Coal is powering the developing economies of the Far East with huge new investments in coal burning power plant for India and China demanding corresponding developments in coal production and shipping plus storage and reclaim at the utilities as illustrated right at Hua Yang.

The name of Gustav Schade has been synonymous with the very best in chain scraper reclamer design from the 1950s and now in the forefront of the development of enclosed circular storages incorporating very high performance radial stacking and reclaim booms (see right).

Coal is still a favoured fuel for many power utilities second only to oil on a worldwide scale, oil representing 37% and coal 25% with gas at 23% of total capacity.

However, in the Far East this ratio changes more in favour of coal with the bulk of the new power plant built in recent years and presently under construction all based on coal for mainstream base load generation.

With both China and India expected to maintain around 9% GDP growth rates and with the present accelerating demand for power in India in particular we can see a real expansion in coal trades even surpassing recent volumes with probably pricing continuing to harden also.

This is clearly witnessed in the dry bulk shipping industry where the demand for iron ore from China is driving the market with supplies from Brazil and Australia mainly; and in these areas loading facilities are over stretched resulting in last year 665 ship days per week for coal and 140 ship days for iron ore being lost simply waiting to enter the port.

Australia is attempting to correct this with the addition of new capacity, for example at Gladstone being fed from Dawson Creek where Schade are involved with their very high capacity travelling boom stackers, portal reclaimers and bridge reclamer and blending systems.

Considering India alone there are currently five Ultra Mega Power Projects, each 4,000MW, under planning. Three will require coal imports (12-15mt [million tonnes] per annum), whilst two will use coal sourced locally.

Additionally four more projects, each of output 4,000MW, proposed over the next 6–8 years plus a chain of coastal power plants adding up to 10,000MW are in the planning process.

All of these are coal fired...

Combining together the demands of vessel loading and discharge operations to minimize port delays and the storage, handling and blending requirements at the power utility creates a significant opportunity for equipment suppliers.

Additionally, the majority of these new stations are stretching the boundaries of existing designs with ever higher handling rates and more stringent environmental standards with regard to dust, noise and ground water pollution.

Responding to the challenge Schade has developed the enclosed circular storage and reclaim system as illustrated in this article, with 50 units now operating or in progress for China alone.

In most circumstances circular storage represents the most economical and environmentally friendly solution compared with traditional longitudinal design.

Clearly the power industry leads the field and absorbs by far the largest share of coal usage but in addition the cement industry is a substantial and expanding consumer.

With the accelerating cement demand in India particularly and with expansion in China continuing unabated the eastern cement industry now leads the field by a substantial margin with around 1.8 billion tonnes annual production capacity representing approximately 67% of the world total.

A great deal of this new cement capacity is also coal fired creating new logistical demands for fuel transportation, handling and storage facilities.

Here also Schade offer a range of circular and longitudinal storage systems not only for solid fuels (coal and petcoke) but also raw materials such as limestone plus the additions materials such as gypsum plus alternative raw materials such as granulated blast furnace slag.

For over 125 years the Schade Lagertechnik Company (Aumund Group) has developed an enviable reputation for excellence in engineering with the last 50 years specialized in chain scraper reclamer systems for power plant and coal terminals.

Schade won its first order for reclamer equipment in 1952 for a German power plant followed rapidly thereafter with export orders in many different industries and countries worldwide where large volumes of bulk materials are handled.

In most circumstances circular storage represents the most economical and environmentally friendly solution compared with traditional longitudinal design.
The early reclaimer machines were based on the cantilevered boom principle, although this is a later design and in this case specified for breaking out coal from frozen stockpiles; but the principle remains unchanged.

Even today the cantilevered boom design remains a viable option and is an economical solution for smaller stockpiles.

Notably in 1996 Schade supplied its largest portal reclaimer to that date with twin booms able to handle 3,200tph (tonnes per hour) of coal; similar to that illustrated above.

During the early days of the chain scraper reclaimer development the bulk of the business centred on the power stations of the Ruhr valley handling large volumes of coal, such as illustrated below.

A typical plant design such as this includes a high-capacity stacking system to two parallel longitudinal strategic stockpiles each with a portal type reclaimer.

In addition two blending beds are provided using a central radial boom stacker with two longitudinal stockpiles and two bridge type reclaimers to deliver a homogenized blend of coals to the steam boiler bunkers.

In parallel with the development of integrated storages and blending systems for power plant Schade is also active in major coal terminals. The operation above is typical of the scale of these huge installations designed for handling several millions of tonnes annually.

For this project two portal frame reclaimers are provided serviced by a central radial boom travelling stacker servicing two longitudinal stockpiles.

Schade have recently delivered some of the largest ever automated stacker and reclaimer equipment thus far produced with stacking and reclaiming rates of up to 4,000tph.

A total of six stackers and six portal reclaimers were ordered on Schade for the Dawson project managed on an alliance basis by Thiess and Sedgegman. At $350 million this is the largest contract ever awarded in the Australian coal mining industry and will increase the output of the Dawson mine from 7mt/annum to 12mt/annum.

Located 140km to the west of Gladstone, Dawson, one of Queensland's leading export coal operations, is owned by the Moura Joint Venture, comprising Anglo Coal Australia Pty Ltd (51 %) and Mitsui Coal Holdings Pty Ltd (49 %). The mine is operated by Anglo Coal Australia.

Coal is delivered to the new facility from three separate mining resources by a system of overland belt conveyors to the raw coal stacker and reclaiming system, designed by Schade, with a design handling rate of some 4,000tph per unit and a longitudinal stockpile capacity of some 200,000 tonnes.

After processing the coal is stocked out by another Schade boom system to stockpiles of capacity 270,000 tonnes using travelling stackers operating in windrow mode.

Reclaimers similar to the raw coal section automatically recover the processed coal from the product stockpiles which is then transferred to automated train load out stations able to load the 7,300-tonne coal trains in two hours.

With a rail span of 52 metres these are not the widest machines Schade has ever produced (65 metres) but the combination of handling rate and span makes this equipment the largest and most important contract Schade has thus far undertaken.

At the time of writing the Dawson project is still under construction, planned for commissioning May 2007, but the picture below illustrates the type of equipment supplied... if not the scale.
three reclaimers and two stackers.
Illustrated below is the equipment at Dawson Creek shown during the partial assembly of the portal reclaimers.

And also the radial and luffing boom stacker complete with tripper car as illustrated below.

Blending and homogenization is important both for the power industry to ensure a controlled mix of various coal grades and similarly in the cement industry to mix and blend various grades of limestone and other materials.

For this purpose the bridge type reclaimer was developed. There are various solutions for blending depending upon the stockpile strategy which is effectively controlled by the type of stacker. There are fixed boom, luffing boom and luffing plus radial boom options; the latter offering the maximum flexibility. The radial and luffing boom stacker enables material to be laid down in beds either conically (coneshell) or longitudinally in strata or chevrons.

For the best blending effect the chevron stacking pattern is generally preferred; built using the travelling and luffing function to generate the stockpile height incrementally with the boom always discharging to the centre of the blending bed.

In this manner the stacker is in almost continuous motion using a combination of level sensors and other detectors linked to a central on-board PLC such that the whole operation is fully automated.

A typical strata section is illustrated bottom left, showing a coarse increment to demonstrate how the layers are built.

This system has a further advantage in that as the coarse material always falls to the outside of the stockpile these larger lumps are then effectively spread across the whole stockpile base and not concentrated on the outside.

Since the material is spread evenly from each source along the length of the stockpile no one source is concentrated in one section. Clearly the smaller the height increment for each pass the greater the final blending effect.

Longitudinal bridge reclaimers are based on a horizontal chain scraper mounted to rail carriages at each end and arranged to travel at 90° to the stockpile.

A circular blending bed has a fixed central slew ring with a central column and stacker with the bridge supported on the outer travel bogies mounted on a circular track.

For longitudinal stockpiles the horizontal chain scraper conveyor is deflected upwards at the discharge to transfer the recovered material onto a conventional belt conveyor running alongside the stockpile.

This arrangement saves on civil works costs since the receiving belt conveyor, installed parallel to the stockpile, maybe at the same level as the stockpile base and a simple retaining wall employed to contain the material.

For circular storages the chain scraper generally discharges horizontally through a central outlet to a belt conveyor running in an underground gallery.

As with the longitudinal stockpile automated control of the boom stacker motion is essential to achieve the most effective homogenization of the material by the circular bridge reclaimer.

The illustration above shows a typical stockpile profile generated by what is known as the ‘Chevron’ system originated by Schade to maximize the blending effect and stockpile capacity leaving adequate space for the reclaimer to operate.

Material is delivered to the stacker by belt conveyor arranged to span over the bridge reclaimer and discharge to the central axis of the stacker/reclaimer supporting column.

This column may support the head of the incoming belt conveyor also... thus saving on the cost of the bridge structure.
and eliminating any load transfer to the light weight fabricated dome cover.

To control the material flow from the stockpile face to the reclaim conveyor oscillating harrows, arranged to follow the material natural repose angle, move back and forth across the stockpile face using rakes to dislodge the material causing it to flow freely down in a steady stream.

The bridge reclaimer with oscillating harrow provides effective blending of all of the various layers of the stockpile where homogenization is required.

A typical circular storage scheme would be a stacker and reclaimer housed within a building including short vertical load bearing walls with a light weight dome structure above.

Circular storage offers an economical and compact solution compared to a longitudinal design with simplified enclosure requirements; ideal in today's environmentally sensitive market.

This argument is equally true for circular blending beds and also circular strategic storages where no critical homogenization is required and therefore a simple boom type reclaimer may be employed.

This is well demonstrated by the recent projects Schade has undertaken for the power plant as illustrated below, right.

In this project coal is imported from Handymax size ships using a continuous ship unloading system discharging to belt conveyors which deliver the material to the Schade radial stacking boom conveyor, as illustrated below, with central column supporting both the stacker and reclaimer booms plus counterweight.

A total of nine units were delivered during the period 1996 to 1999 at 120 metres diameter for Taiwan plus a further nine units for China of similar design with a stacking capacity 4,000tph and a reclaim capacity of 2,000tph. These were at the time the largest designs of that type ever produced.

For all of the combinations of stacker and reclaimers designs illustrated in this editorial the common thread throughout is the effective management of the stockpiling and reclaiming philosophy to achieve autonomous, automated and safe operation and the level of blending and homogenization required for the ongoing process or fuel grinding plant.

Blending and homogenization of the stockpile is an essential element in the stockyard management for most power plant operators. For this purpose Schade has developed various stacking routines in order that the reclaimer may combine elements of each sample within the total stockpile into a homogenous output.

The simplest stacking routine being based on the coneshell principle where the stacker boom is set to the highest required stockpile level and simply traverses along the stockpile making discrete but adjacent conical deposits with each forward increment of longitudinal movement creating a new shell over the existing cone.

This results in all material from a single source being stockpiled together and as a result when the material is reclaimed there is little blending effect.

For the greatest level of homogenization the chevron or chevcon solutions are preferred, as previously described herein, where material from all sources is spread over the entire stockpile length.

The situation is further complicated by the need generally to stock and reclaim at the same time and often combine strategic stockpiles with minimum blending but high handling rates with smaller blending beds often located away from the main stockpile but nevertheless integrated to operate together as a complete stockpiling and blending operation.

All machines are supplied with comprehensive instrumentation to signal the machine status to a central control system using generally a PLC mounted to the reclaimer plus sometimes the Stacker which communicates with the main plant control system often some distance away.

Software routines have been developed to manage the control of all machine functions which may be integrated to most plant systems and central computer control units and displays.

Clearly the level of control integration must be tailored to the demands of the plant and operators and Schade engineers are always pleased to advise on such systems.

In conclusion, Schade offers not only a wide range of equipment designs but also has an enviable reputation in critical industries for performance, quality, reliability, availability and ongoing support.

In these projects availability is the key consideration as unscheduled outages are both extremely disruptive and expensive and it is in these market sectors Schade is extremely well respected.

In 2001 Schade joined the world renowned Aumund Group benefiting from the Aumund international sales and service organization with strategically located offices in major business centres worldwide.

Enclosed circular storage.

Hua Yang coal import and storage.