aerogels cater to the following markets:

- Oil and Gas Sector;
- Thermal and Acoustic Insulation Industry;
- Construction Sector;
- Healthcare Industry;
- Aerospace industry.

The oil and gas industry is the most dominant of the market applications for aerogels where these act as insulators to maintain the temperature for transported or stored oil or gas. This sector accounted for 74 per cent of the entire aerogels market in 2014 (Figure 3 on page 6).

The US is the major producer of aerogel in North America, driven by the steady growth of aerogel production and government support for research in the field. Europe came second in terms of aerogel production and accounted for 36 per cent of the market in 2014. To date the major players in this EUR 250 million market are: American Aerogel Corp; Aspen Aerogel Inc.; BASF SE; Cabot Corp.

Figure 3: The segmentation of the global aerogel market by application in 2014



Source: Technavio Insights ¹¹

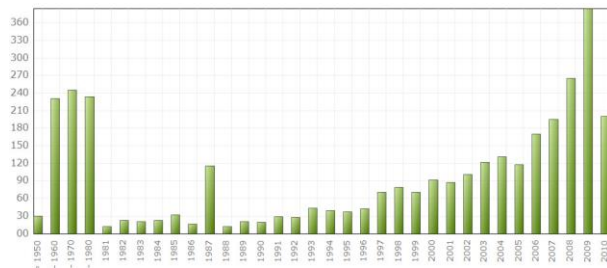
The Global Aerogel market is expected to grow significantly at a CAGR of 35.86 per cent during the forecast period. North America was the leading producer worldwide and accounted for 51 per cent of the market in 2014.

A major market in which aerogels will see increasing importance as a result of the latest innovations in this advanced material, notably in new cost-effective production methods, will be in the construction and insulation markets. This is driven by the growing commercialisation of thermal and acoustic applications across different industries and because of the growing need to reduce energy costs in the face of rising energy prices and increasingly demanding energy efficiency legislation.



There is a lot of potential for economic growth as aerogels enter the insulation market. This market is very large and offers a lucrative potential for aerogel companies. The global insulation market is estimated at around EUR 34 billion and predicted to grow to EUR 50 billion¹².

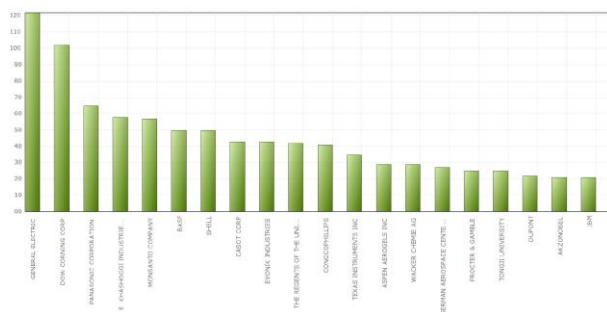
Figure 4: The number of IP publications in the area of aerogels filed over the years



Source: Patent iNSIGHT Pro

The aerogels market has recently seen a surge in the number of patents filed on aerogels in recent history (Figure 4). Published patents started to rise rapidly from about 80 published in 2000 to in excess of 400 in 2009. This demonstrates the increase in nanomaterials research in recent years in the field of aerogels. As shown in Figure 5, the major patent portfolios for this nanomaterial are owned by major market players including GE, Dow Corning Corp, Panasonic, and Monsanto.

Figure 5: Top assignees of patents for aerogels



Source: Patent iNSIGHT Pro

This increase in patents in recent years in tandem with increases in the investment into research (through initiatives like the EUR 4.3 million invested into the aerogel insulation research and commercialization project¹³) can only suggest

that the market believes aerogels will become increasingly important. As a result of which players on the market have begun to protect intellectual property in anticipation.

3.2. The socioeconomic impact of the trend

The development of the aerogels market will help generate growth and create jobs. The Europe currently accounts for 36 per cent of the aerogel market, which means Europe stands to benefit from its development as it will result in an increased demand for skilled labour to support this growth. Given the knowledge intensity of the nanomaterials sector, the majority of the jobs created will require skilled labour and will thus be ideal for the European jobs market vis-à-vis other competing geographies given the emphasis placed in many European Member States to promote skilled labour^{14,15}.

30 per cent of global insulation is accounted for by Europe, the Middle-East and Africa according to market statistics. The consortium of European insulation firms recently called for an enforced target of 30 per cent energy efficiency to be set for their sector by 2030, which they estimate could save consumers EUR 300 billion in energy bills¹⁶. Another example of this future demand can be drawn from the UK's plan to achieve its 2050 energy efficiency commitments. In order to do this, the UK government have estimated that some 3.5 million solid walls will need to be insulated by 2030 in the residential sector¹⁷. This demand could be met by aerogels, which will benefit from the recent technological advances to achieve even greater performance and production at more competitive costs.

One of the business sectors that stands to gain from the development of aerogels is the European construction sector. Sustainable construction practices are becoming more important in line with European policy to help achieve sustainable growth, particularly through improved energy efficiency¹⁸, aerogels could help offer a better insulating material which could be used in smaller volumes than conventional insulation. It has been proposed that approximately 1 million jobs could be created if a 30 per cent energy efficiency target was enforced for 2030 for European insulation and construction companies¹⁶.



4. Drivers and obstacles

The aerogels market benefits from an increasing demand for greater energy efficiency which has been driven by energy efficiency regulations as well as by consumers as these increasingly demand more energy efficient and environmentally-friendly products. The cost of aerogels has so far been an obstacle in the growth of the market, but the latest developments are seeing their cost reduce, which will help drive the market. New construction techniques and architectural techniques are helping to make aerogels more popular. However, the construction sector is notoriously risk-averse and SMEs offering aerogel products face an obstacle in getting their clients in this sector to move away from conventional insulating products towards aerogels. Finally, access to finance for SMEs offering aerogels products is made more difficult by the reluctance of VCs to invest into.

4.1. Increasing demand for greater energy efficiency and environmental-friendliness

One of the primary drivers of the aerogels market is the same one that is driving the insulation market; these being energy efficiency regulations. Given their greater insulating potential than conventional technologies, aerogels stand to benefit from this demand for greater energy efficiency. This demand is due to recent policies implemented at both the EU and national level which has helped create market push.

“Our product is really eco-friendly and despite strict regulations under REACH we were able to achieve our goal of producing effective insulation materials using low cost material and safe processes with green raw materials.” – Green Earth Aerogel Technologies

The EU had set itself the target of achieving a 20 per cent reduction in energy efficiency as part of the Europe 2020 strategy¹⁹ along with the 2012 Energy Efficiency Directive (EED)²⁰. The latter is complemented by sector-specific instruments such as the Energy Performance of Buildings Directive which sets the standards on insulation in new buildings. It is also complemented by the Ecodesign Directive²¹ which establishes performance standards, energy-using products and the Energy Taxation Directive²², which sets minimum rates for energy products.

While the demand for energy efficiency has originally been policy driven, the market is beginning to demand greater energy efficiency independently of these regulations, with consumers helping to create market pull²³. This is because of greater consumer awareness of climate change and the need for energy efficiency, in tandem with the awareness of reducing energy bills through energy efficiency.

In addition to becoming more aware about the role of energy efficiency in the context of energy emissions, consumers are increasingly demanding more environmentally-friendly products. While conventional aerogels are produced from less-desirable materials (in terms of waste management and toxicity), technological advances have allowed companies such as Green Earth Aerogel Technologies to synthesise carbon aerogels using agricultural waste²⁴. These new types of aerogels stand to benefit from existing regulations (environmental or chemical standards like the REACH legislation) and contribute towards the transition to a circular economy.

4.2. The cost of producing aerogels stand to drop as the market develops

Aerogels have been around for several decades now, and despite their high performance, their uptake by the market has been limited. This is mostly due to the high cost of producing aerogel (cost of the substrates as well as the synthesis process) which then result in a high cost of the product. This high cost has meant that the threat of substitution by other products has been high, even if these competing products do not perform as well as aerogels. In addition, this high cost limits the bargaining power of the sellers of aerogels as customers will be more inclined to opt for materials that provide a more cost-effective product, with only niche industries that can afford the elevated cost of opting for aerogels (the oil & gas industry for example). Additionally, aerogel manufacturers have been highly dependent on their suppliers because of the difficulty in sourcing the necessary raw materials and their high costs, giving the suppliers a strong bargaining power¹¹.

As the market develops however, this cost stands to drop. Aerogels Poland Nanotechnology proposed that the aerogels market will benefit from increased investment by the Chinese market into the technology, and as production levels increase, the cost of aerogels will have to decrease and a threshold will be reached whereby aerogels could compete with conventional technologies, particularly insulators. In addition, technological advances in production methods such as the one developed by Svenska Aerogel have meant that aerogels have become far more cost-effective for consumers than they ever were before.



4.3. Increased use of novel construction and architectural techniques

Another important driver, which is tied in with demand for greater energy efficiency through insulation, is the increasing use of novel construction and architectural techniques in the construction sector¹².

Construction projects are increasingly making use of techniques such as daylighting as a means of reducing energy consumption through lighting. In order to improve energy efficiency in tandem with daylighting, fibreglass and glass windows can be substituted with transparent aerogels.

An important advantage is that aerogels can be applied from within a building to insulate walls. Insulation layers in walls

“Aerogels are particularly of benefit to old historic buildings, where you cannot change the façade. They are also flexible, inflammable, hydrophobic and can be installed regardless of the weather” – Aerogels Poland Nanotechnology

are often bulky, and when an existing building needs to be re-insulated, these layers are often simply built around the existing wall. Along with having an aesthetic impact, it can also lead to complications when the building cannot be further expanded because of planning permissions. If the building is only semi-detached

and so certain walls cannot be built upon because they are covered, this is also problematic as it is difficult to insulate from within the building. In addition, aerogels require less volume than conventional insulating materials, so the aesthetic impact is less noticeable.

No more so are aerogels becoming as attractive a solution as in the refurbishment or insulation of old or historical buildings. Amending the exterior of these buildings is often restricted by legislation on national heritage, making insulation with conventional means impossible. Aerogels Poland Nanotechnology have capitalised on this and a good proportion of their aerogel sales are for this purpose.

4.4. Risk-aversion of the construction sector

While the use of new construction and architecture techniques helps drive the aerogels market in what is effectively the biggest target market, entry of the advanced material into this sector is difficult²⁵.

The construction industry is widely regarded as being conservative and slow to innovate and adopt new technologies. This sector's conservatism and risk-averse, stems out of the overriding need for durable and long-lasting products, that are often expensive to build, but also very costly if they fail to perform as required. The industry is also highly fragmented and for the most part populated with SMEs with a low level of industrialisation²⁶.

4.5. VC market less inclined to invest into cleantech

Finally, several of the interviewed companies showcased in this case study stated that they found it difficult to access finance through venture capital because there was a lack of appetite from the VC industry towards cleantech and nanomaterials.

These stated that only a few years ago new environmental regulations and energy efficiency subsidies were helping push market demand for cleantech. Because of this stimulus, venture capital outfits were eager to invest in cleantech like photovoltaics, wind farms and of relevance to aerogels; energy efficiency initiatives such as insulation. When the subsidies ceased however along with a relaxing of environmental regulations following the economic crisis, the appetite to invest in cleantech died down.

“Venture capitalists used to be very enthusiastic about cleantech, but today they are more interested in the next IT or website company than an environmentally and cost-effective aerogel” – Svenska Aerogels



5. Policy recommendations

In order to support the development of the aerogels market, and address the obstacles that hinder its growth, the following policies could be enacted. First, higher energy efficiency targets should be set beyond 2020 in order to continue to help drive the market. Second, public schemes supporting insulation or re-insulation of buildings could be encouraged. Third, investments into applied research on aerogels could be continued in order to help commercialisation of new and better aerogel products. Finally, the visibility of aerogels could be raised through awareness-raising campaigns coordinated out of the public support mechanisms at the Member State level.

5.1. Continue pushing for greater energy efficiency targets

As previously mentioned the aerogels market is primarily being driven by the market push generated by regulations pertaining to energy efficiency. The Europe 2020 targets legislation setting targets for most EU Member States. There are however no binding targets across the EU, only tabled proposals as of yet²⁷.

“It is important that Europe continues to enforce its environmental regulation and not relax them. Equally the consumer should be properly informed”. - Separex

While some Member States have gone and set their own targets of their own accord such as the UK, many have no energy efficiency targets to hit as part of a general climate change policy beyond 2020. The sooner a post-2020 proposal is approved, the sooner the market can begin to increase investing in energy efficiency solutions, including aerogels as an insulator.

5.2. Promote insulation initiatives

Given the huge potential for aerogels to continue to penetrate the insulation market, it is important that policy continue to help encourage insulation and re-insulation of buildings.

As energy-efficiency standards continue to increase, both as a result of policy and because of consumer requirements to drive down energy costs, the greater performance of aerogels can make up for their higher costs. In addition, these costs stand to come down as the market develops and technological advances in production continue.

Policy could be created to help subsidise insulation, or re-insulation, of buildings. While it is unlikely that a policy could be enacted specifically supporting aerogels, if they become more competitive in terms of costs with other insulators, then the aerogels market stands to significantly gain as a result.

5.3. Maintain investment in applied research for aerogels

There are several important European research projects that aim to further develop both our understanding of aerogels but also their applications. Projects like the AerSUS project (which aims to develop aerogel applications and products, and supply them for the space industry) or the aerogel insulation research and commercialization project are major research projects which are bound to produce knock-on beneficial impacts to the wider market.

Given that aerogels are a relatively mature technology, the focus on investment should be geared more towards applied research and into its commercialisation by identifying new ways to incorporate aerogel into products and capitalise on their unique properties.

5.4. Increase the visibility of aerogels as a cleantech

If access to finance, particularly through venture capital, is to be reinvigorated then the market conditions driven by public support that spurred their enthusiasm should be brought back by continuing the policy drive for greater energy efficiency and environmental standards. This could be complemented by an awareness campaign driven by policy.

This awareness campaign would help encourage investors as to the trend for aerogels as a new solution. This could be done through the support of networking and visibility initiatives run by incubators, accelerators or demonstrators at the national level and encouraging the participation of VCs. This is particularly the case vis-à-vis the construction industry. Increasing this visibility would help improve the appetite for investors to support aerogels,



6. Appendix

6.1. Interviews

Company	Interviewee	Position
Green Earth Aerogel Technologies	Fortunado Cardenas	CTO and founder
Svenska Aerogels	Anders Lundström	CEO
Aerogels Poland Nanotechnology	Dariusz Krakowski	Sales representative
Separex	Audrey Ngomsik-Fanselow	Managing Director

6.2. Websites

Company	Web address
Green Earth Aerogel Technologies	www.green-earth-aerogel.es
Svenska Aerogels	www.aerogel.se
Aerogels Poland Nanotechnology	www.aerogels.pl
Separex	www.separex.fr

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