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The cover story of this quarter’s issue looks at tunneling technology. Few people outside the construction industry realise the massive amount of planning, financing, human resources and time it take to bore large tunnels through mountains, under rivers/lakes or beneath the soil. The boring machines used are gargantuan marvels of human applied science, IT and engineering.

Our Feature section looks closely at steel fabrication as an industry. Creating the man-made world from available resources has help to create the highly developed and technological built-world in which we live today.

Two interesting upcoming metro rail projects in India and China (PRC) are featured in the Transportation section. The Energy section showcases an excerpt from a white paper entitled “Global Energy Efficiency Policies” and also presents the technology behind “Clean Tidal Power”.

A Projects Alerts Asia page, News & Events, Finance & Legal section round out this latest issue.

Steven Ray Wemple
Consulting Editor
Tunnelling Singapore’s New Downtown Line
Singapore has experienced an enormous economic growth over the last few years. The requirements placed on the transportation infrastructure of this 5 million inhabitants SEA metropolis city have risen as well. Hence the Land Transport Authority of Singapore (LTA) has set its target by doubling the existing metro network to a total of 278km by 2020. The new 40km long fully automatic and driverless Downtown Line is split into three phases and will be completed by 2016. Phase 1 and 2 are currently in the midst of construction and Phase 3 is still undergoing tender stage.

After a successful completion of Phase 1, Herrenknecht was chosen to participate in the construction of Phase 2 which has commenced construction since 3rd July 2009. Herrenknecht will be providing 10 out of 19 machines required (Ø 6.60m – 4x Mixshield and 6x EPB) for this 16.6km-long tunnel. These machines will be tunneling more than 10km of tunnels.

The first two machines for Down Town Line 2 Beauty World Station to King Albert Park Station, S-548 and S-549, had their workshop acceptance middle of 2010. The third Tunnel Boring Machine (TBM) (S-606) and fourth TBM (S-607) have completed its acceptance in December 2010 and January 2011, respectively, and currently are in Singapore. The construction of the tunnels is scheduled to begin in second quarter of 2011.

Mixed ground condition poses different problems and challenges. To avoid clogging and to break the hard Bukit Timah granite, Herrenknecht designed a cutting wheel equipped with heavy-duty disc cutters and more gauge cutters in order to perform optimally in the variable ground conditions. The 6 of 10 machines are equipped with displacement main drives which allow the designed cutting wheel drive unit to displace 200-500mm independent of the shield. Eight machines are installed with double-chamber locks in order to reduce downtimes for regular cutterhead intervention and cutter tool changes.

Herrenknecht is also delivering two effective separation plants with overall capacity up to 2,400m³/h together with the two Mixshields sold to Alpine Bau GmbH. The separation plants offer more capacity for dealing with sudden surge of the clay content and flushing in the excavation chamber. The separation plants are also equipped with Urethane pre-screens for better wear resistance and lower screen change times.

Upon its completion in 2016, approximately 500,000 Singapore passengers per day will eventually be using the new line. The traveling time from Bukit Panjang to the city centre (CBD) will be reduced by a third. In addition, commuters further abroad from Bedok Reservoir and Tampines can change from bus to the metro network.
Twin Boring Under The Qiantang River
Herrenknecht super large Mixshield (Ø 15.43m) is excavating a double-tube six-lane traffic tunnel under the Qiantang River connecting Yanguan, Jiaxing and Xiaoshan, Hangzhou, China (PRC). Meanwhile, a Herrenknecht AVN-D3080AH (Ø 3.83m) is constructing a gas tunnel almost parallel to the aforementioned traffic tunnel for the Nanchang-Shanghai Branch of the project West-East Gas Pipeline II.

The 132-metres long Mixshield was used in the 7.47km Shanghai Yangtze River Tunnel. After an overhaul, the machine is deployed again. The machine started from south river bank, excavating a 3,242 meter tube northwards, and then returns to excavate the parallel tube. The deepest tunnelling point is 27.6 metres under the river bed (ie. the distance from river bed to tunnel horizontal axis).

Introduced by the project supervisor, the project faces difficulties as Qiantang River features wide and strong spring tides. However, since the launching in April 2010, an S-593 boring machine has tackled the problems. Before the Tunnel Boring Machine crosses Qiantang River, it must excavate underneath the flood protection embankment at a depth of 33.7 metres from the bottom of the embankment. The Contractor (Shanghai Tunnel Engineering Co., Ltd.) set up a total of 27 monitoring points at nine cross sections of the embankment to control any deformations to the embankment.

The S-593 managed to tunnel through the south embankment on the 2 Sept 2010. The recorded maximum settlement is 2.36cm, which is lower than the maximum permissible 5cm settlement. In November, the Mixshield tunnelled through the deepest point. The machine has now tunnelled a total of 2,940 metres. Ninety per cent of the tunnelling works were completed with a best daily rate of 22 metres and best monthly rate of 434 metres.

China Petroleum Pipeline Bureau is using a Herrenkencht ANVD3080AH micromachine, M-1250 to tunnel through this 2,792 metre tube and inner diameter 3,080mm. 1,016mm diameter tubes and 10 bar pressure gas pipes will be laid in the tunnel.

The 311 tonne and 85 metre long M-1250 has its workshop acceptance at the end of 2008 and commenced its excavation task in Haining, Zhejiang in June 2010. The machine has to tunnel downslope at 2.8 % for 594m followed by a 0.3% upslope for 2,099 metres. Lastly, 2.8% upslope for another 99 metres to arrive at the receiving shaft at Xiaoshan, Hangzhou. The machine has tunneled a total of 2,632 metres as of 31 March, 2011 with a best monthly rate of 418 metres.
Kumpulan-Nishimatsu-Hock Seng Lee consortium (KNH), the contractor for the Kuching Waste Water Management project achieved a major technical milestone with the completion of Malaysia’s longest ever under-river tunnel jacking. The 280 metres river tunnel which runs parallel to the Tun Salahuddin toll bridge is the first of its kind in Borneo. To date, the entire tunnel system consists of more than 166 shafts and measures more than 8,000 metres in length.

“Tunnelling under a major river is a significant technical feat and we are very proud of our team,” declared KNH representative, Simon Lau. The laser-guided Tunnel Boring Machine (TBM) arrived on schedule after its arduous 280 metres journey during which its cutter head parts had to be changed three times. The construction team was prepared for many eventualities during the underwater crossing.

Fortunately, the geo-technical conditions were consistent with mostly hard rock and while this does churn through our TBM’s ‘bits’ rather quickly, it is at least predictable and stable terrain,” noted Lau. “While we were technically well prepared for this enormous challenge, we nevertheless, were very happy to see our TBM break through into the receiving/retrieval shaft on the opposite side of the river,” added.

To complete the Sarawak river crossing, the construction team jacked a total of 92 sewerage pipes of 1.5-metre diameter into place. Construction of the deep shafts throughout the city in order to enable the lowering and retrieving of TBMs is now 80 per cent completed with the entire project 35 per cent completed. Without the tunnelling technology, the contractor would have to dig open trenches for the entire piping route through the city and the river crossing would have involved a costly bridge-mounted pipe and pumping station.

With the successful Sarawak River crossing, the main sewerage line now makes its final journey to the sewerage treatment plant complex near the Zecon toll in Kuching. Once commissioned, this sophisticated facility will process the wastewater from Kuching a series of treatment stations until it is clean (Standard A) and fit for discharge. This will be a revolutionary change for the city and will remove a huge source of water pollution.

Currently, sewerage or ‘black water’ was stored in septic tanks which had to be regularly pumped out or ‘de-sludged’ by the local councils with solids then sent for burial and liquids discharged into waterways largely untreated. Meanwhile, the city’s ‘grey water’, a putrid mix of soaps, chemicals, food wastes and so on generated by some half a million people, goes directly into rivers and waterways by way of the open monsoon drains. Once the centralised waste water management system is complete, both the black and grey water will be properly treated. The main sewer line will be completed by next year with property connections within the Central Business District starting this year.
ArtScience Museum Opens in Singapore

Singapore: Along with the grand opening of Singapore’s Marina Bay Sands recently, another milestone was achieved with the launching of the world’s first ArtScience Museum by the Prime Minister Lee Hsien Loong.

An iconic structure that will inspire generations of Singaporeans with its cutting-edge design and unique exhibits, the museum was officially unveiled by Sheldon Adelson, chairman and chief executive officer of Las Vegas Sands Corp., together with Dr. Miriam Adelson and design architect Moshe Safdie in a Mongolian-inspired event complete with horses and “warriors” decked out in full regalia.

With a lotus-inspired design and ten ‘fingers’ symbolising the ‘welcoming hand of Singapore’, the 50,000 square-foot museum features an impressive four opening exhibitions in its 21 galleries. Moshe Safdie, Marina Bay Sands’ design architect, said, “From the inside out, every element in the design of the ArtScience Museum reinforces the institution’s philosophy of creating a bridge between the arts and sciences.”

The Museum’s design features both breathtaking form and environmentally-friendly function. Its dish-like roof channels rainwater through the central atrium of the building, creating a 35-metre water fall into a small, reflecting pool. The rainwater is then recycled for use in the building’s restrooms. Material such as Glass Fiber Reinforced Polymer (GFRP), typically used in high-performance racing yachts, which has never been used in a project in Singapore, was used for the construction of this architectural wonder.

SOM to Develop Green Tech City in Vietnam

Hanoi, Vietnam: As raising “green buildings” is a buzz word among the construction sector, we see more eco-cities and sustainable villages popping up across the globe. To contribute to global green initiatives, Hanoi has awarded to build its own Green Tech City to leading architectural firm Skidmore, Owings & Merrill (SOM), Inc. Covering an area of 145 hectares, the design integrates two existing villages to create a sustainable city for 20,000 people that will reduce carbon emissions and energy consumption while enhancing and greening the local culture and urban heritage.

The master plan expands and reinforces the local traditions and green urban character of Hanoi. The plan also engages and enlivens the strategic green landscape corridor envisioned at the city scale along the adjoining river and applies state-of-the-art technology in carbon emissions reduction, energy needs reduction and smart infrastructure.

The green corridor will feature low-rise residential neighborhoods to balance the high-rise buildings of the skyline. The development will be mixed use, featuring cultural amenities, retail, residential, office, education, healthcare and other public facilities.

A key geographic feature of the development is the series of networked waterways that enhance the surrounding environment as well as provide flood control, prevent runoff and act as a source for irrigation. This, in addition to nearby green spaces, will provide habitat for native wildlife and plants.

Sustainability

Extensive wind and solar analyses were conducted to determine the positioning of the district with regard to streets and buildings, to reduce the use of energy and take advantage of the natural climate and environment. According to a SOM communiqué, “Sustainable district-wide technologies like canal water cooling, tri-generation plants, waste recycling and rainwater harvesting are integral components of the plan.”

Tekla expands in South East Asia

Singapore: 3D BIM (Building Information Modeling) software provider Tekla has opened a regional office in Singapore. To be headed by area director Thomas Phang, the expansion is expected to boost Tekla’s global presence and strengthen the company’s operations in South East Asia.

The Singapore office will serve as the Tekla hub office in South East Asia – a region that is increasingly seeing innovation and change in the planning, design and construction of buildings.

The Singapore team will also contribute immensely towards Tekla’s battle against software piracy in the region. Tekla has allocated considerable resources towards global anti-piracy campaigns such as tracking down pirates and other parties involved in making or distributing illegal copies of Tekla software.

“It is very important for companies here to ensure that they only use licensed software; this will instill their confidence and boost their reputation. Companies subcontracting on construction projects will be expected to comply with the law by their business partners,” Thomas Phang said.

Having served with top software companies such as Autodesk, Microsoft, Sun Microsystems and HP, Thomas brings with him more than 20 years of experience in the IT industry. On his appointment, Thomas said, “These are exciting times for the industry, and even more exciting times for Tekla. I am thrilled to be able to build and grow the business in this region with a marvelous team who are exceptionally committed to the business and our customers.”

In addition to Singapore, Tekla has SEA offices in Indonesia, Malaysia and Thailand; and partners in the Philippines and Taiwan.
Tekla Gives New Software Solutions to Construction Industry

SINGAPORE: To make an impact on the construction industry, 3D modeling software provider Tekla has launched a new advanced application for building information model-based project communication and cooperation. Tekla BIMsight can be downloaded and shared over the internet for free. Using BIM software contractors, designers, architects, MEP detailers and fabricators can combine their models, check for clashes and collaborate more effectively.

This software application makes it easy to combine and understand 3D models created by different AEC disciplines with different software, to interpret the design intent, check for clashes, and comment and mark changes. Tekla BIMsight presents a centralised way to maintain and communicate shared construction information: project participants can see the big picture as well as every important detail in the same, illustrative and easy-to-grasp 3D model. Tekla BIMsight can be used throughout the workflow of construction, from the design phase of the building to its erection and site management.

“Tekla’s mission is to drive the evolution to digital information modeling, multiplying our customers' potential to think and achieve big in their projects and businesses,” explains Tekla Executive Vice President Risto Räty. Tekla BIMsight has been described as ‘the missing link’ BIM software application because it enables accurate and effective 3D building information model-based project collaboration and management for everyone in the industry. BIM-based way of working supports the modern requirements of sustainability and green building, for example, by optimising prefabrication and site management and enabling a paperless process.

Accurate, model-based communication enables better constructability through finding, reacting to and correcting possible design errors early before on-site construction. All this motivates people working in engineering and construction to centralise their data and to make requests for information accurately and efficiently through one shared application that presents the combined model of a whole construction project from every possible angle.

“The building industry in Asia Pacific is recovering from the global economy slowdown and is slowly getting back on course. Because of that, clients in this region see the need to reduce escalating construction costs and are looking for a more efficient and effective design and construction process. The new Tekla BIMsight can be integral in achieving these objectives, and there has never been a better time to introduce it to the industry,” said Tekla SEA Area Director Thomas Pang.

Tekla Structures 17

Along with Tekla BIMsight, Tekla also launched new version of its main product Tekla Structures called ‘Tekla Structures 17’. The new application introduces many improvements for project collaboration, such as better project managing tools and even more interoperability with other software systems.

The most noticeable new features of Tekla Structures 17 are improved clash checking, organising, viewing, snapping, commenting and project managing tools, including easy input to the free-of-charge Tekla BIMsight collaboration application.

Tekla Structures 17 provides even more interoperability than before with leading software systems, such as Unitechnik, BVBS 2.0, and BETSY for those operating in the precast concrete industry. For the steel industry there is now an improved DSTV connection to CNC machinery. Tekla Structures 17 allows higher accuracy with more customizable and automated drawings. Visualisation of parts and objects in the model has been enhanced. Tekla Structures 17 functions are more and more Windows-like to make its use more intuitive and standardised.

The development of user experience and assistance is continuous at Tekla. In addition, Tekla Structures 17 is now certified to support the use of 3D connexion mouse.

Hanoi Skyscraper to be World’s 11th Tallest

Property developer Kinh Bac Corp will soon start building a 400-metre-high skyscraper in Hanoi, Vietnam which is expected to be the world’s 11th tallest. The company has submitted 24 designs for the US$1 billion, 100-storey Lotus tower in Tu Liem District to city authorities for approval. Construction is scheduled to begin this quarter.

The building, to be constructed on a four-hectare site, will have separate residential, commercial, and entertainment areas, office space for lease, luxury shopping mall, and a six-star hotel. Kinh Bac chair Dang Thanh Tam said, “Among the designs provided by London-based architect Foster and Partners, his company prefers an energy-efficient one with hanging gardens.”

The construction schedule will be known once the approval is received. The building was originally planned to be built by Japan’s Riviera Corp in 2009 at a cost of US$800 million and with just 15 floors. However, the company scrapped the plans last year due to financial problems.
Hospital Build Asia 2011

To be held at Marina Bay Sands in Singapore, Hospital Build is the fastest-growing, global business-to-business platform dedicated to bringing together investors, commissioners, backers and managers of healthcare-related building projects with key players in planning, design, construction, operations, management, supply and refurbishment. As investment in the region’s healthcare infrastructure continues to rise, Hospital Build Asia 2011 is set to be bigger than ever with more than 100 exhibitors covering 7,000sqm of exhibition floor space, an estimated 5,000+ visitors, as well as more than 2,000 conference delegates.

Hospital Build Asia Exhibition & Congress is organised by IIR Asia Pacific’s Life Sciences Division, who, along with IIR Middle East’s Life Sciences Division (the creator’s of the Hospital Build global brand) bring a wealth of knowledge and experience of the exhibition and conference industry to Hospital Build Asia; ensuring its continued growth and success. Producing 14 exhibitions and more than 50 conferences annually, IIR Life Sciences is also the name behind the success and continued growth of Arab Health; the world’s second largest healthcare exhibition, taking place annually in Dubai, United Arab Emirates.

Hospital Build Asia will engage an expected 5,000 trade visitors with twice the exhibition floor space, offering an intense networking experience for all stakeholders in the business of hospitals for the region. The nine-track conference series covering different key aspects of healthcare including financing, planning, designing, operating, managing and refurbishing of healthcare facilities will run alongside the exhibition in this premier three-day show dedicated to advance the design, build and management in the region’s largest healthcare meeting. Connect with over 2,000 senior-level delegates and walk away with practical insights into the latest industry trends in Asia, best practices and proven business and management strategies at the congress.

Asia’s healthcare sector is continuously under development due to fast-growing populations and increasing demand for better healthcare infrastructure. New hospital projects are being undertaken to jump start economies and attract foreign investors.

The monumental boom in the building and development of government and private medical facilities requires a world-class forum specifically aimed at healthcare projects in developing markets around the world. Hospital Build Exhibition & Congress is the region’s first event of its kind to offer a multi-track conference programme and exhibition across the breadth of this expanding sector. The eight dedicated conferences are:

1. Healthcare Management & Maintenance
2. Hospital Design, Build & Upgrade
3. Imaging & Diagnostics
4. IT in Healthcare
5. Leaders in Healthcare at Hospital Build
6. Clinical Skills and Practice Management (new conference track)
7. Quality, Standards & Accreditation
8. Clinical Surgery

This event will be an excellent opportunity for the medical community to connect and explore cutting-edge technological developments, develop industry best practices and trade high level insights from healthcare business leaders. This Asia premier event presents the best business solutions, products and services to drive forward the Asian healthcare industry. It is a must-attend event for decision makers and medical professionals who want to develop their medical capabilities in their organisations.

The ‘Hospital Build’ brand was launched in 2009, with inaugural events taking place in Singapore and Dubai. Following on from the successes of their respective second editions in 2010, two new editions have been added to the portfolio, Hospital Build China and Hospital Build Europe; which will see their inaugural shows take place in 2011.

Event: Hospital Build Asia 2011 Exhibition & Congresses
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Work Begins on Vietnam’s 1,200 Mw Lai Chau Hydro-power Project

A ground-breaking ceremony has been completed for Vietnam’s US$1.8 billion, 1,200MW Lai Chau hydro-power project. The hydro-project, located in Nam Hang Commune in Lai Chau Province and owned by Electricity of Vietnam (EVN), is expected to start generating in 2017. This announcement follows recent news from Vietnam that the 2,400MW Son La hydro project, which is Southeast Asia’s largest hydroelectric power station, has begun operation. The first of six turbines at the Son La hydropower station has been connected to the national power grid, said the director of the plant’s management board.
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FABRICATING THE
"Fabrication" as an industrial term refers to building metal structures by cutting, bending, and assembling. The cutting part of fabrication is via sawing, shearing, or chiseling (all with manual and powered variants); torching with hand-held torches (such as oxy-fuel torches or plasma torches); and via CNC cutters (using a laser, torch, or water jet). The bending is via hammering (manual or powered) or via press brakes and similar tools.

The assembling (joining of the pieces) is via welding, binding with adhesives, riveting, threaded fasteners, or even yet more bending in the form of a crimped seam. Structural steel and sheet metal are the usual starting materials for fabrication, along with the welding wire, flux, and fasteners that will join the cut pieces. As with other manufacturing processes, both human labor and automation are commonly used. The resulting process may be called as fabrication. Shops that specialise in this type of metal work are called “fab shops”.

What is Fabrication?

The built environment of the modern world would not exist beyond natural cave dwellings, hunting and gatherings with primitive tools and fending off the elements with sticks and stones had not man learned to use natural resources to literally shape, cast, bend and mold the earth’s natural resources into useful and beautiful built objects and manufactured products we take for granted every day. Steel fabricators are a large part of this human technological progress—they are the link between raw materials mostly and the objects or materials used by today’s industries to fabricate our material world. The products produced by welders, which are often referred to as weldments, are an example of fabrication. Boilermakers originally specialised in boilers, leading to their trade’s name, but the term as used today has a broader meaning. Similarly, millwrights originally specialised in setting up grain mills and saw mills, but today they may be called upon for a broad range of fabrication work. Ironworkers, also known as “steel erectors”, also engage in fabrication. Often the fabrications for structural work begin as prefabricated segments in a fab shop, then are moved to the site by truck, rail, or barge, and finally are installed by erectors. (Source: Wikipedia.org)

Examples of typical steel fabrication processes include laser cutting, profile cutting, shearing, punching, bending, forming, drilling, TIG & MIG welding, CNC machining, milling, turning, tube & pipe bending, aluminium extrusions, precision assembly, general fabrication, metal finishing, hot dip galvanising, anodising & powder coating.
Basic Sheet Metal Fabrication Techniques by David Scott

Sheet metal is classified as metal that is thinner than metal plate, but thicker than foil. Sheet metal can be shaped and formed for all of its various uses. Usually, sheet metal is fabricated by one of two processes: deep drawing or flat rolling.

Flat Rolling
In the process of flat rolling, metal is fed through a roller, which reduces the thickness of the metal. This can be done for large pieces of sheet metal, and can produce a large variance of thicknesses relatively easily. Depending on the desired thickness of the metal, it may have to be fed through many rollers to be sufficiently flattened. In most cases, the rollers are mechanically driven. Because the pressure needed to flatten the metal is very great, the rollers must be able to exert very large forces in order to create uniform sheet metal.

Deep Drawing
Deep drawing is one of the most common methods of sheet metal fabrication. It basically involves squeezing the metal until its thickness is sufficiently reduced. This is done with a punch, which exerts a calculated amount of energy on the metal, hence drawing the metal out radially. Each punch usually only compresses a certain size of metal, so various press sizes are used for fabricating different sizes of sheet metal. The punches can be hydraulically driven or driven by other mechanical means. However, to change the thicknesses of the sheet metal that is being fabricated, the punch must have adjustable pressures. This process reduces the metal’s thickness while increasing its other two dimensions, which creates sheet metal without a loss of material.

Sheet Metal Shaping
Shaping sheet metal can be done in a variety of ways. The two most common are spinning and press braking. Press braking is a process in which sheet metal is fed through a press, which compresses the metal into a V-shaped groove to make a bend. It is used for bending sheet metal in defined angles. This process is very similar to deep drawing in the sense that it exerts force on the sheet metal while the metal is stationary. The press forcing the metal into the V-shaped groove must be able to fit into the groove perfectly in order for the metal to be bent properly.

Spinning is used for objects such as cones. It is a process in which sheet metal is spun and pressed around a mandrel to create axially symmetric pieces. The intense spinning exerts a centrifugal force on the metal, which thins it and expands its radius concurrently. The mandrel is used to maintain the shape of the piece. Its function is very similar to the function of the V-shaped groove in the process of press braking. (Source: www.ehow.com/way_5214725_basic-sheet-metal-fabrication-techniques.html)

Fabrication of Metal
Fabrication of Metal is divided into several parts:

Forging: It involves plastic deformation of the work piece by compressive forces. Crankshafts, connecting rods, gears, bolt heads etc., are made by forging.

Rolling: It is a process of reducing the thickness of a long work piece by compressive forces using a set of rolls.

Extrusion: During extrusion billets are forced through one or more dies by a compressive force that is applied to a ram.

Drawing: Drawing is a process of forming sheet metal into shapes such as cups and trays.

Deep Drawing: is a type of drawing where the depth of the part can be greater than its diameter.

Bending: The workpiece is bent to form flanges, contours, curls, seams, corrugations and other geometries by means of applying force through hydraulic, pneumatic and electrical machines.

Spinning: It is a process of forming axially symmetrical shapes.

Shearing: This can be of different types such as conventional shearing, turret punching and blanking.

There are different metal fabrication methods and it depends upon the temperature when the metal is molded, whether the room temperature is warm or hot. Material removal is the process of metal fabrication. In this process the cutting tool is used. Cutting torches and abrasive wheels are used most commonly in the fabrication industry because they are easy to use and transport. Plasma tables, laser cutters, water jet beds, and other types of stationary equipment are much less common, but can produce impressive results with incredible tolerances.

Computer based equipments like Computer Numerical Control Punch Press or Computer Numerical Control Lasers may also be used. (Source: www.articlesbase.com/industrial-articles/metal-fabrication-techniques-3145202.html. Articles Base SC #3145202)
Welding Heavy Structural Steel Successfully

Structural steel is fabricated and erected successfully every day, using a variety of cost effective and dependable arc welding processes. However, as steel plate becomes thicker, as shapes become heavier, and as assemblies become more restrained, the likelihood of problems in construction increase. Whereas distortion can be problematic when lightweight sections are welded, cracking and lamellar tearing are more likely to occur as members become heavier.

The use of heavy steel appears to be on the rise. Some of this increase is due to the movement to more blast-resistant design or seismic concerns. Column-free convention spaces and sports facilities with complex moving roofs require the use of heavier steel. Regardless of the reason, member sizes for these structures are larger, and connections are more complex. The inherent rigidity associated with such connections can pose fabrication and erection challenges.

Compounding the complexities of welding under such conditions is the reality that assemblies of highly restrained members typically serve critical functions. As redundancy decreases, for example, the remaining members usually are larger and thus more restrained, and simultaneously more critical in that fewer alternate load paths exist. Accordingly, it is essential that such connections be properly designed, detailed, fabricated, and inspected.

Background and History

Welding on thick, restrained steel is always a challenge, and successfully welding on “heavy sections” is no exception. AISC Specification A3.1c uses this term to describe rolled shapes with flange thicknesses exceeding 2 in., and built-up heavy shapes composed of components made from plate exceeding the same dimension. In the case of the rolled sections, these were formerly the Group 4 and 5 rolled shapes, typically called “jumbo sections.” Originally contemplated for use as column sections, these shapes found use as tension members in trusses and other tensile members. Problems due to material properties, detailing practices, workmanship, and perhaps other issues, combined and resulted in some cracking during fabrication and erection (Doty, 87; Fisher and Pense, 87; Blodgett and Miller, 93).

The typical cracking that had been experienced in the past was welding-related, with the cracks occurring in the base metal, driven by the residual tensile stresses on the thermally cut surface as well as the shrinkage stresses caused by welding, not by service loads.

Cracking often initiated from workmanship-related notches associated with weld access holes. Investigation into the problems revealed that near the web-to-flange interface, material existed with low Charpy-V Notch (CVN) toughness, even though at that time, the material was not required to meet minimum CVN toughness levels, nor was this region the typical ASTM CVN testing location. Small notches, combined with the high residual stress of welding and the low localised fracture toughness, enabled cracks to initiate in this region and propagate elsewhere.

AISC responded by codifying a variety of new provisions. To ensure that the base metal had adequate toughness to resist fabrication stresses, a minimum CVN toughness of 20 ft-lb at +70°F was imposed. The CVN test specimen was required to be taken from a new location; not from the flange tip as is typically the case, but from a portion of the flange directly under the web—the location expected to have the lowest CVN values (AISC Specification A3.1c).

To control notches in the area, a maximum surface roughness value was imposed. When the radius portions of the access holes were to be thermally cut, a preheat of 150°F before thermal cutting was mandated to decrease the possibility of cracking on the cut surface. As an alternative to thermal cutting of the access holes, an alternative technique was promoted, namely drilling a hole to form the radius. Although not mandated in the AISC Specification, this practice had two beneficial effects. It eliminated the potential for harmful metallurgical structures developing due to thermal cutting, as well as reducing the residual stresses from cutting. All thermally cut surfaces were required to be ground to a bright finish, and inspected with magnetic particle or dye penetrant.

To help minimise the concentration of residual stresses from welding, the weld-access holes were modified and increased in size, not simply for welding access, but to minimise the interaction of multi-directional residual stress fields created by the weld shrinkage.

Sheet Metal Fabrication

Sheet metal fabrication is a classification of manufacturing processes that shape a piece of sheet metal into the desired part through material removal and/or material deformation. Sheet metal, which acts as the workpiece in these processes, is one of the most common forms of raw material stock. The material thickness that classifies a workpiece as sheet metal is not clearly defined.

However, sheet metal is generally considered to be a piece of stock between 0.006 and 0.25 inches thick. A piece of metal much thinner is considered to be “foil” and any thicker is referred to as a “plate”. The thickness of a piece of sheet metal is often referred to as its gauge, a number typically ranging from 3 to 38. A higher gauge indicates a thinner piece of sheet metal, with exact dimensions that depend on the material. Sheet metal stock is available in a wide variety of materials, which include aluminum, brass, bronze, copper, magnesium, nickel, stainless steel, steel, tin, titanium and zinc.

Sheet metal can be cut, bent, and stretched into a nearly
Inspection of structural steel typically address material traceability, cutting, beveling, drilling, fit-up, welding operations, high-strength fastener installation, and dimensional accuracy throughout steel fabrication. Bureau Veritas’ welding inspectors routinely inspect Welded Structures for various US fabrication shops and state and local government agencies.

The company’s experience includes providing quality assurance services associated with the fabrication of structural steel of varying type, size, and complexity. Steel items most often inspected include: lift bridges, swing bridges, suspension bridges, bascule bridges, plate girder, trapezoidal box girder, tub girder, box truss, tubular truss, angle truss, arch, cable-stayed and canopies and pedestrian bridges; highways, cantilever and overhead sign structures; elevator frames, staircase frames and rails; and elevated track framing and elevated stations.

Benefits include:
- Assure that a quality product is supplied from various subcontractors
- Receive a finished product in compliance with industry and client standards
- Third-party inspection results assure for independent, un-biased results
- Provide advance warning of the development of critical issues to prevent costly construction delays
- Provide the intimate insight into and record-keeping of the fabrication processes resulting in a detailed historical record needed in the unfortunate event that litigation should arise

Steel fabrication inspection companies such as Bureau Veritas offers a wide range of services related to in-shop inspections:

Non-Destructive Examinations
- Ultrasonic Testing, Magnetic Particle Testing, Liquid Penetrant, Visual Inspection
- Radiographic film interpretation
- Protective Coatings Applications
- High Strength Bolt and Fastener Testing
- Rebar Testing
- Weld Procedure Review
- Welder Qualifications Review
- Welding Consulting
- Pre-Construction Meeting Coordination

(Source: www.us.bureauveritas.com/wps/wcm/connect/BV_USNew/local/home/our-services/industrial_manufacturing_compliance/structural_steel_fabrication_inspection)

Case Study: Bureau Veritas' Shop Inspection of Structural Steel Product Conformity, Consistency and Reliability

Inspection of Structural Steel in a Fabrication Shop

In contrast to specific metal fabrication, Sheet metal fabrication service providers manufacture components by cutting, bending, rolling, forming, stamping and welding sheet metal. Components manufactured through sheet metal fabrication services are used in a variety of applications such as enclosures, computer equipment, HVAC components, kitchen and sanitary equipment, machine tools and other industrial applications. Sheet metal fabrication services include a diverse range of processes used to fashion sheet metal into usable products. These processes may be broken down into three rough categories, cutting, forming, and finishing services.

Sheet Metal Cutting
Sheet metal cutting services includes a number of techniques used to cut metal into smaller pieces so that it can be molded or formed into components. Common types of sheet metal cutting involve shearing, electrical discharge machining (EDM), sheet metal laser cutting, water jet and abrasive cutting. Shearing uses a specialised machine to cut sheet metal by applying shear stress. This process is used to cut large sheets of metal into smaller parts.

Sheet metal fabrication processes can mostly be placed into two categories: these are “forming” and “cutting”. Forming processes are those in which the applied force causes the material to plastically deform, but not to fail. Such processes are able to bend or stretch the sheet into the desired shape.

Cutting processes are those in which the applied force causes the material to fail and separate, allowing the material to be cut or removed. Most cutting processes are performed by applying a great enough shearing force to separate the material, and are therefore, sometimes referred to as shearing processes. Other cutting processes remove material by using heat or abrasion, instead of shearing forces. (Source: www.custompartnet.com/wu/sheet-metal)
Laser cutting machines use laser light to cut or etch holes or profiles. Laser cutting machines are very precise programmable pieces of equipment. Water jets and water abrasive jets rely on highly pressurised water (20,000 - 60,000 psi) flowing through a nozzle or “jewel” approximately 0.010” in diameter. Advantages of using water jets include almost no material heating during cutting, low side loads, and ability to achieve complex shapes and tight inside radii. Low fixture costs and fast setup and programming times make this process very suitable for prototypes or short runs. It is most widely used for two dimensional cutting; three dimensional machining is possible in specialty applications.

Wire electrical discharge machining (EDM) equipment is used to cut conductive materials using a thin electrode. The electrode is a thin wire (typically .004”-.012”) that follows a programmed path. The wire does not physically contact the part. It is charged to a certain level and surrounded by de-ionised water. A spark is generated that jumps the gap and melts a small amount of material on the part.

Sheet Metal Forming

Sheet metal forming processes include those actions used to fashion metal into specific shapes or semi-finished pieces. Common techniques include bending and forming, rolling, stamping, punching, welding, and hardware and fastener creation. Bending and forming processes are used to shape the sheet metal to its final shape.

In the rolling process, a series of roll stands is used to progressively shape or bend a strip of flat-rolled metal to a desired cross section. Stamping is the process of impressing surface definition and three dimensional designs onto materials with pressurised tools and dies. Punching is the process of punching holes in the sheet metal. Welding is the joining of metals and metal parts by melting and re-forming a metal bond between materials, with or without additional filler metal.

Hardware and fastener creation is the capability to supply and integrate hardware such as handles, latches and threaded, self-clinching fasteners used to provide threads in sheet metal that is too thin or soft to be tapped.

Sheet metal fabrication facilities manufacture components by cutting, bending, rolling, forming, stamping, and welding sheet metal. Components manufactured through sheet metal fabrication services are used in a variety of applications such as enclosures, computer equipment, HVAC components, kitchen and sanitary equipment, machine tools and other industrial applications.

Sheet metal fabrication services include a diverse range of processes used to fashion sheet metal into usable products. Precision sheet metal fabrication may be broken down into three rough categories, cutting, forming, and finishing services. Sheet metal cutting services includes a number of techniques used to cut metal into smaller pieces so that it can be molded or formed into components. Common types of sheet metal cutting involve shearing, electrical discharge machining (EDM), laser cutting, water jet and abrasive cutting.

Sheet metal forming processes include those actions used to fashion metal into specific shapes or semi-finished pieces. Common custom sheet metal fabrication techniques include bending and forming, rolling, stamping, punching, welding, and hardware and fastener creation. Bending and forming processes are used to shape the sheet metal to its final shape. In the rolling process, a series of roll stands is used to progressively shape or bend a strip of flat-rolled metal to a desired cross section. Stamping is a sheet metal fabrication process for impressing surface definition and three dimensional designs onto materials with pressurised tools and dies.

Punching is the process of punching holes in the sheet metal. Welding is the joining of metals and metal parts by melting and re-forming a metal bond between materials, with or without additional filler metal. Hardware and fastener creation is a sheet metal fabrication capability to supply and integrate hardware such as handles, latches and threaded, self-clinching fasteners used to provide threads in sheet metal that is too thin or soft to be tapped. (Source: www.metaldynamix.com/technical-reference-metal.html)
China is midway through a highly ambitious project to build an all-new metro system in Chengdu, the country’s tenth largest city. High-speed, light rail and metro rail projects are all high priority in China, which is particularly keen to exploit the mass transit capacities of metro networks to reduce huge congestion and pollution issues that exist within many major population centres.

Chengdu is the capital of Sichuan Province of western China, an important commercial centre with a population of 11 million. It lies 1,500 miles west of China’s eastern seaboard and has heavy rail connections to 12 major cities in China, including the capital Beijing. The metro project was incorporated into infrastructure planning by the local government in 2001, with the combined aim of upgrading urban infrastructure and improving the standard of living.

**The Project**

Construction of the Chengdu metro began in December 2005. Five lines will be built in the first phase of development, covering 126km (78.75 miles) and 116 stations. Eleven of the 116 will be interchanges between routes. The network is being designed to cope with massive passenger demand. By 2020, it is expected to carry 13.1 million passengers every day, rising to 14.1 million a day by 2035.

Trial operations on Line 1 commenced in March 2010, with formal opening scheduled for October of the same year. Lines 2 and 3 are still under construction; completion of Line 2 is expected in 2014. Preliminary assessment for the construction of Line 4 was passed on 12 March 2010.

**Infrastructure**

The umbrella project is the establishment of seven new metro lines over the next three decades, although initially five have been devised, all radiating from the city centre. Line 1 was approved by the State Development Planning Commission, and divided into two sections; phase I runs 15.1km (9.4 miles) between Honghuayan and Shiji Square, and cost $783m to build.

In total, Line 1 is 26.7km (16.7 miles) long; 11.76km of this runs underground, while the remaining trackbed is at ground level or elevated. The route serves 18 stations, has a depot at Huayang, two main sub-stations, ten traction sub-stations and one control centre. There is also an interchange with Chengdu’s north and south railway stations.

A minimum curve radius of 400m has been employed where possible, although certain restricted sections have 300m radius curves. The maximum gradient for the route is 35%. The track uses 60kg/m rails laid to standard 1,435mm gauge, allowing a maximum operational speed of 80km/h (50mph). The power supply will be 750V DC with third rail collection and running rail return.

The project has set a national record by applying natural ventilation techniques in the construction of a subway from the southern third ring road to the new international exhibition and convention centre. Ventilating outlets are built every 30m along the subway to allow fresh air and meet fire emergency needs. In addition, supplementary ventilation equipment is also installed. Natural ventilation is considered as an ideal way to save energy and reduce the construction cost.

Advanced communication systems will be installed on the platforms and in the halls of every Line 1 station as the phase I trial of the route progresses. This will consist of 46 x 52in high-definition electronic display terminals, which give passengers information on train times, news and other multimedia. The start and finish points of the remaining lines in the programme have already been decided:

- Line 2 will run from Honghe Downtown District to west section of the Third Ring Road at the Chegdu-Duijiangyan bus station – 50.65km total, with 15 underground stations and 11 elevated stations.
Quick Facts

City population: 11 million
Operator: Chengdu Metro Limited Liability Company
Opening Date: 2010 (Line 1)
Route Length:
26.7km (total of Line 1)
Gauge: 1,435mm
Number of stations: 18
Maximum line speed:
80km/h (50mph)

Electrification:
Voltage: 750V
Current: DC third rail

Rolling Stock:
Number of vehicles:
22 three-car trains (planned)
Builder: TBA
Capacity: 1,200

Special Characteristics:
Passenger numbers expected to reach 14.1 million by 2035; Five line network planned under initial proposal; Chengdu is Western China’s central city; Relocation of residential areas outside the city centre; US$783m cost for phase 1 of Line 1; October 2010 opening date planned for Line 1

Future Lines:
Line 2: Honghe-Chengdu-Dujiangyan bus station
Line 3: Liujiijian District-Liulichang District
Line 4: Chengdu-Nanchong-Zhuzigiao District
Line 5: Chengdu-Yaan Expressway-Chengdu University

Source:
www.railway-technology.com

- Line 3 will run from the Liujiian district to the Liulichang district – 49.28km total, with 11 underground stations and eight elevated stations.
- Line 4 will run from Chengdu-Nanchong Southwest bus station to the Zhuzigiao District – 38.9km total, with 11 underground stations and eight elevated stations.
- Line 5 will run from West Chengdu-Yaan Expressway to Chengdu University – 24.63km total, with 11 underground stations and two elevated stations.
- The Line 6 main line will run from Shaway to Sihe – 22.05km total, with 11 underground stations and two elevated stations.
- The Line 6 branch line will run from Bolichang to Shuangliu Airport – 15.11km total, with four underground stations and four elevated stations.
- Line 7 will run from Shengtai to Longtandong – 41.93km total, with 17 underground stations and five elevated stations.

Rolling Stock
In common with other modern metro systems in China, the Chengdu network is destined to receive Type B rolling stock from the Changchun Car Company, a Chinese builder. Each three-car train will have air conditioning and capacity for 1,200 passengers. The cars are 2.8m wide and 19m long, formed into three-car sets and later to be expanded five-car trains. The average train speed during each journey will be 35km/h, although the maximum speed will be 80km/h (50mph).

Each three-car train will have air conditioning and total capacity for 1,200 passengers. A fleet of 22 formations is expected to enter traffic at the opening of Line 1.

Signalling and Communications
Chengdu Metro will be a highly sophisticated network, equipped with Automatic Train Control, Automatic Train Protection, Automatic Train Stop and Automatic Train Operation. In addition to the on-train/track systems, fire alarm and automatic fare collection systems will also be installed.

The Future
The Chengdu project will become the seventh metro in China, following the pioneer network in Beijing and others in Tianjin, Shanghai, Guangzhou, Nanjing and Shenzhen. It is aimed at aiding the redevelopment of central Chengdu by turning the city centre over to commercial trade and finance industries, encouraging the old residential areas to relocate in due course. The anticipated passenger loadings are extremely high and take into account the massive population growth taking place across the region.
The Bangalore high-speed rail link (HSRL) project is being undertaken by the government of Karnataka to connect the city centre with Bengaluru International Airport (BIA). The $1.2bn project will run along the National Highway 7 (Bangalore-Hyderabad) and cover a distance of 35km from MG Road up to the BIA.

Although the project was proposed in 2006, implementation could not move forward due to disagreements between different expert groups set up to review the project. The construction of the HSRL was considered to be a hurdle for executing future road projects to address the increasing traffic problems in the city. In addition, the huge investment required for the project led to several alternatives being proposed such as extending the metro rail link and the construction of a dedicated expressway project.
Bangalore High-Speed Rail Link Project

The project was approved by the Indian Government in June 2009. The Government of Karnataka set up an independent entity, Bangalore Airport Rail Link Limited (BARLL), to design and implement the project. The project will require 65.95h of land and will be integrated with the metro rail link and the proposed monorail project. The Government of Karnataka and the central government will jointly fund the project. Around $225m will be provided by the centre and the state will spend about $110m towards land acquisition. The remaining funds will be raised by the consortium selected to carry out the project.

Five consortia are bidding for the project, including Reliance Infrastructure and CSR Nanjing Puzhen Rolling Stock; L & T Transco; ITD Cementation Joint Venture; Pioneer Infratech & Siemens Project Ventures, and Lanco Infratech & OHL Concessiones. BARLL is expected to award the contract for the project in the next few months.

HSRL Line Routes

The route of the HSRL will start at BRV Grounds (MG Road) and move along Police Thimmaiah Circle, Raj Bhavan Road-Sankey Road, Windsor Manor junction and Mehkri Circle-Hebbal flyover. This part of the railway line will be elevated. The remaining part of the railway line from Hebbal flyover will be laid at ground level along the NH-7 to the BIA.

Bangalore HSRL Infrastructure

The HSRL will have four stations along its route. The first station will be at MG Road, the second at the end of the Hebbal flyover and the third station will be at Yelahanka town road junction. All the three stations will be elevated. The last station will be at the BIA terminal. The BIA terminal station will be underground below the airport lounge, about 100m from the check-in counters.

The MG Road and Hebbal stations will have check-in facilities where passengers can check-in their baggage and collect their boarding passes for the airlines. The Yelahanka station will be a pick-up station where passengers with hand luggage can take the train. The stations will be integrated to other modes of transportation. Feeder bus routes, approach roads, pedestrian ways and parking lots will be provided as part of the project.

HSRL Rolling Stock

The HSRL will be serviced by ten trains with six coaches, which will be fully air-conditioned. Half of each coach will accommodate checked-in baggage. Train frequency will initially be ten minutes, which may later be reduced to six to four minutes. The maximum speed of the trains will be 160km/h and the maximum operating speed will be 145km/h. The trains will have a passenger capacity of 575.
Tell us something about your company and services you provide for the global customers?

ITT Corporation is a high-technology engineering and manufacturing company operating on all seven continents in three vital markets: water and fluids management, global defense and security, and motion and flow control.

ITT Fluid Technology's objective is to bring clean water to everyone with its innovative pumps and systems in water handling, control, treatment, and distribution. We go to market through four market-oriented business units. I am leading Residential & Commercial Water (RCW) for the Asia-Pacific region.

RCW has an extensive product portfolio for the building trades and agriculture and irrigation markets. Under the brand names of Goulds, Lowara, Bell & Gossett, McDonnell & Miller, Vogel, A-C Fire Pump and Flowtronex, we manufacture and market a wide variety of high quality pumps, packaged systems, and accessories for residential, commercial, municipal, and light industrial applications. We have a solid installed base and our products can be found in major installations in Asia and across the world. One thing I enjoy doing the most is working together with customers in finding out how our products can provide best solutions that add value to their businesses and customers.

What are the advantages and future prospects of Fluid Technology business?

It has never been a better and more critical time to be in the Fluid Technology business. Simply put, we need water and energy to survive. However, accessibility to clean drinking water has become scarce and costs of electricity continue to trend upward. More countries are putting in regulations to enforce water conservation. As a company that has products that touch every part of the water cycle – delivering fresh water to communities and commercial businesses, treating and disinfecting it, transporting the wastewater and returning it to streams and rivers cleaner than it came in – we take pride in making sure that by developing new energy efficient technologies and modifying the way pumps and systems interact with one another, we are giving more people access to clean water while saving energy.

Describe about ITT’s vision and Values and specific milestones achieved in your division?

ITT’s vision goes far beyond our shareholders to focus on our customers and employees. We believe our work is critical to create more livable environment and to
enable communications and provide protection and safety. We drive to do essential things in extraordinary ways. Our core values are simple and straightforward: respect, responsibility, and integrity. They drive us toward social responsibility, green, and energy efficiency. Some of the key examples include the community service and philanthropy work that our employees around the world have voluntarily been involved in. On the product side, we introduced the high efficiency eSV and high efficiency wastewater pump and systems last year. These advance hydraulic designs are helping users around the world optimise energy and water usage and reduce life cycle costs.

What is ITT’s integrated Management System?
ITT’s integrated Management System is a set of strategic processes aligned around our vision and values, which is to do essential things in extraordinary ways for our customers, employees, and stakeholders. The processes are divided into 4 core areas: profitable growth, which is supported by valued-based management and product development; resource optimisation, supported by premier resource management and portfolio/planning allocation; operational excellence, supported by valued-based lean six sigma and value-based goal deployment; and leadership and learning, supported by value-based leadership development and partnership for performance. The Integrated Management System truly represents the way we think and operate.

Do you have any research initiatives or findings pertaining to your division of residential and commercial water?
Energy consumption is a huge concern in every marketplace served by pumps. Because pumps are especially intertwined with water use, lowering energy costs has always been one of our top R&D priorities. Efforts put in by our cross functional teams have resulted in products with proven performance and have quickly gained market acceptance - the high efficiency multistage pump eSV is just one example. Another example I am very excited about is the agreement we signed with the national water agency in Singapore (PUB Singapore) during the Singapore International Water Week last year. Working together, we are establishing a joint program on R&D and field testing of innovative technological solutions to improve efficiency and reduce energy consumption in water treatment and transport.

Can you tell us about community involvement & philanthropy sides of ITT?
ITT people over the world believe we have a responsibility to care for our communities. We are very active in Asia Pacific. For example, in 2008 and 2009, ITT funded the construction and installation of hand-pumps, arsenic filters, hand-washing stations and student-designed latrines benefiting 235,000 children and teachers at 90 schools. And in August 2009, eight ITT employees from around the world leveraged their experience and volunteered to provide on-the-ground water monitoring and mapping services.

And recently, two dozen volunteers from our Residential & Commercial Water pump assembly plant in Calamba City, Philippines, constructed a pair of clean water towers for nearby Pila Central Elementary School. The towers are now delivering enough clean water to meet the daily needs of the school’s 2,000 students. The success of the Philippines effort showcases an exciting example for ITT Watermark, where help begins in the backyard.

Could you please elaborate on your ITT Watermark?
ITT Watermark links to our corporate value of responsibility. ITT people around the world believe they have a responsibility to care for the environment and our communities. Through ITT Watermark, we leverage the full capacity of our resources – our people, our technology and our financial strength – to make a sustainable mark in the world by providing and protecting safe water resources for children, families and communities in need.

At ITT, our solutions are engineered for life, and our corporate citizenship solutions are no different. By working at both spectrums of the water crisis, in both developed and developing countries, we believe ITT Watermark can create holistic, sustainable solutions that addresses the critical role water plays in public health, economic development and global security, both today and for years to come.

ITT recently announced it plan to separate its business into three standalone companies. Can you elaborate on it?
Certainly. By the end of 2011, ITT plans to spinoff into three distinct publicly-traded companies. Water-related businesses that include our division, Residential & Commercial water, along with Water & Wastewater, and Flow Control divisions, will become a pure play global water company.

The Defense segment will be a diversified defense technology and information solutions company, and ITT Corporation will continue as a standalone, highly engineered industrial company. This change will allow all three companies to have better management focus while maintaining the strong market positions and brands and a culture of proven operational excellence. The future water company will have a broad suite of innovative equipment, systems and applications in the residential, commercial, municipal, agricultural, construction, building trades, dewater, beverage and leisure marine markets, as well as analytical instrumentation for water and wastewater, environmental, medical and beverage applications. The company is expected to benefit from an already strong installed base, driving attractive aftermarket opportunities, as well as a diverse global footprint with approximately 55% of revenues coming from international markets and strong emerging market growth prospects.
KUALA LUMPUR, MONDAY,
MAY 9, 2011: The fourth Malaysian Services Exhibition 2011 (MSE 2011), which was held from April 17 to 20 in Abu Dhabi, United Arab Emirates, opened doors to Malaysian services providers in securing new projects in the Middle East valued at US$73.5 million. A further US$1.76 billion in potential projects are under negotiations. MSE 2011 was organised by Malaysia External Trade Development Corporation (MATRADE).

Malaysian construction and professional services related to construction services companies led the Malaysian services sectors with projects valued at US$845.64 million. The next performing sectors were energy, power generation & environment management services with projects valued at US$652.01 million and specialised training, business and financial services valued at US$56.01 million.

A total of 42 individual business meetings were organized during the International Business Partner Meeting (IBPM) held in conjunction with MSE 2011 and discussions resulted in US$35 million worth of projects. Among the foreign partners participated in the session were from India, UAE, Saudi Arabia, Oman, Kuwait, Qatar and United Kingdom.

MATRADE’s CEO, Dato’ Noharuddin Nordin, said, “For the fourth consecutive show, Malaysian companies have demonstrated yet again their capability in delivering world-class, holistic services and solutions to meet the growing needs of the Middle East economies.”

“The Malaysian services sector has proven itself to be world-class providers in successfully executing numerous technical and engineering projects throughout the Gulf Cooperation Council (GCC) region. This impressive record of project sales identified at MSE not only recognizes Malaysian companies’ strong reputation among project owners in the GCC, it also resoundingly validates MSE as a highly strategic marketing platform for

US$73.5 MILLION IN PROJECTS NEGOTIATED AT MSE 2011

CONSTRUCTION AND PROFESSIONAL SERVICES RELATED TO CONSTRUCTION SERVICES SECTOR POTENTIAL PROJECTS FOR MALAYSIAN SERVICES PROVIDER
Malaysian service companies in this region”, he emphasised.

A total of 98 Malaysian companies, government-linked companies (GLCs), ministries, agencies and associations, participated at MSE 2011 in the following service sectors, namely, construction and professional services related to construction, oil and gas services, renewable energy, power generation and environment management services, Information and Communications Technology (ICT), healthcare and hospital-related services and specialised training, business and financial services.

MSE 2011 received a total of 5,619 trade visitors, the highest number of visitors ever received since the inaugural show in 2008. A total of 1,841 trade enquiries were received for the four days. A total of six Memorandum of Understanding and Memorandum of Agreement were signed between Malaysian and GCC companies at the MSE 2011.

MATRADE

The Malaysia External Trade Development Corporation (MATRADE) was established on March 1, 1993 as the trade promotion organisation of Malaysia’s Ministry of International Trade and Industry (MITI). Its functions are:

- To promote, assist and develop Malaysia’s external trade with particular emphasis on the export of manufactured and semi-manufactured products and services;
- To formulate and implement export marketing strategies and trade promotion activities to promote Malaysia’s export;
- To undertake commercial intelligence and market research and create a comprehensive database of information for the improvement and development of Malaysia’s trade;
- To organise training programmes to improve the international marketing skills of Malaysian exporters;
- To enhance and protect Malaysia’s international trade investment abroad; and
- To promote, facilitate and assist in the services areas related to trade.
TRENDS IN DEVELOPING RUSSIAN PPP LEGISLATION

The Russian Public Private Partnership (PPP) legislation is still evolving. So far, there is no single statutory instrument in Russia regulating PPP or at least laying the foundations for these relations. A number of PPP schemes are implemented on the basis of specific regulations (concession and product sharing agreements, etc.). The legal framework for employing various PPP schemes has not yet been fully developed, so implementation of PPP projects involves certain risks and complexities. Even so, some generally positive trends can be observed in the Russian PPP legislation.

To begin with, commercial relations involving the state are specific in nature since they involve public authorities. Among the factors impacting on PPP projects is the fact that, when they are implemented, the state (municipality) undertakes both civil law and administrative obligations (for instance, to change the legal status of a specific territory, to ensure that requisite permits and authorisations are issued, to introduce tariffs, etc.). Enforcing such state commitments, especially if only civil law remedies are available, is far from easy. Another extremely problematic issue is recovery of funds from the budget.

Furthermore, the very fulfilment of these undertakings is often beyond the powers of the authority that concludes the contract with the investor. Thus, the approval procedure for citing a facility on a specific territory involves a wide range of authorities and organisations determining whether or not the facility complies with the relevant regulatory acts, technical regulations, environmental, construction, sanitary standards, etc. This issue is particularly relevant for PPP schemes not sufficiently regulated by the legislation (such as projects implemented under BOOT/BOT schemes, etc.)

Russian Lawyers recognise that this problem is very relevant and give individual suggestions as to how it should be resolved. Yet no serious statutory amendments remedying this problem have so far been elaborated. The risks faced by investors can be reduced somewhat by proper structuring of PPP projects.
At the same time, a number of amendments to the industry-specific legislation are being developed to facilitate and promote PPPs in Russia.

The new developments in the land legislation elaborated by the Ministry for Economic Development are intended to resolve a problem arising in connection with allocating land for PPP projects. This problem is very relevant for most of PPP formats. In parallel, the legislative developments are discussed by the Council of Experts of the Russian State Duma. The effective Russian legislation permits public land to be allocated for construction purposes in restricted instances - by holding ad hoc tenders (which do not meet PPP objectives and can hardly be used for the purpose), by undergoing a dedicated procedure (also running counter to the essence of PPP projects) and in cases expressly envisaged by the legislation (concession agreements, Brownfield development contracts, etc.)

Legislative changes aimed at resolving investor selection problems are yet to be developed by the Council of Experts of the Russian State Duma. As of now, the procedure for selecting private partners for most PPP schemes is not regulated by the Russian legislation. On the one hand, this creates a background conducive to abuse and corruption and, on the other, the state itself often fails to understand how tenders are to be held. Discretionary choice of an applicable procedure is associated with the risk that the tender results might be contested.

Recoupment of PPP projects is another issue debated by the legal community. It often depends on tariffs, regulation of which falls within the terms of reference of state authorities at various levels. For instance, utility tariffs are determined by the regions of the Russian Federation, while tariff surcharges to be paid by consumers are established by municipalities. Furthermore, tariffs are introduced for a limited term, normally one year. This might mean that a state authority is unable to guarantee a favourable tariff. It is, however, worth mentioning that legislative efforts have already been taken to protect private partners against these risks within the scope of certain PPP schemes, such as concessions.

Various state authorities give individual suggestions on how to improve the legislation governing allocation of budgetary funds for long-term PPPs projects. The Russian government’s capabilities for undertaking long-term financial commitments are currently extremely limited, since the federal budget is drafted for three years ahead - for the next fiscal year and a two-year planning period, while draft budgets of constituent entities of the Russian Federation (local budgets) are developed for one or three years (the next fiscal year and the planning period). Even though budget funds might be allocated within the scope of long-term special-purpose programmes, the law nearly always allows the competent authority freedom to cut budget funds designated for any programme or discontinue such a programme before its completion (for instance, if it is found to be inefficient). The possibility of funds being allocated from the Investment Fund of the Russian Federation is limited. On the other hand, taking into account the discussions and conflict between various authorities and structures, we believe that the pertinent legislation is unlikely to change in the near future.

At the same time, there are a number of other issues to be resolved, including, inter alia, difficulties with public entities buying back BOOT projects. Projects for reconstruction of public property using private funds also face issues with distributing the developed property and applying the privatisation regulations. Impediments faced by concession projects mostly stem from lack of flexibility and restrictions imposed by the legislation. Amendments to the legislation targeting some of the above problems are being discussed.

Let us hope that the legislative changes currently under development in the Russian Federation will build a legal framework for implementing PPP projects and will facilitate subsequent development of PPP in Russia.

About Goltsblat BLP

The law firm Goltsblat BLP, established as a result of the merger with Berwin Leighton Paisner (UK), currently has one of the biggest teams with over 90 Russian and English qualified lawyers, including 12 partners, based in Moscow.

Goltsblat BLP provides assistance with any legal need a business may face ranging from handling complex transactions, including ones of a cross-border nature, to day-to-day operational legal support on corporate, commercial, real estate, tax, customs, finance, competition, employment and IP related matters.

Goltsblat BLP team has over 15 years experience in supporting large-scale foreign direct investment projects in Russia, the firm’s key strengths being: Legal Support for Foreign Direct Investment Projects, Corporate/M&A, Dispute Resolution, Real Estate & Construction.

For more information, visit www.gblplaw.com

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True BIM Coordination

With increasing expertise, the Pittsburgh Flexicore team was ready to handle its most challenging BIM project to-date. The firm was selected to be part of the design team for a seven-level, multiuse structure, which would contain over 3,000 hollow-core planks.

The first three levels call for hollow-core planks set on a Versa System. The remaining level calls for hollow-core planks set on steel stud walls and concrete/masonry unit walls. The architect and structural engineer developed drawings using AutoCAD, while Pittsburgh Flexicore created a 3D model from the preliminary drawings using Tekla Structures.

Laptas says, “We overlaid our model on top of the AutoCAD model and were able to see and communicate conflicts between the architect and engineering drawings clearly. Over the course of a month, we worked closely with the rest of the project team to refine the permit drawings based on our 3D model.”

To shorten the RFI (Request for Info) cycle, Pittsburgh Flexicore used the Tekla Structures Model Reviewer, a free downloadable tool, extensively to support coordination activities. The team can use redlining tools in the Model Reviewer to identify and annotate locations of interest, while the contractor can use the model to fly directly to these locations. Consequently, any changes, issues or RFIs can be easily discussed using the 3D model as a visual aid. The owner received permits and financing shortly after, and construction is scheduled to begin shortly.

Laptas concludes, “The first five months of BIM adoption have been exciting. We are very pleased with the speed of adoption internally and are sold on the quality and communication advantages the technology provides to our company and customers. 2D is on the way out; BIM is in and we’re ready to take advantage of everything BIM has to offer in terms of efficiency, collaboration and quality.”

With its software, Tekla Corporation drives the evolution of digital information models and provides thus more and more competitive advantage to the construction and infrastructure industries. Tekla was established in 1966, and today it has customers in nearly 100 countries, offices in 15 countries, and a global partner network.

With an ambition to multiply its customers’ potential to think and achieve big, Tekla provides an accurate, detailed, and data-rich 3D BIM (Building Information Modeling) software environment that can be shared by contractors, structural engineers, steel detailers and fabricators, as well as concrete detailers and manufacturers.

The highly detailed as-built structural models created, combined and distributed with Tekla Structures enable the highest level of constructability and production control. Centralising building information into the model allows for more collaborative and integrated project management and delivery. This translates into increased productivity and elimination of waste, thus making construction and buildings more sustainable.

CASE STUDY: TEKLA STRUCTURES

Immediate Value for BIM to an American Concrete Manufacture

For over 50 years, Pittsburgh Flexicore Company has been a leading manufacturer of pre-cast and pre-stressed concrete components, and structures in the north-east of USA.
In that time, the company has manufactured over 25 million square feet of hollow-core products for approximately 4,000 projects, and become a premier supplier of products from beams and columns to stairs and wall panels. The company has seen numerous changes to the way pre-cast concrete components are designed, manufactured and erected—though perhaps no change as profound as the industry’s current shift to building information modeling (BIM).

Karen Laptas P.E., chief engineer with Pittsburgh Flexicore, explains, “New technologies, such as BIM, are reshaping and redefining our industry. Adopted correctly, these technologies have the ability to help us complete tasks faster, for less money, and with greater quality.” With this in mind, Pittsburgh Flexicore set out to implement BIM principles throughout its sales, estimating, production and erection business practices with the help of Tekla Structures software.

Internal Adjustments
Like most pre-cast manufacturing companies, Pittsburgh Flexicore production process relies on 2D drafting, along with various estimating tools and automated production processes to manufacture products with relative speed and ease. Efficiency is the key to success with just two engineers and one estimator/project manager to handle drawing checks, production and erection tasks.

Laptas says, “We’re a small lean company, which is one of the reasons we search out highly efficient and accurate tools. We had heard BIM required some significant changes in conventional practices, so we decided to start small. In the early stages, our primary goal was to combine developing the Tekla Structures-based modeling program with our everyday engineering tasks.”

These tasks included working with an estimator to determine layout, design and connection details, developing submittal packages, and creating production tickets and erection reports. In order to achieve this goal, the company began modeling selected projects that would develop the custom component catalog, reports, and general layout and production drawings. The first job was to fabricate simple concrete beam supports for a client.

Components and Connections
“In this first foray into BIM, our team went from sales to engineering, approval and production in two days,” says Laptas. “Production gave a solid feedback on the drawings.

They particularly liked the 3D sketch that our detailers provided with the shop drawings.”

The Tekla Structures profile editor tool allows users to sketch variable cross sections. These cross sections can be as simple as I-beam profiles or as complex as hollow-core profiles. The tool allows you to sketch the profile, dimension it accurately and then use it throughout the current model and any subsequent models. Once created, the profiles can be adjusted from a dialog by simply changing dimensions or returning to the sketch editor. This tool gives the user the flexibility to create a customised library of profiles.

The company’s next BIM-enabled job focused on a church expansion project. For this effort, staff engineers modeled the necessary concrete components and connections. The structural framing of the addition consisted of 10-inch hollow-core floor slabs setting on a combination of steel columns and beams, and concrete masonry unit and cast-in-place walls. Pittsburgh Flexicore modeled the entire structure in Tekla Structures based on architectural and structural 2D drawings. All seemed to go well until the slabs arrived at the site.

Laptas recalls, “When crews went to set one of the hollow-core planks on a steel beam, they found that the hollow-core plank was 4-inches too short. With the help of the model, we were able to determine that the steel erection drawings were incorrect, and then help the erector figure out how to reset the beam. Of course, if the entire project team had grasped the concept of collaborative model earlier, we might have avoided a costly erection error.”

Cataloguing Success
The church expansion project also allowed Pittsburgh Flexicore to begin development of custom component catalog for use within Tekla Structures. Currently, the catalogue contains custom parts such 8-inch, 10-inch and 12-inch hollow-core sections, beam and column profiles, as well as field and embed plates and hardware. Engineers also created custom intelligent seam components for varying connection conditions such as hollow-core slab to masonry or a hollow-core slab to a steel beam. Laptas says, “The custom component catalog will continually evolve as we detail increasingly complex projects. Every modeller keeps a log of the components (parts, details, connection, seam) along with notes of how to improve the components if they are used again.”

Along with building the custom component catalog, the company was able to refine its general arrangement drawings, sections and detail sheets and shop drawings and develop customised reports. It wasn’t long before Pittsburgh Flexicore customers and project partners began to realize a noticeable return on investment.

Demonstrating Value
Adamson Stadium, the home of the California University of Pennsylvania football and track & field team, in California, Penn., is undergoing some major renovations including the rehabilitation of the over 50-year-old pre-cast concrete stadium structure. Pittsburgh Flexicore was called in to provide a pre-cast system that would help raise the platform connecting the existing upper level stadium to a new masonry elevator tower. The system consisted of beams, L spandrels, spandrels and slabs.

“It was a small but complicated addition with hidden and slip connections. The contract drawings were difficult to understand until we built the Tekla model—then everything made sense to us and the rest of the project team,” recalls Laptas. The Tekla Structures Model Viewer was particularly helpful in communicating with the general contractor, architect and engineer about how the various connections met the design requirements.

Laptas explains, “In addition to producing general arrangement and section and details drawing, we were able to produce shop drawings, embed and erection plate drawings along with customised production and erection reports.”
INFRASIZATION

1 Mutiara Mas, Malaysia
1 Mutiara Mas consists of 173 units of three-storey shop offices with a built up of 4620-5040 sqft is strategically located fronting the high traffic main road of Jalan Gelang Patah which easily connects to Gelang Patah (Nusajaya) Taman Ungku Tun Aminah, Taman Nusa Bestari & Taman University. Unique feature of 13ft high ceiling for better ventilation.

Vetrerra, Chennai, India
Primex’s Vetrerra is one of Chennai’s first green residential project that offers 1, 2 & 3 BHK apartments with all modern amenities. This project is a green living space incorporating environment friendly features to efficiently use energy and water, protect the health of its occupants and reduce pollution of all types. Spacious and well-designed.

D’Leedon, Singapore
This 36-storey condominium was designed by internationally-renowned architect Zaha Hadid.
It’s located on Farrer Road, D’Leedon is a short walk to the upcoming Farrer Road MRT station. Expected to be completed in 2015. Total Units: 1,715 residential units (including 12 villas) 8 retail shops. Total Blocks: 7, 36 storeys each Site Area: est. 840,049 sqft. Facilities include • Lap Pool / Gym Pool • Clubhouses • Spa Pavilions • Jacuzzis • Fitness Areas • Tennis Courts • Multi-purpose Court • Basketball Court • Event Courts • Gymnasium • Jogging Tracks • Play Areas • BBQ • Mini Race Track • Theme Gardens • Restaurant/Retail Space

Concourse Skyline Residential Cum Retail Development at Beach Road-Singapore
The Project comprises of four blocks of 15-storey residential buildings with a multi-storey carpark, commercial facilities, precinct pavilion and an electrical sub-station at Bukit Panjang Neighbourhood 4.

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
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<td>Centre Stage</td>
<td>Malaysia</td>
<td>Mixed Use</td>
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<td>Anguila Park Condominium on Orchard Road</td>
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<td>Residential</td>
<td>66.18 million</td>
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<td>Kanchrapara Rail Project</td>
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<td>Audi Terminal Singapore</td>
<td>Singapore</td>
<td>Commercial</td>
<td>55.48 million</td>
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<tr>
<td>Dankuni Rail Project</td>
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<td>Infrastructure</td>
<td>44 million</td>
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<tr>
<td>Buangkok Vale</td>
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<td>Bukit Panjang Neighbourhood 4 (Contract 14)</td>
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<td>Changi Motor Sports Hub</td>
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<td>Thin Film Solar Panel Plant</td>
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<td>South Beach Development</td>
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<td>Mixed Use</td>
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<td>Dankuni Rail Project</td>
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<td>1 Medini</td>
<td>Malaysia</td>
<td>Mixed Use</td>
<td>193 million</td>
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<td>Vinahud</td>
<td>Vietnam</td>
<td>Residential</td>
<td>3.1 billion</td>
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</tbody>
</table>
Robinson Suites Singapore


1 Sulaman – Malaysia

1Sulaman is a landmark for the city of Kota Kinabalu. Introducing a water theme park within the grounds of the residence, 1Sulaman located in Jalan Sulaman is the first in Sabah to have this unique combination: living and leisure within the comfort of your own home. Integrating European-inspired designs, the grand entrance of 1Sulaman features an impeccable facade, with 8 specially commissioned sculpted brass stallions with regulated musical water fountain and special effects. The units, modern and contemporary, are 9 elegant designs with 2 to 3 bedroom units ranging between 700 sqft and 1,100 sq ft. Facilities include: Water Themed Park, 5-Star clubhouse with extensive facilities for swimming, jogging, gym, basketball, badminton, squash, table tennis, a multi-purpose hall and others. Total units 109.

1 World 2 – Malaysia

Located at Bayan Lepas in Penang, 1-World 2 consists of two 26 storey blocks with a total 250 apartment suites. The suites come with a wide choice of layout ranging from 1,380 to 1,650 sqft. Facilities include: BBQ area, children’s playground, yoga pavilion, gymnasium, community hall, children’s pool, pool deck, sport bar, swimming pool, tea house and tai chi area.

400-Metre High Skyscraper in Hanoi, Vietnam

Property developer Kinh Bac Corp will soon start building a 400-Metre Skyscraper in Hanoi, Vietnam which is expected to be the world’s 11th tallest. The building, to come up on a four-hectare site, will have separate residential, commercial, and entertainment areas, office space for lease, luxury shopping mall, and a six-star hotel.

The Glyndebourne, Singapore

The Glyndebourne is a luxurious freehold condo located in the tranquil yet convenient good class landed property enclave which is near to good local & international schools, MRT stations and shopping amenities. Location: 38 Trevose Crescent (District 11). Facilities include: Guard House, Arrival Plaza, The Club House, Gymnasium, Function Hall, Lounge, EntertainmentRoom, Side Gate, Barbeque Gazebo, Wading Pool, Kids’ Turf, Fitness Lawn, Sunken Tennis Court, Floral Garden, Ginger Court, Fern Court, Iris Court, Tea-time Veranda, Piano Court, 50m Lap Pool, Bubbling Pool, Aqua Jet Beds, Sundeck, Floating Cabanas. Expected Completion: 2015. Site Area: Approx. 178,995 sqft. Total Units: 150*

The Peak @ Cairnhill, Singapore

The Peak @ Cairnhill. Location: 51 Cairnhill Circle (District 9). Expected Completion: 2015. Total Units: 52 (1 block, 15-storeys).

Sport Centre Project – Vietnam

The South Korea-based Indochine Partners Investment Consulting Co is investing US$200 million in building the first sport centre. The projects will be carried out in three phases. The company will need an area of 20 hectares in the third phase. Construction of the sports centre is expected to last for 20 years.

Canberra Residences at Canberra drive – Singapore

An exclusive 320 unit low-rise development just a short walk to Sembawang MRT station. Facilities include: 50-metre swimming pool, Cavern Spa, beach bay, gym by the water, Bamboo Forest, Heliconia Walk, Jacaranda Trail, Evolvus Court, awter playground, wading plaza, water jets, sky lawn, outdoor lounge, and a teppanyaki & grill pavilion. Expected for completion in 2015.

1,200 Mw Lai Chau hydropower project, Vietnam

This hydro project which is located in Nam Hang Commune in Lai Chau Province, Vietnam and is owned by Electricity of Vietnam (EVN) is expected to begin generating power in 2017. The value of the project is US$1.8 billion.
Policies Driving Energy Efficiency Worldwide

The political environment for energy efficiency has never been better. In the past few years, it has become abundantly clear that current energy systems are unsustainable, and that energy efficiency is the fastest, cleanest, and cheapest solution to global economic, security and climate challenges. It also is evident that energy efficiency is a necessary step in developing technical and energy infrastructure advances as the smart grid and renewable energy.

Business and policy leaders worldwide are increasingly examining ways to expand implementation of energy efficiency, especially in facilities. For example, in the USA alone, buildings account for more than 70 per cent of electricity use and almost 40 per cent of CO2 emissions. Consequently, a change in political willingness to invest public dollars in energy efficiency and renewable energy means that forces are combining like never before to radically change the building efficiency landscape, with tremendous results. According to Pike Research, the total opportunity for major green renovations in the American commercial building sector (both public and private) is approximately US$400 billion over the coming years. Comprehensive efficiency retrofits are expected to more than triple in annual revenue to $6.6 billion by 2013.

Seizing this opportunity will require greater awareness of three types of various existing and proposed developed nations’ governmental policies that can impact businesses and organisations: market-based incentive policies, performance-based regulations and information programs.

Policy Types

Market-Based Incentive Policies: The price global consumers pay for energy today does not reflect the true cost to their society because it does not reflect externalities such as pollution, natural resources depletion, energy insecurity and health impacts. Subsidies, taxes, and cap-and-trade systems may be used to correct for market failures that lead to under-investment in energy efficiency versus a level that is optimal for any society.

Subsidies: In addition to externalities, energy efficiency faces other market barriers that lead to capital misallocation. Businesses often make purchase decisions based on first cost alone rather than using discounted cash flow methods to assess total cost of ownership. Efficiency measures inherently trade capital expense today for savings tomorrow. However, businesses may not have access to capital, even for projects with very attractive return of investments. Subsidies can take many forms from tax credits to grants to loan guarantees. These financial incentives shift the economics so that investments in energy efficiency become more attractive.

Taxes: Implementing a carbon tax on industries that emit the most CO2 will create incentives to use less energy and emit fewer emissions.

Cap-and-Trade: A growing number of international and regional governments are regulating carbon emissions through a cap-and-trade system or a ‘carbon tax’ to put a price on carbon emissions. In a cap-and-trade system the government will determine the quantity of baseline emissions and allocate fewer permits each year so that the emissions decrease over time. Emitters that reduce emissions faster can sell their excess permits to those that reduce it slower. Using market mechanisms like this assures that the cheapest carbon reductions are done first.

Performance-Based Regulations: One of the biggest problems in the global marketplace is the split incentives problem, where one party (government, corporation, landlord, builder or manufacturer) makes decisions about energy impact, while another party (tenant, buyer, citizen, consumer or user) foots the bill. That means parties are usually systemically rewarded for inefficiency, such as a real estate developer who has an incentive to minimise first cost prior to flipping the property. These market failures and barriers to energy efficiency can be overcome through performance-based mandates.

Codes: By regulating energy efficiency through stricter building codes or appliance standards, a government can force improved performance. For example, the Alliance to Save Energy states in America that building energy codes are the most effective way to improve the efficiency of new homes and commercial buildings, and that improved codes could save at least 150 million tonnes of carbon dioxide emissions a year by 2030, equivalent to taking 28 million cars off the road.

Resource Standards: Energy-efficiency resources standards (EERS) are targets set by government utility commissions or other regulatory bodies requiring that utilities meet a fraction of forecasted load growth through measured and verified efficiency investments.

Registry and benchmarking programs also provide the information necessary to illuminate cost effective energy savings opportunities. But as proposed at the beginning of this paper, the price global consumers pay for energy today does not reflect the true cost to their societies because it does not reflect externalities such as pollution, natural resources depletion, energy insecurity and health impacts.

Source: Excerpt from white paper (www.johnsoncontrols.com)
CLEAN & GREEN TIDAL POWER
Prepared by Mr. K. Velmurugan, M.E CAD

TIDAL ENERGY OVERVIEW
Renewable energy offers a global solution to the energy problems, hydro electric Power is the great renewable energy source of the 20th century!
Worldwide Tidal power capacity has reached 0.3 GW during 2005. These tidal fluctuations generate an average power dissipation of 3.7TW per year.
Sixty-eight percent of tidal currents or the sea wave motions are produced due to the gravitational interaction between the moon and the earth and 32% of wave motion happens due to interaction between the sun and the moon. Tidal energy is the extraction of this kinetic energy of the sea tides into electrical power through the mechanical rotation of the turbine. Tidal energy can be captured anywhere on the ocean where sea water motion is substantial.

Lots of energy we get out of a turbine is directly proportional to the density of the fluid flows back forth. So the tidal turbine can extract about 800 times more power than that of a wind turbine due to high density of water compared to air.
The Rance Tidal Power Station is the world’s first tidal power station which Opened on the 26th November 1966. The facility is located on the estuary of the Rance River, in Brittany, France.
Ocean Power Delivery Ltd, Scotland has installed successfully 2.5MW turbine to extract the tidal power at the coast of Portugal. A way far, occupying less than a half square of ocean , will generate 30 MW power are enough for 20,000 homes.

FREE STREAM TURBINE
Free stream turbines, which only has the turbine blades without any diffuser or duct surrounding it. For example: Atlantis in Scotland unveils the worlds biggest free stream tidal turbine for a capacity of 1MW with a total weight of about 130 tonnes. Another conceptual design example of gravity based free stream turbine is shown below, these gravity based turbines has an advantage of eliminating major foundation work needed during the installation of these turbines, instead these type of turbines can be directly dropped into the seabed since the gravity base structure supports the system against the fluid forces and the twin turbine increases the amount of power extraction from the flowing fluid.

SHROUDED TURBINE
The second type of tidal turbine is the shrouded turbine which has the venturi or duct around the turbine blades, a sample example of conceptual design of the shrouded gravity based turbine is shown below. Lunar energy is one of the companies developing the shrouded type tidal turbines in UK.
Even though the shrouded turbine cannot overcome the Betz efficiency

FLOWCHART DESCRIBING WORK STRUCTURE OF TIDAL PLANT

- Kinetic energy available in sea tides / river water flow is the inlet source of energy
- Kinetic energy in the water flow rotates the turbine to generate mechanical energy
- Turbine shaft transmit the power through gears to achieve the required speed of the generator shaft
- Torque generated is converted into electricity using generator which is attached at the shaft end
- Generated electric power is then transmitted to transmission sub stations through cables.
limit of 59.3%, it can generate 1.15 to 4 times more power output than a free stream turbine without venturi, since it has the advantage of capturing more volume of water flow due to higher area of venturi on the front region and the back side of the shrouded diffuser maintains low pressure which reduces the turbulence losses which enables the turbine to operate at higher efficiency. Some of the special blade designs will make it suitable to operate in both directions of sea waves (under positive and negative axial directions of sea tide motions).

**GENERAL DESIGN VALIDATION PRACTICES**

In general, once a conceptual design of tidal turbine is finalised, then the design will be subjected to computational fluid dynamic (CFD) simulation to analyse the flow pattern around the blades and to evaluate the efficiency of the turbine blades. The strength of the blades needs to be checked so as to withstand the tidal flow forces. The gravity base structure has to be subjected to finite element analysis (FEA) to validate the Structural stability of structure. Finite element analysis also needs to be performed to check the overall integrity of the structure under the lifting conditions. Once the final design was evolved after using the software simulations (CFD and FEA) the final design can be tested using small scaled prototype to confirm the behavior and stability. Geotechnical engineering guidance is needed to select the suitable site location on the seabed where the tidal energy resource is enormous.

**POWER AND ANNUAL REVENUE**

The below calculation is to give a general idea about the amount of power and the annual revenue from a tidal turbine.

For example a tidal turbine with a Duct diameter of 6m and fluid velocity of 3m/s will have the following power and revenue values.

**ADVANTAGES OF TIDAL POWER PLANT**

Tidal energy or river stream energy offers a number of advantages for people who use it, for the environment and for the electricity suppliers. • Electricity generated by Tidal is not dependent upon the price of uranium, oil, or other types of fuel. This makes electricity costs affordable and more stable, which is one of its most significant advantages. • The energy extracted by tidal power plants compared to wind power plants are nearly 800 times higher due to high density of water compared to air for the same sized power plants.

- There is no CO2 emission in tidal energy generation as it generates clean energy, there is no radioactive wastage, environmental impact.
- Most plants are largely automated, so there is no need to have many employees to run a tidal power station.
- Tidal power stations can be set up in almost any size, depending upon the sea tides or river stream used to operate them; big enough to power a single home, factory, small town, or large city.
- Like wind and solar, Tidal energy is a renewable form of energy; it does not rely upon finite resources like natural gas or coal to generate power.

The above-mentioned factors make tidal energy a form of energy generation which offers advantages with regard to cost, pollution, flexibility of installation, and conservation of resources.

**POWER CALCULATION**

\[ P = C_p \times 0.5 \times \rho \times A \times V^3 \times LL \times GGL \]

- \( C_p \) = the turbine coefficient of performance (say 19% for free stream or 59% for shrouded)
- \( \rho \) = the density of the water (seawater is 1025 kg/m³ or 998 kg/m³ for fresh water)
- \( A \) = the sweep area of the turbine (in m²)
- \( V^3 \) = the velocity of the flow cubed (i.e. \( V \times V \times V \))
- \( LL \) = \( x \times .95 \) line losses (multiply by .95) assuming a 5% loss in a cable run of 1000 meters.
- \( GGL \) = \( x \times .95 \) Gearbox and Generator Losses (multiply by .95) assuming 5% for gearbox and generator losses.

Assuming,
- Velocity of fluid = 3m/s
- Radius of intake area = 3m
- Sweep area = 28.26 m²
- Power = 0.59 x 0.5 x 1025 x 28.26 x (3)³ x 0.95 x 0.95
- Power = 208223W or 208KW.

**Annual revenue (R) = P \times $ \times Y \times Hr**

- $ = price per kilowatt (assuming 50cents per kilowatt)
- Y = Year (365 days)
- Hr = operating hours a day (assuming 12 hours a day of operation)
- R = 208 x 0.5 x 365 x 12 = $455,520/annum

Mr Velmurugan has great exposure to design products from Conceptual stage up to the final product in the automotive and Oil & Gas industries. He is a gold medalist in his master graduation in Computer aided design in Anna university India. Not only exposed to various energy turbine projects but he was also interested in doing research in the energy industries, I hope everyone will enjoy and get some useful ideas in the article same as I enjoy doing the research.
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**Indo Buildtech Expo Jakarta**
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**Asia Infrastructure’11**
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7 - 10 September 2011
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Kuala Lumpur Convention Centre (KLCC), Kuala Lumpur, Malaysia
http://www.biztradeshows.com/trade-events/igem.html

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**Renewable Energy Indonesia**
Jakarta International Expo (JIExpo), Jakarta, Indonesia,
http://www.biztradeshows.com/trade-events/renewable-energy-indonesia.html

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