

# POWERHOUSE ON WHEELS STEAM FOR THE 21ST CENTURY!

With its oil waning, Australian locomotive engineers are looking at alternative sources of power - steam is on the agenda again!

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reports on radical proposals to build not only a 2-14-2+2-14-2 but also a 4-10-4+4-10-4. Garratt's may well be on the way back. Yes, it's true...no, it's not an April Fool spoof! Read on...

Active development of steam traction effectively ceased in the 1950s, yet the use of coal to make steam is still common in power stations. Now, 1990s technology is being applied again to steam traction - in Australia.

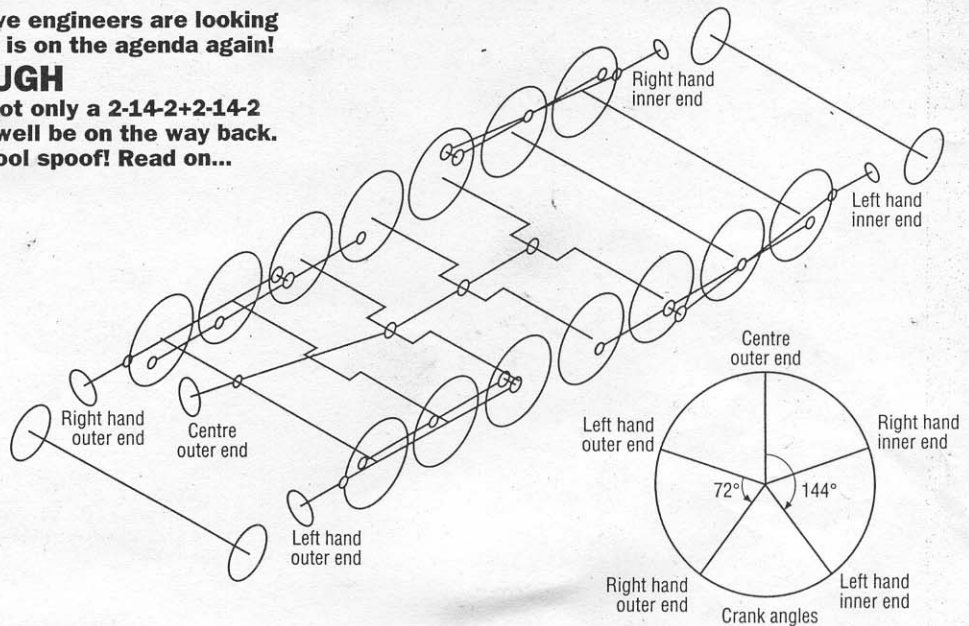
With its indigenous oil reserves waning, Australia imports oil at high cost; however, it still has extensive natural gas and coal reserves which the Government is keen to use. Most electricity is generated by modern, clean, coal-fired stations, yet despite having an efficiency of around 38%, another 50% of the fuel's energy is lost through turbine exhaust. However, the 'mini-power' station concept has recently been developed where energy efficiencies in excess of 70% are possible.

Peter Jones, a chemical engineer with industrial experience and now lecturing at Granville College of Technical & Further Education, New South Wales, now intends to apply this technology to rail. He's published three technical papers setting out his case, taking advantage of alternative fuel research.

Four designs were suggested, of which two may yet come to fruition. One proposal is for a 4-10-4+4-10-4 Garratt fuelled by compressed natural gas. This has attracted serious interest from railway suppliers, natural gas and chemical companies. A triple expansion unit would be used on each engine with high and intermediate pressure cylinders located on the inner ends of each engine. Exhausted steam would be re-superheated before being used in two low pressure cylinders on the outer ends of each end unit. Exhaust would be condensed in four radiators, as on the South African '25NC' 4-8-4s. A group based in Canberra is interested in building this locomotive for tourist use and is developing the concept and sourcing funds.

The other proposal is to develop an amazing 2-14-2+2-14-2 Garratt for heavy freight, replacing three or four diesels normally used. It would produce an energy efficiency of at least 20% and almost smoke-free, compared with a much lower efficiency of 7% for conventional steam engines. The high-pressure water tube boiler, steam-powered compressors and instruments will be standard components, to reduce costs.

To provide space for the high-pressure water-tube boiler, the locomotive will be built as a Garratt and for maximum tractive effort the coupled wheelbase will be the same as that used on the USA's Union



Pacific Railroad's 4-12-2 '9000' Class - 30ft 6in. Their use of lateral motion devices on the front/rear driving axles allowed a curve of 358ft to be negotiated.

With an axle load of 21½ tons, the continuous tractive effort of around 150,000lbs at 31mph on level track can be augmented on starting by transferring weight via secondary suspension to the driving wheels. The driving wheels will be 4ft 9in in diameter, allowing 14 coupled wheels to be fitted into a 30ft 6in driving wheelbase. Thus a double 2-14-2 wheel arrangement allows a high tractive effort with only moderate axle loading. A piston stroke of 32in provides stronger driving wheels by giving adequate metal thickness between the axle and crankpins, and to maximise efficiency when working hard, a triple-expansion engine is proposed.

The unusual five-cylinder triple-expansion layout is illustrated. This should produce an even driving force with minimum hammer blow. Each unit has two outside high pressure cylinders, mounted on each inner end, driving the third coupled axle. Two low pressure cylinders are mounted on each outer end, again driving the respective third axle. The fifth, intermediate pressure cylinder is mounted at the outer end, between the frames and driving the outer end third crank axle. There are coupling rods fitted inside the driving wheels, linking the three centre axles. On each side, the cranks at opposite ends are at 144 degrees - this will almost eliminate lateral oscillation.

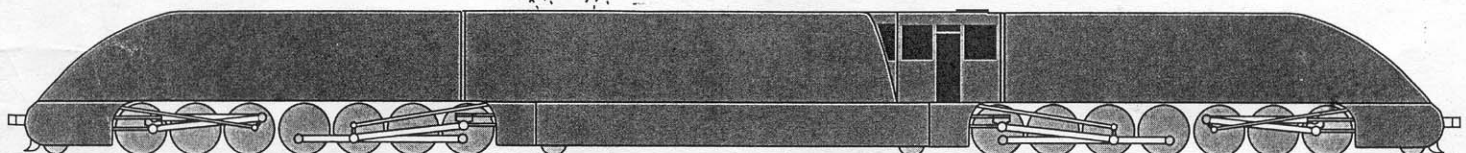
The high-pressure water tube boiler with 900psi pressure will produce around 49 tons per hour of steam, providing a power output of 13,432hp -

equivalent to three Class 90 diesels. Preliminary costings have shown that the engine will be able to do this work cheaper than equivalent diesels: a saving of £366,000 per annum including building, running and depreciation cost has been calculated! The engine will be fuelled by 'ultra-clean coal' - a liquid created by dissolving out ash with a chemical solvent, producing a viscous suspension of finely ground coal in alcohol.

Before the end of steam, Junee in southern NSW was important. At the junction for the main southern line from Sydney to Melbourne with the secondary line to Griffith, it had the second largest roundhouse and workshops on the line. Through crewing of diesels closed the depot and crippled a town which relied on the railway for 90% of its jobs. Agreement has been reached to build the locomotive at Junee.

The International Environmental Engineering Initiative has been formed to build and operate the locomotive. The Australian Government provides grants for alternative fuel research through the Energy Research Development Fund (ERDC); the New South Wales State Government provides similar funding through the State Energy Research and Development Fund (SERDF). Applications for 100% funding are being made. Given that the capital cost (around £1.2m) is around half that of equivalent diesels and with the current emphasis on developing alternative fuel uses, the prospects look good - if so there is the possibility that the pipe dream will quickly turn into reality.

We will be keeping an eye on this project!



2-14-2+2-14-2 'Powerhouse on Wheels'