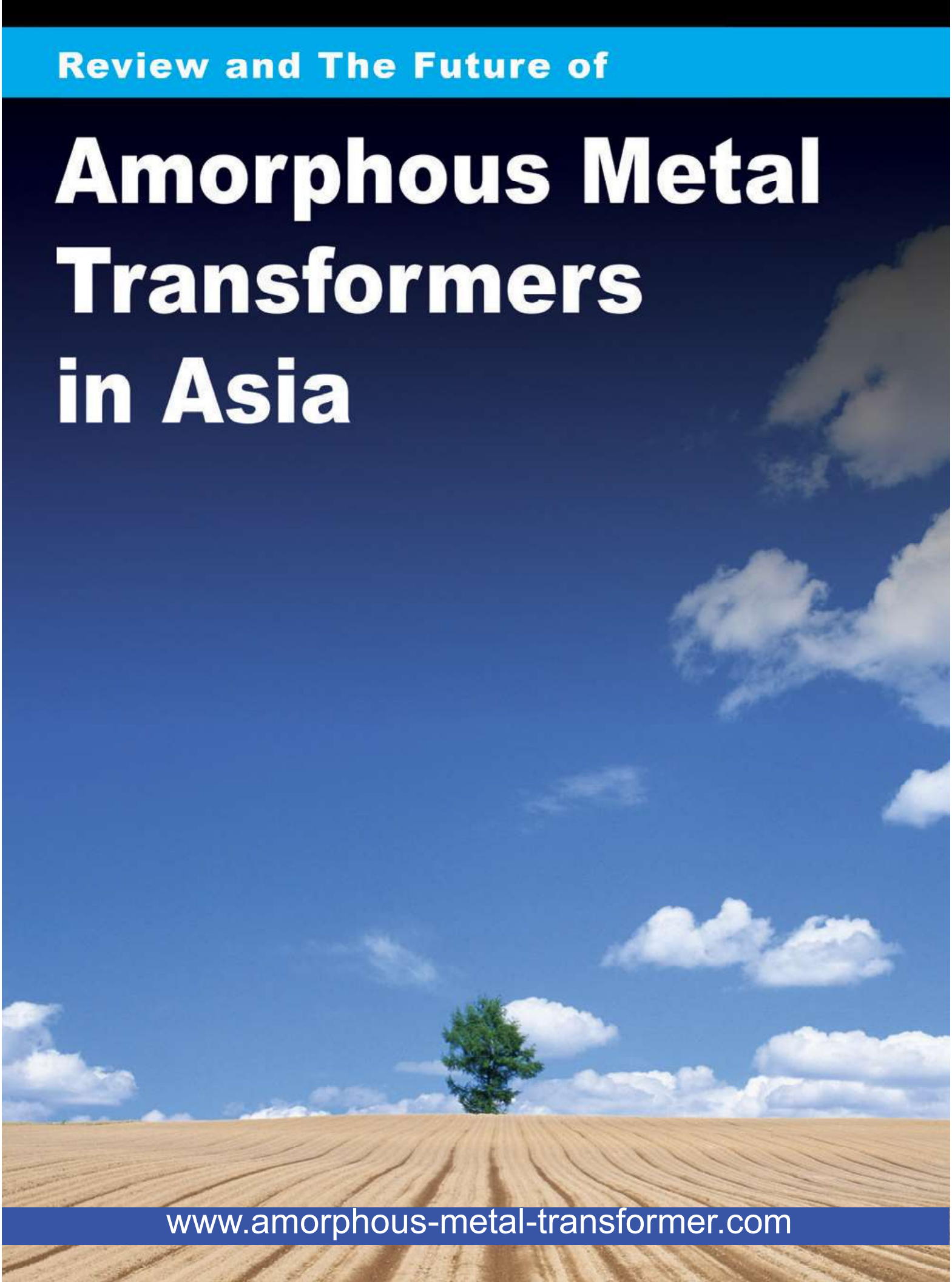
Review and The Future of

Amorphous Metal Transformers in Asia



www.amorphous-metal-transformer.com

Review and The Future of

Amorphous Metal Transformers in Asia

2011 Edition

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CONTENT

FOREWORD

We are delighted to be here in Brunei Darussalam as a sponsor of the ASEAN Energy Business Forum 2011. This event, taking place alongside the annual ASEAN Ministers on Energy Meeting (AMEM), comes at an important time for the region.

ASEAN is confronted by the challenges of enhancing and expanding energy supplies to keep up with economic growth and improve the lives of its people while also guarding against the increasing dangers posed by climate change and environmental degradation.

The need for safe, reliable, cost-effective and energy-efficient technologies has never been greater.

Asia Energy Platform (AEP) is pleased to be holding an exhibition in this beautiful city of Bandar Seri Begawan focusing on Amorphous Metal Transformers (AMT), which offers huge energy-saving results compared to the traditional silicon steel distribution transformers.

More than 10 years ago when I presented a conference paper about adopting energy-efficient transformers in Asia (Li, 2000), China and India were at the initial stages of deploying AMTs. As of today, the two countries have widely adopted the technology in order to effectively reduce T&D loss and save energy. There are immense economic benefits to develop and promote the application of these transformers across ASEAN, and we believe facilitating closer cooperation is the best way to materialize this mission.

AEP is a non-profit-oriented entity that promotes the use of energy-efficient and renewable energy technologies. We also help to develop project frameworks and assist our partners in seeking financing.

We look forward to meeting the distinguished participants and guests at this year's Forum and sharing our mutual experiences.

Sincerely,

李振峰

Jerry Li
President, Asia Energy Platform

Chapter 1

AMORPHOUS METAL TRANSFORMERS - A Smart Solution

Energy demand is growing rapidly in Asia in tandem with economic growth. But as the region grapples with how to expand its power supplies and distribution networks, it must also confront the challenges posed by climate change and environment problems.

Amorphous Metal Transformers (AMT) offer key benefits that make them an important part of advanced energy distribution grids for both the present day and the future.

IMPROVED ENERGY EFFICIENCY: AMTs reduce power transformer "no-load" losses by around 70% compared to traditional silicon steel transformers.

COST SAVINGS: By reducing no-load loss, AMTs enhance distribution efficiency and offer savings in generation capacity investments.

ENVIRONMENTAL PROTECTION: Because of the reduced generation need, the use of AMTs lowers CO_2 and SO_2 emissions and helps to protect the environment.

Amorphous Metal Transformers are recognized as a reliable and advanced technology and are widely used in major energy markets including the United States, Japan, China and India. Demand is also increasing in the developing economies of Asia.

As of end of 2010 China has installed approximately 70 million KVA of AMTs, and India 35 million KVA.

For the most current information, please visit:
www.amorphous-metal-transformer.com

10KV Amorphous Metal Transformer

Chapter 2

WHAT ARE AMORPHOUS METAL TRANSFORMERS?

Amorphous metals, also known as "Metglas", are generally alloys made using techniques to rapidly cool molten metal. The production process results in the atoms being stuck in a disordered structure, like glass.

As such, amorphous metals offer key benefits over traditional transformer core materials such as silicon steel, which have a crystalline structure.

One major advantage is that amorphous metals are easier to magnetize or de-magnetize which directly translates into lower no-load losses in electric transformers. The no-load loss occurs in the magnetic cores and takes place over the life of the transformer regardless of the load.

Compared with other materials in common use, AMTs can dramatically lower transformer no-load loss, providing major improvements in energy efficiency.

Where do you find AMT?

Transformers that use amorphous metals as magnetic core material can be found at the distribution voltage level grid (below 35KV). The common size range of AMTs varies from tens of KVA to several thousands KVA.

AMTs reduces core loss by about 70% compared to traditional silicon steel based transformers.

What does that mean?

While it depends on the grid design, distribution transformer core loss accounts for about a quarter of the total T&D technical loss of a typical modern grid. By deploying AMT, 15-20% of the total technical loss could be saved. Using China as an example, full adoption of AMT would have saved 40TWh in 2008, or half of the power generated by the Three Gorges Dam, the world's largest hydro-electric plant, in the same year (based on 2008 consumption).

Which countries have deployed this technology? Who can supply this type of transformer?

The AMT technology is applied extensively globally. Currently, China, India, the US, Japan and South Korea are the most steady users. China, for example, installed 25 - 30 million KVA of AMT in 2010. A number of ASEAN countries are at an early phase of deployment. Multinationals such as ABB, GE and Hitachi are all capable of supplying AMT. Meanwhile, a good number of regional manufacturers are also capable of supplying this type of transformer.

For the most current information, please visit: **www.amorphous-metal-transformer.com**

Chapter 3

HISTORY

It was on April 13, 1982 that the first Amorphous Metal Transformer went into commercial use. A switch was flicked to energize an experimental pad-mounted 25-KVA distribution transformer manufactured by General Electric to provide electrical power to a residence in Hickory, North Carolina. That same month a similar device made by Westinghouse Electric was installed atop a utility pole in Athens, Georgia. (DeCristofaro 1998).

These two devices were unique among the 40 million transformers in the United States. Their magnetic cores were made from a Fe-B-Si (iron-boron-silicon) amorphous metal alloy produced by Allied Chemical (later AlliedSignal, which subsequently merged with Honeywell). By replacing silicon steel in the transformer cores, the amorphous metal reduced the core losses of the transformers by around 75%.

The first reported amorphous metal was produced by scientists at the California Institute of Technology in 1960. But it was the oil crisis of the 1970s that spurred the commercial development of Amorphous Metal Transformers (AMTs). Soaring energy costs focused the minds of governments, utilities and researchers on ways to enhance the efficiency of electrical power distribution.

In the early days, there were concerns about the performance of these new metal alloys as well as the complexity of the manufacturing process. So in 1983, the Electric Power Research Institute initiated a programme in the United States to assess the commercial viability of using amorphous metal in transformer cores (DeCristofaro 1998)

In 1985, 1,000 25-KVA units were produced in a pilot manufacturing facility and shipped to 90 utilities across the country for a two-year field trial. The results confirmed the long-term stability of AMTs under actual operating conditions. No failures of the amorphous metal cores were recorded.

AMTs have been commercially available since 1986, and AlliedSignal began to operate the world's first commercial plant for the production of amorphous metal alloy. Before long, this new product was being promoted in international markets.

The China Factor

Much as the 1970s oil crisis provided impetus for the development for AMTs, heightened environmental concerns alongside surging energy costs in recent times have helped to spread the adoption of this technology around the globe.

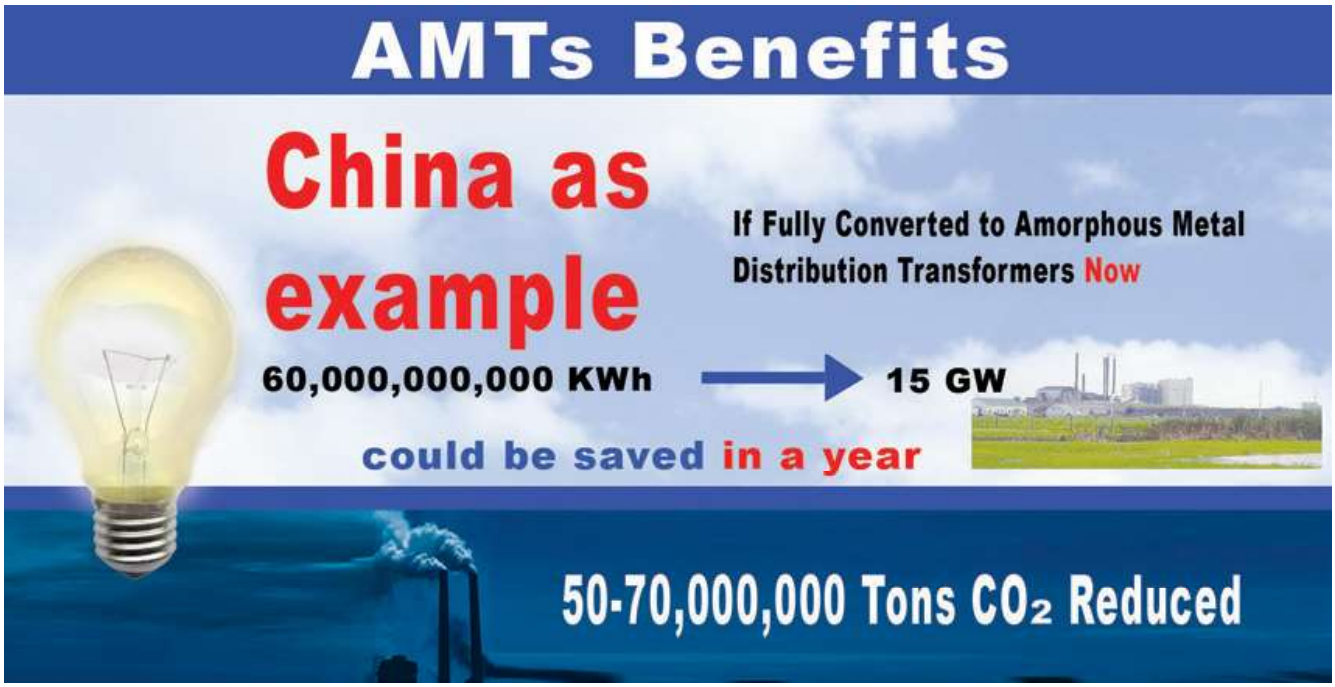
In just a few short years, China has become the world's largest user of amorphous metal materials. To overcome electricity distribution supply bottlenecks and keep up with surging demand, the country almost doubled its electricity generating capacity between 2004 and 2008. AMTs are playing a key role in delivering the electricity generated to users in most efficient manner.

An experimental programme launched in Jiangsu Province in 2005 to test AMT was a success. As a result, the technology was recommended for large-scale adoption (Li 2008)

For China the energy saving potential of AMT is huge. Full adoption of AMT would have saved 40TWh in 2008, or half of the power generated by the Three Gorges Dam, the world's largest hydro-electric plant, in the same year (based on 2008 consumption).

Commercial Operation & Development of AMT in Asia over the past 20 years	
1991-1995	Japanese transformer manufacturers started AMT production
	India developed national AMT Standard for rural electrification
	Indian Power Ministry approved a US$1 million grant for AMT field trials
	Indian transformer manufacturers started AMT production
1996-2000	Chinese AMT manufacturers started production
	Taiwan transformer manufacturers began AMT production
	Korean transformer manufacturers began AMT production
	Chinese Government offered tax benefits for AMT application
	Metglas took license from GE for AMT with rights to sublicense outside North America
	AlliedSignal bought Honeywell and took over the brand
	China deployed AMT for 1st phase of rural electrification
	Active technology transfer to create strong base for AMT manufacturing
2001-2005	China developed national standard for AMT
	Indian Government launched APDR program to reduce T & D losses in which AMT is widely adopted
	Hitachi Metals bought Metglas from Honeywell
2006-2010	AMT listed in China's State Grid as key energy-saving technology (ISBN 978-7-5083-5266-4)
	Large scale AMT experimental deployment started in China
	Japan's new Top-runner Program defined transformer energy efficiency standard, opening up the market for AMT
	TEPCO adopted AMT with new HB1 material
	US DoE passed minimum efficiency standard for transformers, AMT market expanded
	Filipino transformer manufacturers started AMT production
	Vietnam transformer manufacturers began AMT production
	India's estimated installed AMT capacity was 35 million KVA
	China's estimated installed AMT capacity reached 70 million KVA and is growing at around 25 million KVA per year
2011	AMT is being recommended in Chinese government NDRC's " Technicial Guildline for Rural Grid Upgrade".
	AMT listed in Chinese Government Decree No.9 "Guidance Catalogue for Industrial Structure Adjustment" as an "encouraged item"

USAGE, CURRENT APPLICATION & EVALUATION



Today, AMTs are widely adopted in China and India, where they have been used to successfully cut greenhouse gas emissions. The two nations can potentially save 70-100 TWh electricity annually, eliminate 15-20 GW in generation investment, and reduce as much as 100 million tons of carbon dioxide emissions by fully utilizing this technology.

Following a successful trial in Jiangsu Province in 2005, China started to massively install AMTs in a number of energy intensive provinces as a key technology for improving the nation's grid efficiency and the product is currently undergoing large-scale deployment. Nearly 70 million KVA of such transformers have been installed in recent years.

Experiences in all these provinces have consistently proved that this technology is delivering significant results. Subsequently, State Grid chose AMT as a key technology for grid loss reduction (SGCC 2007). In 2008, over 90% of the newly installed distribution transformers in some energy intensive provinces were AMTs.

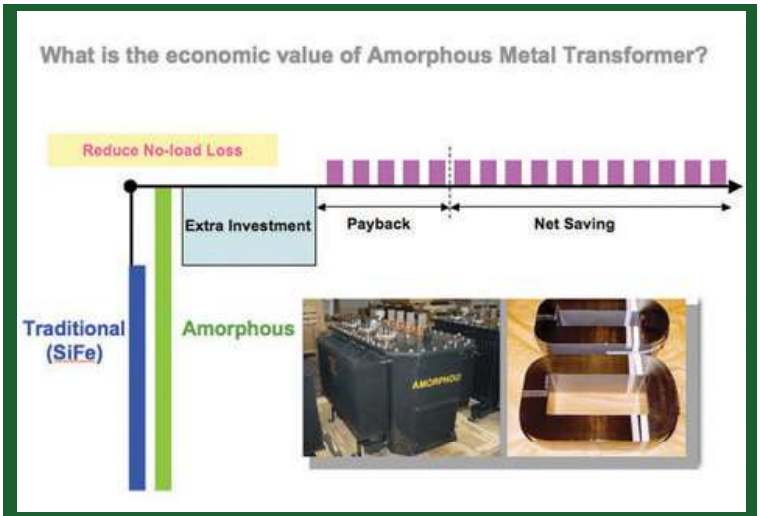
China is a leading spender on clean energy with investment topping US$35 billion last year – three times that of Britain's US$11 billion and way ahead of the US$18 billion spent in the United States. It has even surpassed the US as the most attractive market for renewable energy investments.

Beijing is serious about trying to get to grips with environmental issues by curbing energy growth and exploring a more sustainable path. One main focus is to develop the strong smart grid to allow power from different sources to integrate seamlessly into the main electricity network, and enhance energy distribution to minimize wastage. A key AMT player, Zhixin Electric, has moved a step further by producing smart distribution transformers using AMT as one of the core technologies, and hence created the smart AMT in line with China's Strong Smart Grid initiative.

Evaluation

1. Total Owning Cost

One method of illustrating how AMTs provide economic savings is by evaluating on a Total Owning Cost (TOC) basis. TOC encompasses both the initial cost of the transformer, plus the future cost of energy losses over the life of the equipment (Corhodzic & Kalam 2000; Li 2000). The essence of transformer loss evaluation is to recognize that there is a cost of losses associated with the distribution transformer purchase decision that is just as important as the initial price. A user who saves money on the initial purchase price of the transformer may in fact be losing money by not properly considering the value of energy losses over the transformer's active life.

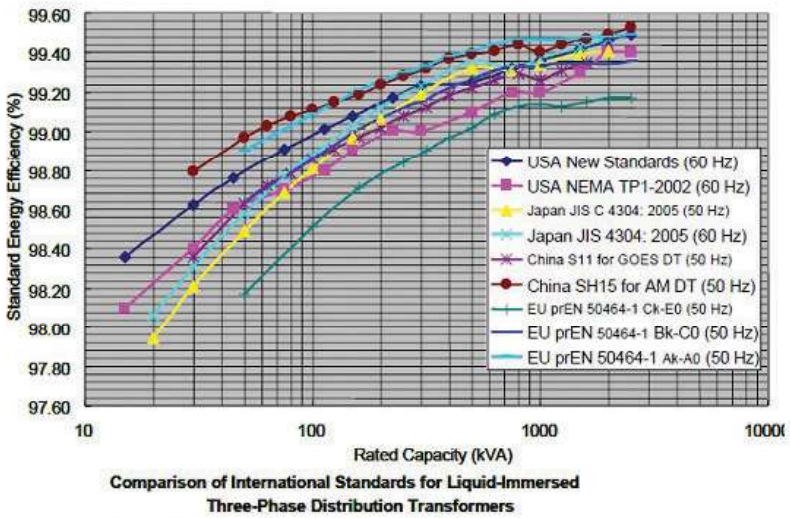


The TOC concept properly accounts for the future savings of energy efficient products.

2. MEPS

Globally there is a growing movement towards increasing energy efficiency (EE) of all equipment used by industry and consumers in response to concern over escalating energy costs and climate change. Generally these improvements are market driven but increasingly they are mandated by policy-makers, regulators and governments. Typically, a governing body would set Minimum Energy Performance Standard (MEPS) for a given device. Distribution transformers are no exception.

Makers of these devices are free to offer products which are more energy efficient than MEPS but cannot make or sell products less efficient than these standards. In other words, MEPS is acting as a floor on the EE scale.



Comparison of International Standards for Liquid-Immersed Three-Phase Distribution Transformers

Source: Van Tichelen P, et al., 2011

The availability of AMTs makes achieving the demanding MEPS an easier task than ever before. Designing AMTs according to loading factors of specific locations not only can maximize energy performance at a level much higher than that of MEPS, it can also bring significant total economic benefits at a mini-

Chapter 5

FUTURE

China's wide AMT deployment has scored a big win for energy-efficient products (China_Decree9 2001; SGCC 2007) India is another big user of AMTs. Japan, South Korea, Taiwan and a number of other Southeast Asian countries have also followed suit and installed a significant amount of AMTs over the past few years.

In the Western world, the US Department of Energy recently issued a new and very encouraging efficiency standard for distribution transformers (US_DOE 2007). A number of European utilities are experimenting with AMTs at the moment. The European Union's Eco-design team has recognized AMT is the best available technology for distribution transformers (Van Tichelen et al. 2011). All in all, the global adoption rate of AMT is growing rapidly.

Gaining popularity worldwide

Amorphous metal is not a new invention; the material research started about 50 years ago and the first commercial AMT was produced in the early 1980s. As for popularity, AMT has been known to many and has been used for a long period of time.

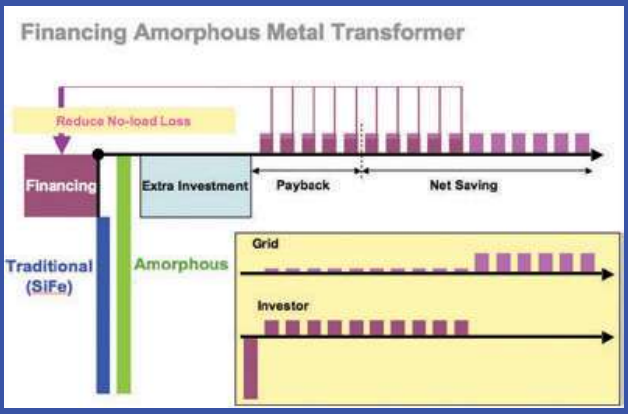
However, AMT was regarded as a niche product in the past and only a small number of manufacturers were equipped with specific facilities to produce it. Because of its increasing importance in energy conservation, overall environmental benefits and low loss characteristics, the focus on AMT has shifted from niche application to mass application in recent years.

Overcoming obstacles

But popularizing the use of AMT in more countries will require substantially different efforts. We need to tackle various aspects such as the technological know-how, technology availability and financing (Li 2008)

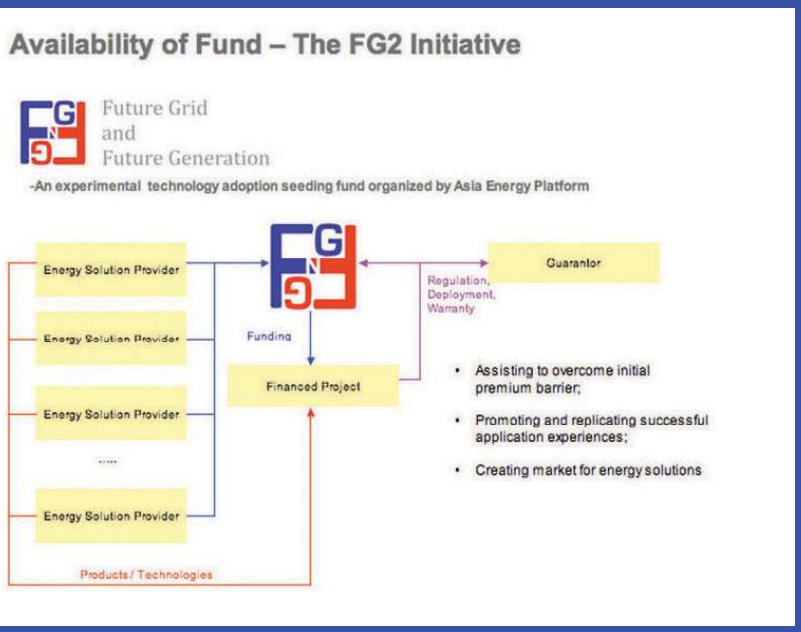
The technical aspect is tackled in terms of assuring the stability of AMT in producing energy savings which means the intrinsic value of the product is guaranteed.

With regards to the availability of the technology, China is a good example. After years of development, the country has acquired technological know-how and well-developed, reliable production experience. Its experience can assist ASEAN and other countries to pick up the technology for extensive adoption in a relatively short time.



Future savings of AMT are more than sufficient to payback its investors for the extra initial investment.

As with financing, the initial extra investments for purchasing AMTs could be funded by investors such as banks and international financial institutions. Paybacks can be made in stages through savings achieved as a result of reduced electricity generation brought on by reduced no-load loss and energy efficiency.



Details can be obtained by contacting AEP at FG2@aepfm.org

Big-scale projects are often funded by international financial institutions, but smaller scale ones often find it difficult to get financial support.

In view of this, Asia Energy Platform has come up with an innovative financing concept – the Future Grid and Future Generation (FG2) Initiative. The idea is to bring together energy solution providers and financial investors to provide financial assistance to operators in overcoming the initial premium barrier.

Chapter 6

AMT IN ASIA'S ENERGY CHALLENGES

Regional dynamics and global implications

Rapidly soaring fossil resources prices have raised concerns about energy security around the world. The topic has taken centre stage in the regional dialogue on economic development in Asia, where fast growing economies are becoming ever more dependent on oil imports from Africa and the Middle East.

Although the United States remains the primary consumer of the world's petroleum resources, since 1990 more than half of the annual growth in global oil consumption has originated from Asia, fuelling fears of tension among different nations.

Coal remains the primary source of energy consumption in China and will continue to be for years to come, which raises concerns about the problems of air pollution and global warming. Meanwhile China will continue to enhance its domestic oil and gas exploration activities and infrastructure to maximize production.

Therefore, it is of utmost importance for governments in the region to closely examine future directions for the Asia Pacific energy market, explore viable alternatives as well as strengthen cooperation among regional countries on common areas to improve energy efficiency and environmental factors.

Developed countries need to transfer substantial financing and low-carbon technologies. An estimated US$80 billion a year of net additional investment is needed over the next two decades to pave the way for a low-carbon future. Of the US$80 billion investment need per year, approximately US$25 billion a year of concessional financing is needed to cover the incremental costs and risks of energy efficiency and renewable energy. Substantial grants are also needed to build local capacity.

Many international financial institutions are committed to scaling up policy advice, knowledge sharing, and financing in sustainable energy to help the region's governments make such a shift. At the same time, however, energy technologies being deployed must be proven and can be quickly adopted and be able to deliver significant results. AMT is clearly an exceptional choice among existing technologies.

AMT plays a vital role

In the big picture of electricity generation, transmission and distribution, there are numerous components. When it comes to energy sources and generation, we have coal and other fossil fuels as well as renewable alternatives. In the area of transmission and distribution improvement, Smart Grid technologies, Ultra-high Voltage Transmission and AMT play the key roles (Li 2009).

The AMT technology is a real godsend for the entire energy sector, which is confronted by depleting sources and deteriorating climate problems. The technology is easy to adopt and readily available, and can maximize performance in electricity distribution. AMT brings the region closer to realizing its potential in achieving high energy efficiency.

Asia leading the way

Many Asian nations are firmly committed to increasing their energy efficiency and use of green technology.

In the Joint Media Statement of the 28th AMEM 2010, the Ministers re-affirmed their commitment to energy cooperation in the direction of regional integration and building of the ASEAN Community, and stressed the need for coordinated efforts in the implementation of the ASEAN Plan of Action on Energy Cooperation (APAEC) 2010-2015. Areas covered include Energy Efficiency and Conservation (EE&C), Coal and Clean Coal Technology, Renewable Energy, Nuclear Energy, ASEAN Power Grid and Trans ASEAN Gas Pipeline.

In 2007, China founded its National Leading Group on Climate Change, headed by President Hu Jintao, and adopted its National Climate Change Program, the first by any developing country. China achieved its target to lower its energy consumption per unit of GDP by 20% relative to 2005 levels by 2010. Now it is aiming for a 40-45 per cent reduction per unit of GDP by 2020 compared to 2005.

In 2008, India unveiled an ambitious National Action Plan on Climate Change, which includes eight national missions, including solar and enhanced energy efficiency missions.

With these commitments, Asia is at the forefront of innovative energy technology and policy efforts. For example, Japan and South Korea were third in the amount of grid connected solar photovoltaic panels added in 2008; the Philippines was second for total geothermal power and third for total biomass power; Indonesia was third for total geothermal power; China ranked the first in the world in wind power and small-hydro capacity in 2010, as well as the world's largest producer of solar cells.

The rapid deployment of AMT in the region has also led to substantial advancements in AMT design and manufacturing capacity in this part of the world, propelling Asia to further contribute to global efforts in grid efficiency improvement.

Chapter 7

Key Players

Amorphous Metal Ribbon Manufacturers

Hitachi Metals Ltd.

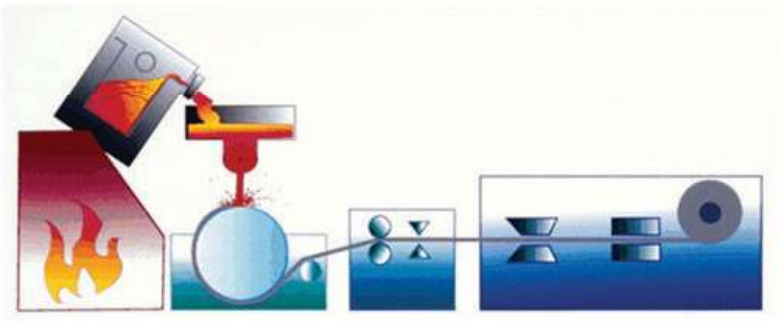
Hitachi Metals, a vital supplier of functional materials and components, is widely respected for its distinguished technology and outstanding development capabilities. For over a century since first establishing itself as the Tobata Foundry Co. in 1910, Hitachi Metals has endeavored to contribute to society and practice quality-based management.

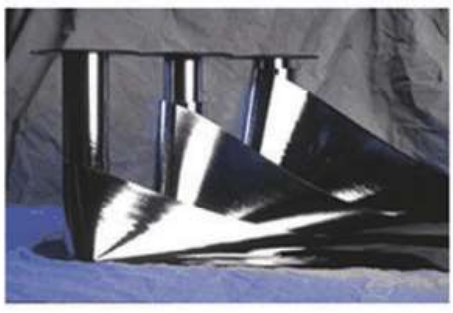
Materials Mag!c
Hitachi Metals

Hitachi stays true to its roots as a manufacturer that specializes in materials development. It offers high-grade specialty steels, rolls, cutting tools, magnets, components for information and telecommunications equipment, soft magnetic materials, casting components for automobiles, piping components and construction components. It services a wide range of industries, including in the automobile, electronics and industrial infrastructure areas. The Group strives to address the many needs of its customers by providing truly original products and contributing to environmental protection at the same time.

The company is famous for pioneering work in amorphous metal technology and the development and commercialization of amorphous metal.

Amorphous metals differ from conventional soft magnetic materials. This results from manufacturing, which involves extremely rapid cooling (over one million degrees Celsius per second) of molten alloy. This process imparts properties not ordinarily found in conventional crystalline materials. The industry leading Metglas brand exhibits high magnetic permeability and exceptional, low-loss soft magnetic properties while maintaining a high level of saturated magnetic flux density. This is possible because it has neither crystalline grain boundaries nor the anisotropic properties of crystalline structures. With mass-production capabilities for this innovative material, the Hitachi Metals Group contributes to greater energy-saving and higher-efficiency in products such as transformers in the power supply industry.





Hitachi operates its Metglas operations across the globe in Asia, the Americas, Europe, the Middle East, Australia and Africa and has manufacturing plants in Yasugi, Japan and South Carolina in the United States. The company is able to produce 100,000 tons of amorphous metal ribbon per year.

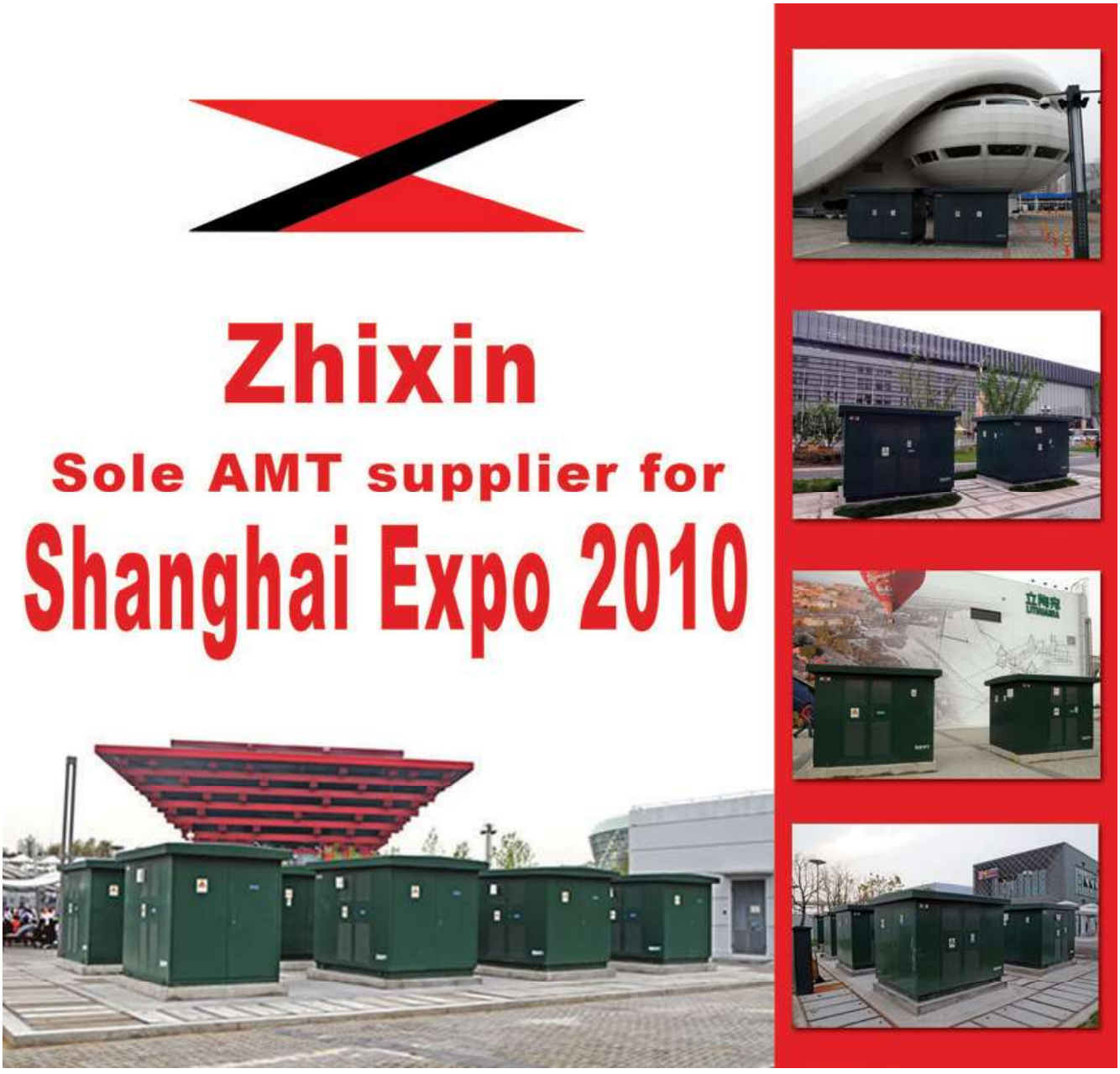
Advanced Technology & Materials Co., Ltd. (AT&M)

Beijing based AT&M is another manufacturer of amorphous metal ribbon.

Amorphous Metal Transformer Manufacturers

Shanghai Zhixin Electric Co., Ltd.

The company is mainly engaged in design and manufacturing amorphous metal transformers for utilities and industrial applications.



Zhixin is the top producer and supplier of AMTs in China. It has the largest production facility; the most advanced technologies, the highest standard of product quality as well as the most complete range of transformers compared to other transformer producers.

It was the first company in China to engage in the large scale development and production of AMTs. In 1998, Zhixin reached an agreement with General Electric to import GE's technology. Zhixin now owns 140 patents in relation to amorphous metal transformers. It is now the world's largest manufacturer of amorphous metal transformers.

Zhixin was listed on the Shanghai Stock Exchange in 2003. It was the sole supplier of AMTs at the Shanghai Expo in 2010, most noticeable the one on the top of China Pavilion. It also played a significant role during the Beijing Olympics, supplying the two-week-long sports extravaganza with a great number of AMTs to achieve an optimal level of energy saving.

The company has been awarded the ISO9001 certification for its internationally recognized Standard for Quality Management Systems and the ISO14001 certification for putting in place an effective Environmental Management System of an internationally accepted standard. All its products have to go through a stringent examination process before being approved and certified by the government to meet national as well as international standards.

China Electric Equipment Group Corporation (CEEG)

"Foresight, innovation and responsibility" are core values CEEG, and "supplying the world with quality power" is the company's mission.

Headquartered in Nanjing, China, the company was founded as Jiangsu Zhongdian Equipment Manufacturing Co., Ltd in 1990, and then re-organized into the China Electric Equipment Group Corporation in 2003. It now owns four major industries, including power transformer, PV technology, insulation materials and complete substation. Besides, it has 15 subsidiary companies in Jiangsu, Shanghai, Jiangxi, Hong Kong etc. One of its subsidiaries, China Sunergy was listed on the American NASDAQ Stock Market (Stock code: CSUN) on May 18, 2007, thus became the first enterprise going public on NADAQ from Nanjing area.

Being an exceptionally successful company in it field of endeavour, CEEG has been awarded in succession with many national and international honors and attracted attention at national level.

Prime Minister Wan JiaBao visiting CEEG, Oct 2005

The company has established long-term strategic cooperation with predominant international enterprises both in China and abroad, including Dupont USA, Schneider France, DSI USA, MKM Germany and Wuhan Iron and Steel (Group) Corp. China. In November 2010, it signed a strategic cooperation agreement with Hitachi Metals, which spelled the beginning of its active involvement in the production and supply of AMTs.

CEEG's series of transformers have been utilized in numerous state major construction projects, such as Beijing Olympic Center, Beijing Capital International Airport, Shanghai Yangtse River Tunnel Project, State Manned Spaceflight Project, Xiaolangdi Hydropower Complex Project, Inner Mongolia Huitengshile Wind Power Station, Shenzhen-Hong Kong Sea-crossing Bridge and Suzhou World Heritage Conference etc.


CEEG pioneering auto-batch manufacturing process for AMT.

CEEG's PV solar energy business has been continuously taking lead in solar element conversion efficiency in the PV industry. After establishing complete photovoltaic industry chain, CEEG demonstrates obvious competitiveness in R&D of solar elements and modules and EPC of solar system projects. CEEG's PV industry has undertaken and is undertaking a lot of key scientific projects for China's Eighth, Ninth, Tenth and Eleventh Five-Year Plan, and has established Sino-American, Sino-Italian, Sino-European, Sino-Spain and Sino-Japanese and many other international cooperation projects.

Jiangsu Yangdong Electric Co., Ltd.

The scope of Yangdong's business covers not only the prduction of AMT, but also designing and supplying specialized facilities to transformer manufacturers who want to enter into the AMT manufacturing sector.

Yangdong has invested extensively in the research and development of AMTs and the equipment for producing AMTs over the years, and is now a recognized leader in AMT manufacturing equipment design. Their customers and Yangdong itself operates these advanced production facilities to produce the best AMTs in class. On it's own, Yangdong can produce up to 3,500 tons amorphous metal cores and 2 million KVA AMTs annually.

All its products have satisfied top international requirements. They have been awarded the internationally recognized ISO9001-2000 certification for Quality Management Systems and the ISO14000 certification for its effective Environmental Management System.

On top of these international certifications, Yangdong's products have also passed a quality assessment process set by the country's quality control centre for the testing of transformers.

China Amorphous Technology Co., Ltd. (CATECH)

Established in 2008, CATECH began to engage in the amorphous metal transformer industry in the following year. It is one of the fastest growing companies in the AMT sector.

It is the company's belief that energy-saving will change the world, and it's management is devoted to develop and provide the best energy saving amorphous metal transformer for utilities and industrial users.

Besides AMT, CATECH is also active on developing electric materials such as nanocrystalline magnetic materials. In May 2011, CATECH has been officially recognized as a national hi-tech enterprise.

CATECH is closely working with national and international experts in the AMT field and spending heavily in product research and development. Thousands of AMTs produced by the company are now installed and safely operating even at high latitude and other challenging environment.

Besides supplying AMT to users, CATECH also assists fellow manufacturers to enter into the AMT sector by providing them with high quality amorphous metal cores. As of today, more than 50 transformers are purchasing cores from CATECH to produce AMTs.

As the company motto states,

ENERGY-SAVING WILL CHANGE THE WORLD.

Xian Amorphous Alloy Zhongxi Transformer Co., Ltd.

The company designs, manufactures and distributes amorphous metal cores and amorphous metal core transformers and also produces a series of electronic products. Based in Xian, the predecessor of the company was founded in 1999 and is currently operated as a subsidiary of China Power Equipment Inc, a US corporation.

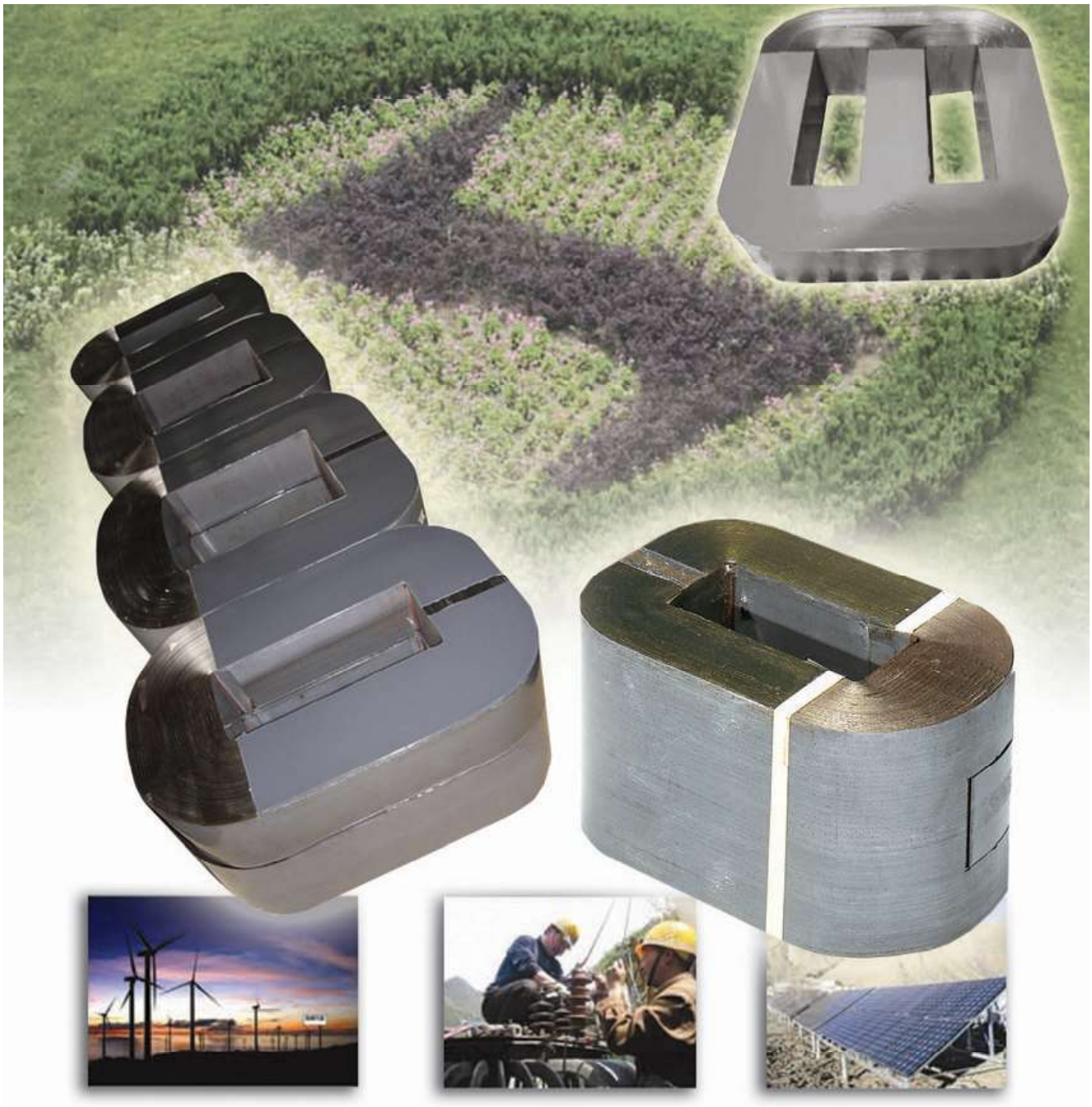
It is the very first Chinese company engaged in amorphous metal transformer development, and was shouldering the responsibility of manufacturing AMT for technological feasibility research during the "9th Five Year Plan" of the country.

On top of supplying AMTs to utilities and general industrial users, the company specializes in supplying high quality AMT to oilfields. No-load loss of transformers connecting to oilfield equipment is a significant component of cost and Xian's AMTs provide a very vital solution for savings.

Based on the modernized facility which has a manufacturing area of 36 Chinese Mu, the company has an annual capacity of 6,500 tons for amorphous transformer cores, and 2,000,000 KVA for amorphous transformers. Currently the company has five series of products, including amorphous cores, amorphous transformers, and substations.

San Jiang Electric Manufacturing Co., Ltd.

As a pioneer to amorphous technology since 1996, San Jiang Electric has delivered more than 100 thousand cores to over 50 countries and regions throughout North and South America, Europe and Japan. Globally recognized as one of the leading manufacturers of amorphous metal cores and amorphous distribution transformers, San Jiang Electric is known for its consistent on-time deliveries and outstanding quality to top leading transformer manufacturers worldwide.



San Jiang Electric specializes in custom made cores ranging from 5kVA to 6.5mVA for dry type and oil type transfomers.

Wide deployment of AMT in Asia has led to substantial advancements in AMT design and manufacturing capacity. In addition to companies mentioned earlier, there are yet many active manufactures in the region. Examples are Hitachi IES (Japan), Woojin (Korea), Cheryong Industrial (Korea), Beijing ZJLG (China), Zhongzhaopeiji (China), Tatung (Taiwan), Fotune (Taiwan), Vijai Electrical (India), Kostons(India), among others. With these capabilities, Asia is eready to futher contribute to global efforts of improving energy efficiency, and mitigrating enviromental and climate concerns.

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