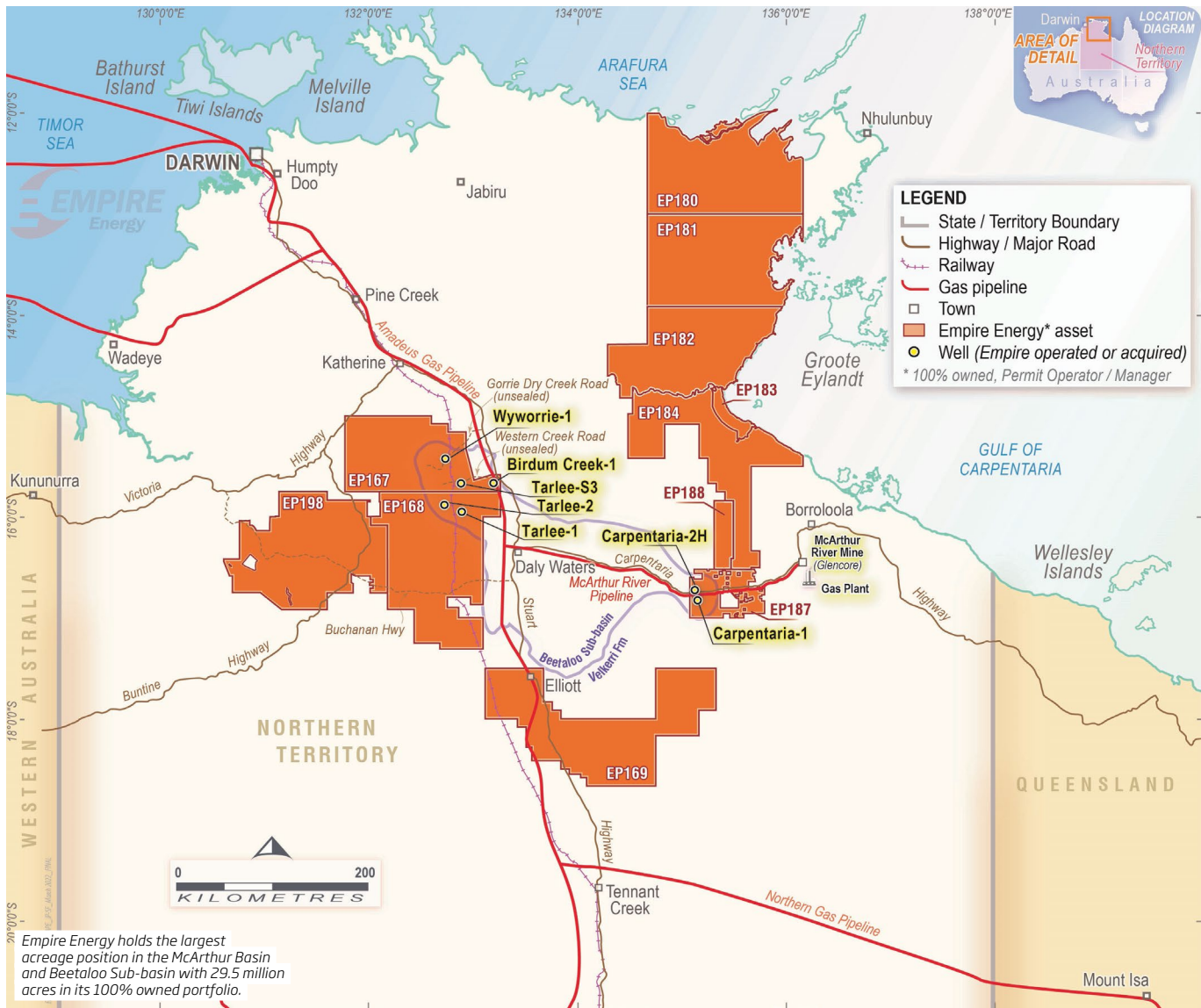


The Empire Strikes Back with Spectacular Results in the Beetaloo



 **DALE GRANGER**

A series of transformational events over the past six months has put Empire Energy on the cusp of an epoch making, energy supply transition for Australia in the Beetaloo Sub-basin.

In an almost serendipitous fashion, the Federal Government's identification of the Beetaloo in the *National Gas Infrastructure Plan* (NGIP) in November as a "critical, emerging gas supply source" needed to fend off an ever-

encroaching energy famine in the eastern states was followed, on cue, by a substantial reserves' upgrade of Empire's acreage in the Top End. Then, to show it meant business, the Commonwealth reaffirmed a \$19.4m



The Carpentaria-2H was Empire Energy's first horizontal well.

grant to the Sydney-based company to expedite exploration in the Top End.

By all accounts, the stars were aligned for Empire in January 2021 when the Federal Government declared: "The Beetaloo Sub-basin has the potential to rival the world's biggest and best gas resources" and that the \$224 million Beetaloo Strategic Basin Plan "sets out bold, innovative and cooperative actions. These actions will help us seize the opportunities presented by the natural resources in the Beetaloo."

Empire's subsequent drilling of Carpentaria-1 and Carpentaria-2H, the company's first horizontal well, rapidly reinforced the view that the Beetaloo – which is believed to contain up to 100Tcf of recoverable gas with liquids upside – has the potential to secure energy security for Australia.

Empire was encouraged to drill Carpentaria-2H (lateral) following initial success in EP187 from the vertical results of Carpentaria-1, which identified the thickest sequence of Velkerri gas-bearing shales of any well drilled in the basin to date, with the highest ratio of liquids-rich gas in that formation. The second well confirmed the continuity of gas bearing shales across the block.

The results were, in fact, staggering as Empire announced a significant 866%

increase in its 2C resource from 42Bcf of gas to 396Bcf and an even more substantial, 1400% upgrade of the company's 3C resource from 86Bcf of gas to 1292Bcf. Overall, the company's prospective resources increased to 43Tcf of recoverable gas.

Empire Energy managing director, Alex Underwood, said these were "truly world scale numbers" and drew comparisons with the North West Shelf, which was developed off 33Tcf of gas of which one third had to date been produced.



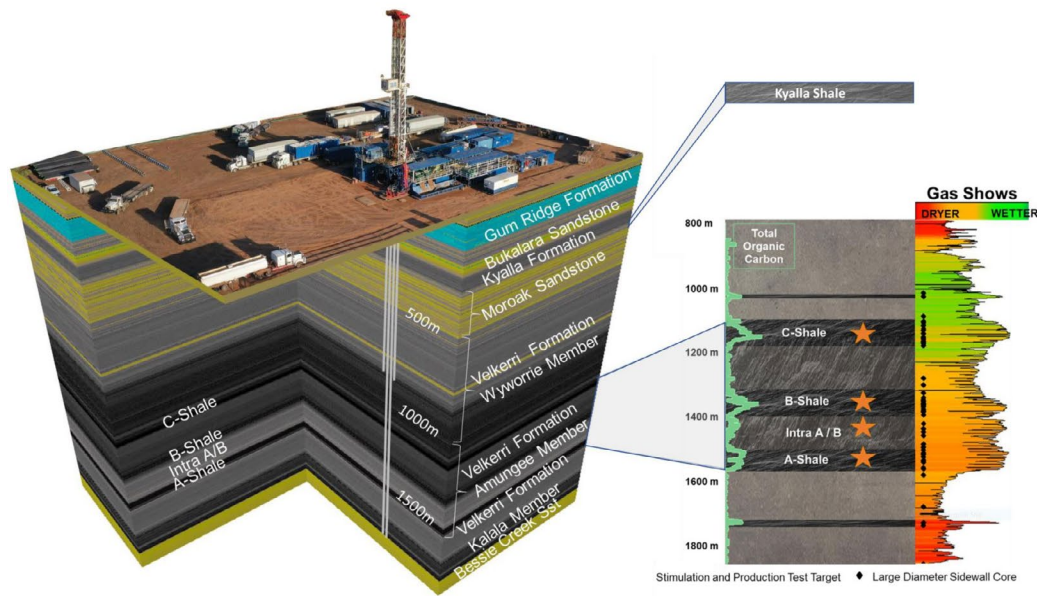
Empire Energy managing director Alex Underwood.

Considering that Empire Energy, with 29.5 million acres in its 100% owned portfolio, holds the largest acreage position in the McArthur Basin and Beetaloo Sub-basin and that the gas comes with the bonus of low CO₂ content of 0.5% to 1%, the question of infrastructure comes into focus on how to get the wares to market.

For the moment, the company has the comfort of nearby pipeline infrastructure offering potential blending supply options to the McArthur River Mine. In addition, the north-south gas artery running from Darwin to Alice Springs could facilitate backfill to the Santos and Inpex-operated LNG plants in Darwin.

A significant milestone on this potential path emerged in October when Empire signed a MOU with APA, which owns the Amadeus Gas Pipeline, to explore development opportunities and potential infrastructure development to enable expansion of existing pipelines to facilitate additional supplies to Darwin. Longer term, the agreement envisages development of a new Beetaloo pipeline connecting the Amadeus and Carpentaria gas pipeline to Mount Isa to open up supply to southern markets and to Gladstone, where LNG export plants have been red flagged by government confronting critical feedstock shortages by as early as 2030.

In the NGIP report, the Federal Government stated that large scale



The tale of the shale is shown in this sub surface graphic depicting the Velkerri Formation targets at shallow depth.

stimulation of the Beetaloo would entail the development of a new pipeline downstream of Mt Isa by 2028 to transport gas to Wallumbilla for export from Curtis Island, as well as the domestic market. Smaller scale options include compressing the gas utilising existing pipelines.

Ultimately, the size of the prize will prescribe unravelling options and it is significant that the Commonwealth's own estimate of total potential prospective resources in the Velkerri B shale is 50-100Tcf, representing a 10-20% recovery rates of 500Tcf gas in place. The added economic incentive is liquids and additional upside from Velkerri A, Intra A-B and C and the Kyalla Shale.

Carpentaria-1 was drilled to a total depth of 1,915m and intersected a column of liquids rich gas in the Velkerri that was 998m thick. Significantly, the Velkerri Shale was shallower than other analogous Beetaloo Sub-basin wells. Flow testing produced a peak rate exceeding 1.6mmcf/day and 0.25mmcf/day.

Empire's business model gained impetus after it signed a MOU to supply future gas to the Power and Water Corporation in the Northern Territory as the company continues to de-risk its assets and improve the economics. The next cab off the rank will be additional drilling in 2022 and completion of the Charlotte seismic program with integrated data from Carpentaria-2H.

A compelling consensus that the Beetaloo is emerging as a strategically vital, large-scale gas play has been buoyed by laterally consistent results

across the sub-basin and predictably geology that supports substantial resource estimates. Gas flows from both vertical and horizontal wells have exceeded expectations, inspiring comparisons with early-stage US shale gas projects and is believed to have piqued the interest of American investors and operators.

Empire added to its war chest in April last year by acquiring the Pangaea exploration assets – a portfolio of four permits located at the southern and western edge of the Beetaloo Sub-basin – for \$57 million. Over the past decade seven wells were drilled in this area with 1,400km of 2D seismic acquired. The four permits cover 14 million acres and to date drilling has encountered a thick sequence of Velkerri Shale over 300km from west to east. Shale consistency and the quality of the rocks has drawn comparisons to the energy-transforming Marcellus (260 Tcf) and Fayetteville (42 Tcf) shales in the United States. To date, Netherland Sewell & Associates (NSAI) has delineated a 2C resource of 158Bcf of gas and a best estimate prospective resource of 27.62Tcf of gas and liquids.

Flow testing at Carpentaria-1 delivered gas to surface from all four shale target zones, with the B shales the star performer. With flow testing at Carpentaria-2 imminent, Underwood said of the outcome so far: "Results reinforce our modelling of strong continuity of the Velkerri liquids rich gas target shales with a strong match with the Carpentaria-1 location 11km away, albeit 240m deeper at Carpentaria-2. Increased depth is likely to support increased flow rates while maintaining a

- Shales are the source of the hydrocarbons
- Shales are the reservoir of the hydrocarbons
- As the shales are buried and heated they generate hydrocarbons
- The shales generate oil first, with greater heat gas is generated
- Some escapes to conventional targets, but some is retained in the shale.

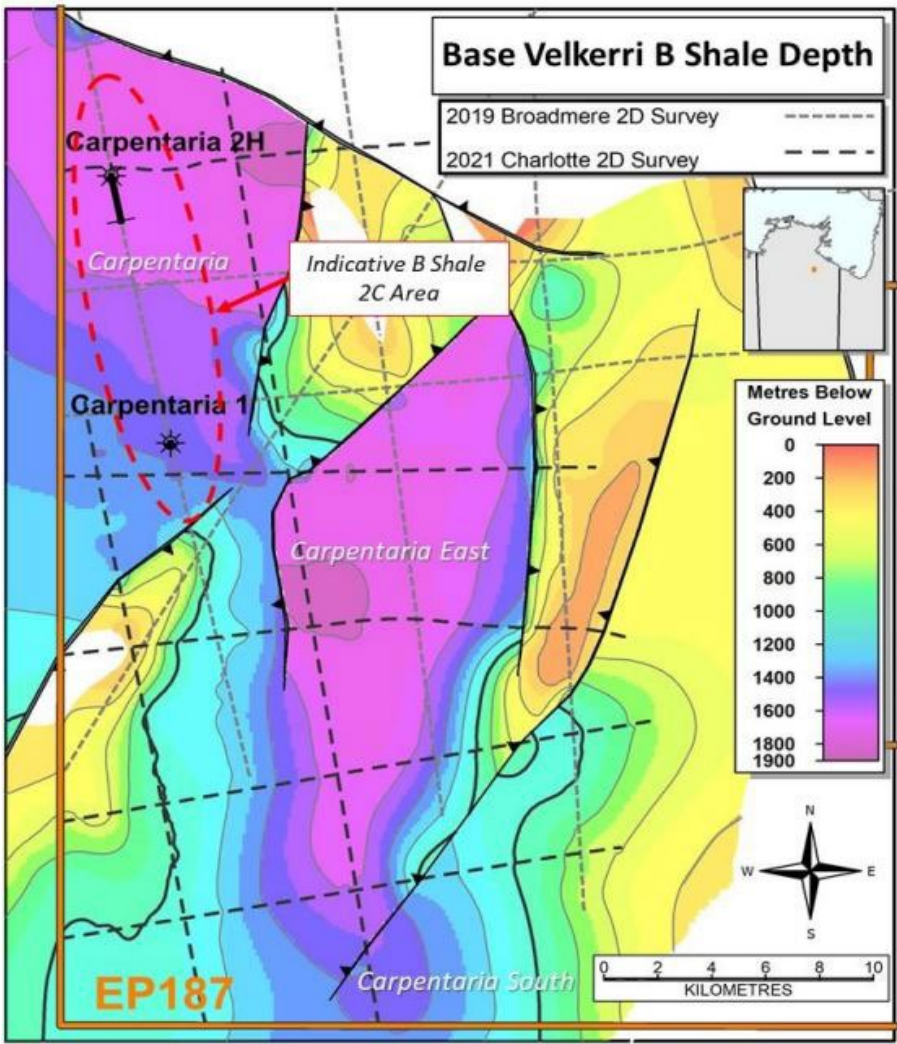
cost advantage over deeper drilling. Live gas bleeds witnessed in sidewall core samples we cut from the target shales further enhance our view that strong production rates may be achieved once we commence flow testing."

Initially, the Broadmere 2D Seismic Survey in 2019, had provided greater seismic definition through infill coverage (nominal line spacing of ~4 km) in the Carpentaria area and greater seismic coverage across Carpentaria East, immediately adjacent to the Carpentaria area and Carpentaria South prospective areas.

The subsequent Charlotte Seismic Survey provided additional coverage over the prospective Carpentaria East and Carpentaria South areas, immediately adjacent to the Carpentaria area where Empire drilled the two successful wells. The updated mapping has de-risked the Carpentaria East and Carpentaria South areas, demonstrating that they are substantially deeper than previously thought (at equivalent depths to Carpentaria-2H) across an area approximately 2.5 times larger than previously mapped.

Interpretation of the Charlotte Seismic Survey delivered an ~80% increase in P50 (best estimate) prospective resources in the combined Carpentaria East and Carpentaria South areas.

Empire's conviction that the Beetaloo Sub-basin can be of crucial importance in alleviating looming east coast gas shortages is based on similarities to prolific US shale basins, where fracture stimulations now comprise over 70%



Map showing depth to base of Velkerri B shale across the Greater Carpentaria project area.

of gas production in the US and has proven to be a significant factor in CO₂ emissions reductions as gas displaces coal-fired power.

The company's strategy is focused on continuing to prove up reserves and move exploration into development to generate cash flow, utilising existing and planned infrastructure to expedite both international and domestic export objectives.

Empire has embraced the success of some of its peers as a complimentary validation of the geology in the basin and thus welcomed the successes of Santos' Velkerri shale focused Tanumbirini-1 well in 2020, which achieved strong flow rates with two fracture stimulated wells. Similarly, Origin flowed liquids-rich gas to surface from its Kyalla-117 well and Tamboran Resources has plans to drill and have executed a MOU with pipeline operator Jemena.

At the time of going to press, oil & gas supplies were in sharp focus on the

global stage as the flames of war raged in the Ukraine, Brent prices flew to US\$147, its highest since 2008, and the United States and the European Union mulled over an oil & gas ban from Russia – which analysts warned could send crude soaring to US\$200 a barrel.

CNN Business reported that Russia was earning hundreds of millions of dollars a day from oil and gas exports, diluting the West's sanctions on Russia for invading the Ukraine. Record high gas prices saw the value of Russian gas exports to Europe spiking to US\$545 million a day, according to Bruegel, with oil also raking in hundreds of millions of dollars a day.

Bruegel said the 27 EU countries relied on Russia for 40% of its gas with Germany (50%) the most heavily dependent on Vladimir Putin to keep the lights on.

With self-sufficiency in energy now a focal point and Europe confronting a major crisis if Putin himself decides to shut down, or curtail gas supplies to the continent, Australia's need to shore

up its own homegrown energy is no less critical – particularly as the Lucky Country is an island totally reliant on oil imports with only 30 days of stored crude supply available in a crisis.

Against this backdrop the oil & gas industry has been fighting its own battles to bring new hydrocarbons to market against determined activists opposed to any new fossil fuel development. Empire is no exception and it was only after the intervention of resources minister Keith Pitt – who overruled a court ruling which had declared the \$19.4 million grant to expedite exploration in the Beetaloo invalid – that it was able to secure government funds.

Empire has spent the better part of a decade building relationships with landowners, in particular traditional owners, regulators and stakeholders and Underwood isn't backing down from the fight.

In February he told the NT News that no industry in the NT had been more widely discussed than the development of natural gas resources, punctuated by hours of public debate, weeks of public hearings before Justice Rachel Pepper's inquiry into fracking, and "wild claims of activist extremists opposed to all forms of fossil fuel production and ongoing efforts of industry to respond to concerns held by many in the community".

Underwood said, "It is now six years since Michael Gunner's government imposed a moratorium on onshore gas development and initiated the fracking inquiry – a two-year independent process conducted by scientists, environmental experts and lawyers that resulted in a 1200-page report and ultimately the lifting of the moratorium four years ago.

"For many the debate continues. But for others, every question that could possibly arise about onshore gas development has been asked and answered, protections have been put in place and it's time, as Elvis put it, for a little less conversation, a little more action."

He reaffirmed Empire's commitment to regulatory requirements, which he described as "some of the strictest in the world" in the Northern Territory.

"We have invested tens of millions of dollars into the Territory economy since

the lifting of the fracking moratorium in 2018. We have had great operational success so far, with an outstanding safety and environmental track record.

“The gas we will produce is not only an important source of power supply, it is also critical for everything we rely upon in our modern lives.

“Gas is an irreplaceable feedstock for fertilisers such as urea, which support food production for the world’s growing population. Gas is used in the production of medical technologies that have given us the best quality of life in human history, among many other issues.”

Underwood added that the Beetaloo Sub-basin’s low CO₂ gas was perfectly placed to provide the energy security Australia needs. It can create thousands of local jobs, substantial royalties to the NT government and economic development for gas and the opportunity for the Beetaloo to bring new supply into the Australian market.”

In addition, Underwood said the Beetaloo Strategic Basin Plan, was not the first time that the Australian government had provided grants to companies to stimulate petroleum exploration.

“In 1957, the Menzies government introduced a 50% subsidy on petroleum exploration, as a result of which the Bass

Strait oil & gas field were discovered by the ExxonMobil/BHP joint venture in the early 1960s .

Those fields gave Australia plentiful oil & gas supply for decades, producing over eight trillion cubic feet of gas and four billion barrels of oil to date, with almost 370,000 full time equivalent job years created and sustained throughout Australia and over \$9 billion of royalties and taxes generated to support a wide range of government initiatives.

The activities Empire will carry out, supported by \$19.4 million of grants, will far outweigh the support being provided by the government under the program,” Underwood said. ▀

‘NO SUCH THING AS A FREE LUNCH’, BUT THE SIZE OF THE PRIZE WAS PLENTIFUL

A casual lunch discussion in 2010 between Empire Energy Director Professor John Warburton and industry veteran Bruce McLeod, over whether the unconventional gas revolution in the United States could be replicated anywhere else, was the launchpad that fired the Sydney-based company into the shale space race.

Having spent his career hunting conventional oil & gas - notably as part of the BP exploration team in Azerbaijan and Kazakhstan that led to the world’s biggest oil discovery (13 billion barrels recoverable) in 30-years in 2000 at the Kashagan oil field, Warburton confessed that he knew very little about shales.

“When do you start? McLeod asked and it was agreed that Warburton would spend six months finding a shale play to add to Empire’s shopping basket.

“At that stage shale gas had been in the spotlight for about a year in Australia and I had assumed that all prospective acreage had been snapped up,” Warburton said.

To his delight, on 24 March 2010 he discovered this was not the case while poring over Northern Territory Geological Survey documents. Of particular interest was a mineral well, GRNT.09, which had been drilled by Amoco Minerals in the Glyde Sub-basin in 1979 in the search for lead and zinc that led to the development of Glencore’s McArthur River Mine.

A light switched on as Warburton discovered that the rig had struck a gas layer and caught



Professor John Warburton.

alight, blowing six metres into the air with a yellow smoky plume that revealed the presence of condensate.

“Someone at Amoco had the foresight to sample the gas, unveiling a 75% methane composition, a heavier C₂ to C₈ presence and very little carbon dioxide contaminant. I then used the NTGS maps to track the geographic distribution of the rock formation in the Barney Creek and told McLeod, “We’re potentially onto a winner here with a shale play which ticks all of our screening metrics. It’s what we’ve been looking for - an extensive, proven gas-and-liquids rich petroleum system in our own backyard.”

Estimated to be 900m thick in places, the Barney Creek Formation is on a scale comparable to US shale plays and similar in magnitude to the Fayetteville Basin, with Empire’s seven licences, spanning 59,000km², awarded to the company after it had applied on 26 March 2010.

Warburton is of the conviction that shale petroleum can and should transform Australia’s energy self-sufficiency and revitalise LNG exports off the back of volumes far exceeding current, proven conventional numbers.

Warburton said the trick was to drill the sweet spot, shown in the United States to be about 10% of the shale play area but containing about 45% of the basin’s total economic yields.

“Project economics are greatly enhanced by early sweet spot development, delivering good initial production rates facilitating faster returns on initial investments. Later on you can exploit the lower-quality shales.

“I believe the industry must embrace this new frontier to shore up our energy security and deliver the huge potential for the exportation of LNG from shales. It was truly transformational in the United States, where daily shale gas production accelerated from about two billion cubic feet in 2007 to 50 billion cubic feet in 2015. Another upside was a 10% decrease in annual carbon emissions, as gas displaced coal-fired power.” Warburton said. ▀



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