Rubber, plastics and palm waste are not ingredients most people associate with steel girders and beams.

New technology developed and commercialised in Australia, though, “could change the way we think about raw material resources for steelmaking”, according to inventor Veena Sahajwalla.

Salvaging our aluminium cans and newspaper may be ubiquitous but Professor Sahajwalla, director of the University of NSW’s Centre for Sustainable Materials Research and Technology, has in mind a “revolution in waste recycling”.

The crux: the use of high temperatures in steel furnaces – up to 1600 celsius – to transform waste into a useful new resource while reducing carbon dioxide emissions in one of the most energy-intensive industries.

Along with the environmental 3 Rs mantra of reduce, recycle, recycle, should be added “re-form”, Professor Sahajwalla told an international audience in the US “Steel City” of Pittsburgh this week.

Worldwide, some 1.2 billion used tyres are discarded annually. The “vast mountains” of plastics and agricultural waste also offer potential sources of raw materials for the steel industry, she said.

The trick is how the waste, such as rubber sourced from used tyres, gets injected into molten steel in place of coking coal. In the right mix, the waste can act both as an agent to remove impurities while putting more of the iron back into the steel.

Arrium has signed a global licensing deal with UNSW for the so-called Polymer Injection Technology, and has proved its commercial viability at furnaces in Laverton, west of Melbourne, and Rooty Hill in Sydney’s west.

“It stands on its own two feet,” Darren O’Connell, Arrium’s strategic marketing manager, said. “It’s a way to use renewable sources and to reduce cost while raising productivity.”
Using the process, Arrium – formerly known as OneSteel – is consuming 12-16 per cent less coke and cutting power use. In several years of operation, the company has consumed the equivalent of 1.6 million passenger car tyres, easing the strain on landfills.

Cost savings vary, depending on the quality of other raw materials being used, but can exceed 10 per cent – potentially significant in the cut-throat global industry, Mr O'Connell said.

'Standout' technology

"It's a real standout," said Robin Mellon, an executive director at the Green Business Council of Australia.

While cuts in the order of 10 per cent may not sound big, the sheer size of carbon emissions from the sector – about 4 per cent of global pollution – mean "what we're dealing with is huge", Mr Mellon said.

Arrium, which holds the sole licence to the so-called Polymer Injection Technology from the UNSW, is now shopping it to steelmakers from South Korea to the Americas. A Thai company, UMC Metals, is already using the technology.

"We're trying to increase this as much as we can so that close to 100 per cent of our material inputs are getting to a recycled nature," Mr O'Connell said of Arrium's own output.

While discarded tyres are one carbon substitute, UNSW research has also looked into the potential of other materials such as palm shells and plastics including polyethylene.

"It's all about green material in the end – whatever that material happens to be," Professor Sahajwalla said.

And while traditional recycling typically results in the same products – such as plastic – with diminishing quality in each cycle, the same need not be true for high-temperature transformations.

"It's a beautiful part of the story," Professor Sahajwalla said on the phone from Pittsburgh, where she spoke at the annual gathering of the Association for Iron and Steel Technology.

"There should be no limits to how many times you can do that."