

THE A9X BEATER

No, there isn't a Torana V8 any more; yes, you can get V8 performance from a Torana; no, Holden isn't building this A9X-beater; but yes, you can buy one ready to go, from a Holden dealer — complete with turbo-charged 3.3-litre six, breathtaking performance, and full new-car warranty

THE HOLDEN Torana's performance image hasn't died with the passing of the V8 motor: it has just gone quiet temporarily, while the behind-the-scenes "fixers" catch up.

And catch up they have. The very-effective Normalair Garrett turbo-Holden project we uncovered in the February issue has reached "production" a lot earlier than forecast.

It isn't factory production at this stage, but it's the next best thing: you can order your turbo Torana from selected Holden dealers, have it built to your specification, and pick it up ready and raring to go.

And, most importantly, you'll still have your full new-car warranty covering this 140 kW fire-breather.

The Torana SL/T (the T is for turbo) is the brainchild of Normalair Garrett project manager David Inall, who has combined with a number of Holden dealers to provide the "production-line" turbo package.

The cars are ordered through the dealer, and go straight from the factory to Normalair Garrett for conversion before delivery. As long as the car is bought with certain options, Normalair Garrett itself will carry warranty responsibility on driveline components disallowed by Holden because of the conversion.

The mandatory options include a heavy-duty clutch and radiator, taller differential ratio, four-wheel disc brakes, and the locally-made M20 four-speed gearbox (the company doesn't trust the Philippines-built MC6 manual to take this power).

The result is stunning, as we discovered when we picked up the "prototype" from Sydney's Suttons Motors, the first dealer to join with Normalair Garrett in offering the conversion.

The Suttons car, a demonstrator which the company will keep to show prospective buyers, covered most of the possibilities available.

Based on a pre-Budget \$7780 SL Hatchback with deluxe equipment package, it featured Torana A9X-type wheel-arch flares and rear spoiler, the turbo conversion, 245/60 rear and 235/60 front Pirelli CN36 tyres on huge alloy wheels, and other dress-up items.

The total cost of the test car, ready to roll, was \$12,500.

If the thought of a Torana costing twelve and a half grand doesn't appeal to you, don't despair — you can have a turbo Torana on the road for as little as \$8300, based on an SL sedan fitted with only the "mandatory" options.

And, at that price, it would be a neat beast to own.

In fact, the standard wheels and tyres on the UC Torana would be better than the enormous "fats" on the test car, unless you're more interested in show than go. The Suttons car, prepared for display at the 25th Sydney International Motor Show, was "over-tyred" for road use.

Early problems with the tyres scraping on the guards were solved, but their effect was still unpleasant; they looked great, but didn't do anything for handling, and upset the ride into the bargain.

Apart from the "show special" wheel/tyre combination, the Suttons car was a dream.

It was smooth and tractable (after an initial sorting session removed a carburettor fault), economical and clean (we haven't seen that combination too often recently), and went like a "proper" car should — fast.

Its acceleration times rivalled those of the 5.0-litre A9X, tested earlier this year, all the way up to 160 km/h — and it proved the quicker up to 120!

It put away the standing 400 metres in 16.1 seconds — just two-tenths of a second slower than the best achieved in the A9X, and identical to the figure recorded in our 1972 test of a pre-emissions 3.3-litre Torana XU1.

The amazing aspect is that all this is achieved simply by bolting on the turbo-charger — in all other respects, the engine is a box-stock 3.3, with all its faults. It still develops its power peak below 4000 rpm, and after that figure starts to run out of breath; though, if you can handle the sounds of strangulation, it will rev out to 5000.

We can imagine how nice it would be to fit the turbo to one of these motors modified to give top-end breathing and "revability".

The turbo-charger does its job, however, by providing plenty of punch in the motor's normal power band — so much so that, on a full-throttle run, the Torana never seems to last more than a second or two in first and second gears. Once the motor comes "on boost" at around 2100 rpm, the tachometer needle swings instantly up to 4000. At that point, it's hardly worth holding on, because an upshift will have you surging forward on boost in the next gear.

The short time spent in the lower gears — and the incredible rate of acceleration between 80 and 160 km/h in top — gives the impression the car could use taller gearing, yet it is already running the non-standard 3.08:1 diff ratio.

Our experience with the Torana, however, suggests the 3.08 diff should be standard, and the turbo should use a 2.78.

We found the standard car too low-geared when we tested it, and have since discovered that the automatic version (which gets the 3.08 as standard) is quicker, faster, and more economical — as well as being much nicer to drive.

Allow us to take this opportunity to suggest that anyone buying a manual Torana should order it with the 3.08 diff; anyone buying a turbo, order it with the 2.78.

The Suttons turbo proved far more economical than the standard

car — that was, we feel, thanks partly to the 3.08 diff and partly to the fact that it doesn't have to be booted in the guts everywhere to get going.

We found that a new driving technique needed to be adopted for this car, and that once we discovered it our fuel consumption improved over an already-acceptable figure.

Where most cars' performance is directly related to how far down you push the right foot, the turbo will give up to 80 percent of its potential on a small throttle opening — so a small push on the pedal will see it ripping past most cars on the road.

And driven like this, it is super-smooth, with a progressive surge of power that will really impress your friends.

The turbo-charger used in this conversion is a further-developed example of the units we detailed in the February issue report — it's known as a Strata 2a.

The original Strata 2 kit provided a 100 percent power increase to 130 kW, with the turbo's boost limited to 85 kPa (12 psi). The Strata 2a includes a waste gate, which acts as a bypass valve to limit top-end boost to a preset figure — preventing damage from over-boosting while allowing greater boost down low.

The result is 135-plus kW — and the Normalair Garrett power figures are terribly pessimistic compared to those quoted by manufacturers.

Convinced? We are, though we'd like to spend a bit of time on the basic motor to make it really nice, then go for A9X-style super-tall gearing with, perhaps, a low first added in to make a five-speed gearbox.

Then we'd happily line it up against just about anything in the country for a bracing highway run.

Say about 5000 kilometres . . .



WHAT IT WILL COST YOU

Torana SL Hatchback	\$6617
Deluxe option pack	\$390
Turbo-charger	\$1600

Necessary options:

Rear disc brakes	\$235
M20 transmission	No cost
Diff (3.08 or 2.78)	\$18
Heavy-duty radiator	\$23
Heavy-duty clutch	Included in turbo price

Other options:

Extra door mirror	\$40
Sports steering wheel	\$50
Roof aerial	\$50
Flares, spoiler	\$750
Wheels/tyres	\$740

PERFORMANCE COMPARISON

	Torana Turbo	A9X
0-60 km/h	4.0s	4.7s
0-80 km/h	6.4s	6.6s
0-100 km/h	8.8s	9.0s
0-110 km/h	10.7s	10.9s
0-120 km/h	13.0s	12.6s
0-130 km/h	15.2s	14.9s
0-140 km/h	17.6s	17.6s
0-150 km/h	20.5s	20.2s
0-160 km/h	24.8s	22.9s
Standing 400 metres		
Best	16.1s	15.9s
Average	16.5s	16.4s
Fuel consumption (litres/100 km)		
Best	11.4	12.3
Average	14.6	17.6

SUTTONS HOLDEN TORANA SL/T

ENGINE

Cylinders	6
Bore x Stroke	92.1 x 82.5 mm
Capacity	3298 cc
Carburation	Single side-draught
Compression Ratio	7.0 to 1
Claimed Power	135 kW at 3800 rpm
Claimed Torque	390 Nm at 2600 rpm

TRANSMISSION

Type	Four-speed manual
Gearbox Ratios	
First	3.05
Second	2.19
Third	1.51
Fourth	1.00
Final Drive Ratio	3.08

SUSPENSION

Front	Independent by coils and unequal-length wishbones with anti-roll bar
Rear	Live axle with four semi-trailing arms and anti-roll bar
Wheels	8J x 14 (rear), 7J x 13 (front)
Tyres	245VR x 14, 1235VR x 13
Steering	Rack and pinion

BRAKES

Front	254 mm discs
Rear	266 mm discs

DIMENSIONS AND WEIGHT

Wheelbase	2593 mm
Front Track	1440 mm
Rear Track	1407 mm

Overall Length	4515 mm
Overall Width	1730 mm
Overall Height	1335 mm
Ground Clearance	130 mm
Kerb Weight	1220 kg
Fuel Tank Capacity	55 litres

CALCULATED DATA

Weight to Power	9.0 kg/kW
Specific Output Power	40.9 kW/litre

PERFORMANCE

Fuel Consumption	14.6 litres/100 km
Standing 400 Metres	16.1 seconds
0-100 km/h	8.8 seconds
Top Speed	165 km/h
Braking from 100 km/h	40 metres

\$11,000 PLUS GETS YOU BATHURST POWER'

Turbo boost for Toranas

TURBO-CHARGED Toranas can now be bought from some Holden dealers – complete with full new-car warranty and a performance to pin back the ears.

The cars are optioned versions of the 3.3 litre six-cylinder SL models.

All the buyer needs is a well-padded bank account or friendly hire purchase company – and a little patience.

The Toranas go direct from the factory to the turbo suppliers, Normalair Garrett, of Melbourne, who carry responsibility for warranty disallowed by the factory after the conversion.

But the cars must have certain mandatory options.

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To cope with the 135 kW output gained, the Toranas must include rear disc brakes, heavy duty clutch, the M20 four speed manual box, taller diff ratio and larger capacity radiator.

These and the turbo lift the price of the Torana SL Hatchback close to \$9000

– nearer \$11,000 if the buyer wants wide alloys and tyres, guard flares to accommodate them, a sport steering wheel and other odds and ends.

It can climb above \$12,000 with things like spoilers and dress-up items.

With or without the fancy items, a buyer gets performance close to that of the earlier 5 litre V8 powered A9X produced for Bathurst.

Low-down acceleration is even better, according to Sydney roadtests of the “puffed up” six.

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Boost with the Strata unit comes in just above 2000 rpm and is reported to “lift off” from then up, giving an 0 to 100 mph acceleration time of less than 25 seconds.

The Turbo incorporates a waste gate and maximum boost is limited to 12 psi. A by-pass valve is pre-set to limit the top end boost and prevent damage.

Fuel consumption is somewhat higher than standard for the 3.3 litre six if maximum use is made of the extra punch available. Under normal driving conditions, it should average 11 to 12 litres per 100 km.

The turbo trend seems headed for an eventual Australian production line unit. The fact that they can be ordered through GMH dealers, and cars are supplied by the factory to the turbo fitters, suggests at least “unofficial” approval.

Garrett and GMH engineers have been associated in research on turbo use for the past year or so.





TURBO

That's the name of the new power game

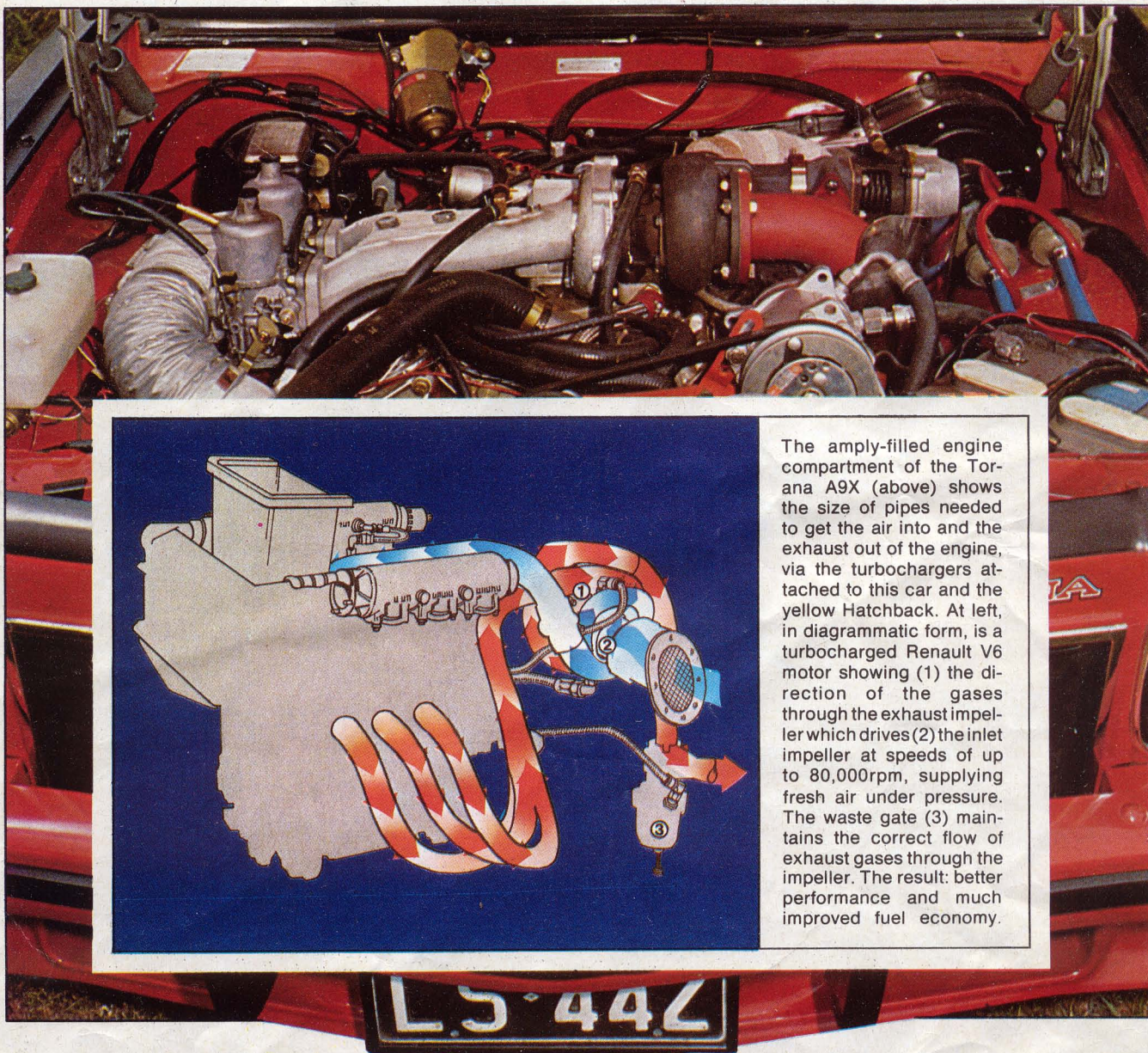
YOU know all about the energy crisis, right? Not the one you experience every Monday morning, but the one caused by the sudden leap in price of the world's fast-dwindling supplies of crude oil. So after you've signed the hire purchase contract and collected your tankful of petrol, there you go again — contributing to the pollution crisis. If Sigmund Freud were alive, there would be reams and reams written about the automotive guilt-paranoia syndrome.

Back in today's world and rolling in overdrive toward 1984, the pressure is mounting on the doctors of engineering to provide the world with the answers. One remedy becoming more and more popular is the practice of turbocharging.

It's not a new idea. Say "turbocharged" to most people and the association is with high-performance racing cars, perhaps marine diesels and, if they are a

supercars **By JOHN HAMPSHIRE**





The amply-filled engine compartment of the Torana A9X (above) shows the size of pipes needed to get the air into and the exhaust out of the engine, via the turbochargers attached to this car and the yellow Hatchback. At left, in diagrammatic form, is a turbocharged Renault V6 motor showing (1) the direction of the gases through the exhaust impeller which drives (2) the inlet impeller at speeds of up to 80,000rpm, supplying fresh air under pressure. The waste gate (3) maintains the correct flow of exhaust gases through the impeller. The result: better performance and much improved fuel economy.

little better informed on technical matters, aircraft engines. What has thrust turbocharging out of the specialist arena and into the spotlight of scrutiny by mass-market passenger vehicle makers is the fact that it offers better performance, much-improved fuel economy and reduced pollution, all through one basic attribute: it makes the raw fuel charge entering each cylinder burn more efficiently.

Magic, you say. Why the big wait to reap these magnificent rewards of technology? Simply, economics. With fuel to burn, so to speak, it hasn't been worth anyone's while to think of turbo units as standard equipment.

The concept of pumping more air into internal combustion engines to boost performance has been applied since World War One, when the problem of keeping aeroplane engines running efficiently at high altitudes first became a challenge. The answer

then, and for many years, was mechanical supercharging — raising the amount of air available to the motor by driving a blower, through a series of gears, off the crankshaft.

It was inevitable that the improved performance offered by supercharging would be applied to car and motorcycle racing after World War One, with Daimler-Benz, Auto Union and Alfa Romeo dominating the car scene and BMW the motorcycle events.

It was also inevitable that another, in some ways more efficient, method of blowing air into a motor would be developed: turbocharging. Very simply, the exhaust gases are passed through a small turbine to drive a high-speed fan which supplies fresh air under pressure to the motor.

This has two important advantages over supercharging: it eliminates the power lost by driving the supercharger

off the crankshaft; and it uses some of the enormous amounts of power engines are wont to blow out the exhaust pipe. John Wynne, project engineer of Normalair-Garrett in Melbourne, and deeply involved in developing turbochargers for passenger vehicles, says that in this respect the average internal combustion engine is only 20 percent efficient.

In the mid-1930s, turbocharging was applied for the first time in a production sense by Lockheed. The vehicle was the P38 Lightning fighter (the one with the well-known twin-fuselage silhouette), which remained operational right through World War Two, although by 1945 it had been left far behind by the tremendous advances in aviation sciences.

As piston-driven aircraft flew higher and further, it became common for engines to have geared superchargers as well as turbochargers. As far as cars are concerned, supercharging became

almost exclusively the province of racing vehicles.

Then came the crunch. In the mid-1970s the world was forced to come to terms with a new concept: resources consciousness. By then Saab of Sweden was already working on one answer — turbocharging its two-litre, four-cylinder passenger car motor as a way of extracting more power and, as an incidental bonus, decreasing the amount of petrol needed.

A second answer, an alternative also being touted today as the savior of a fuel-starved world, had been available since 1936, when Daimler-Benz successfully marketed the first diesel car.

Rudolf Diesel's Rational Heat Engine is a marvellous invention. It does away with all the paraphernalia involved in igniting the fuel charge electrically in the cylinder, achieving combustion by mixing the fuel with air made hot enough to ignite it simply by piston compression.

Unfortunately the diesel motor's less-appealing characteristics — greater weight, noise and vibration, poorer performance and cold weather starting problems — overshadowed its better points in non-commercial applications. Now these better points are beginning to gain precedence.

Chief among these attributes is the much lower cost of producing a litre of diesel fuel relative to the more highly-refined litre of petrol. Another is durability, engendered by the necessity of building the motor to withstand higher compression loads — a factor in the greater initial cost of diesel cars.

One of the "new" techniques used to overcome the deficiencies of diesels for the passenger car market is turbocharging, hardly a surprising evolution considering the widespread use of turbochargers on marine diesels. The two go together so well that many believe this to be the ultimate direction for internal combustion engines.

Already we have the Mercedes 300SD turbo diesel on the US market, and BMW's new six-cylinder turbo diesel available as an option on many of its cars. Volkswagen, quickly into diesel with the Golf and, soon for the Australian market, the Passat, has turbo diesels going around its test track at Wolfsburg.

But while the penetration of diesel thinking can be gauged from the introduction last year of a diesel Seville to the Cadillac range, owners and makers alike are hoping that turbocharging will allow them to keep petrol engines viable for some years yet.

Certainly it's a much easier step for a manufacturer than building up a diesel capability from scratch. Faced with tough fuel consumption requirements in the US, which have to be met

by 1985, Ford and GM have established production of turbocharged petrol motors with the performance of bigger engines, but the economy of smaller, mainly imported, competitors.

Ford has now opted for a 2.3-litre four-cylinder engine to link with a Garrett Airresearch turbo unit, the same make of turbocharger Saab chose for its successful turbo model. In Ford's case, the turbo engine is now available as an option in the Mustang and Capri range — a far cry from the monster V8 Mustangs taken to their ultimate in the Can-Am racing format.

Ford's use of the turbocharger is a good example of the hunt for economy and emission controls rather than trying to gain the maximum increase in power. In this case, the extra power — from 101bhp to 132bhp — is icing on the cake, and a relatively thin layer at that when compared with the potential output. What Ford does get is a much-reduced emission of polluting exhaust gases and up to 35 percent improved fuel economy.

Normalair-Garrett's conversion on a 3.3-litre, six-cylinder Holden raised the engine's output from 110bhp to just over 220bhp, which shows how easy it is to get the power — and you're still getting the improved economy and exhaust control. In Australia, car makers are keeping a close eye on the

efforts of companies supplying and fitting "bolt-on" turbo gear to the requirements of individual customers, companies such as Normalair-Garrett, and Rymec in Sydney.

A round-Australia test organised by Rymec, using a six-cylinder Ford Fairmont fitted with a Rajay turbocharger, produced some very good results. Dr Bob Patterson, with wife Angela as navigator, used the car to pull a two-tonne van over 48,000km of every type of road and goat track in the country, returning an amazing average fuel consumption of 15.7 litres per 100km (18mpg). Without the van, Dr Patterson had the Fairmont returning 10.8l/100km (26mpg).

More importantly, as far as the Pattersons and Rymec are concerned, the car performed very strongly under load. The front end was rebuilt to take the extra stresses resulting from the power increase, spotlighting the need for any motorist who fits a turbo to his car to take a very close look at the ability of his steering, suspension and brakes to cope, and to be ready to upgrade them. Consideration also has to be given to the clutch and gearbox, though if they fail it's more likely to be inconvenient than lethal.

Dr Patterson was not able to monitor exhaust emissions satisfactorily on the trip, but Dr Brian Milton,

senior lecturer in mechanical engineering at the University of NSW, is engaged in thorough exhaust emission tests on a six-cylinder Chrysler motor, using comparisons before and after turbocharging the engine. A full report on the testing, which Dr Patterson is confident will show an important reduction in unwanted exhaust emissions after turbocharging, will go to the Federal Government for use in its pollution studies.

It's this hunt for economy that convinces many people to spend \$1200 or more to fit a turbo unit to their family car — and the extra performance doesn't hurt in helping to convince them to spend the money, either.

But as John Wynne says, the beauty of turbocharging is that it can be tailored very closely to the consumer's needs. By juggling the pitch and attitude of the blades in the radial fan, and the size of the turbine housing, you can give the ubiquitous little old lady the advantages of turbo efficiency from as low a road speed as 30km/h. Equally, you can match peak turbo efficiency to much higher speeds for long-distance driving and, ultimately, racing needs.

Improved performance is often associated with a penalty in engine wear. But, when a turbo unit is fitted, you are actually driving a "softer"

engine — one with reduced compression and usually a retarded ignition setting. This is necessary to avoid engine knock associated with uneven ignition, a problem which plagued engineers earlier this century as they tried to design engines to use higher octane fuels. Today's problem in some ways is similar: you know you can get more power from a more potent charge, but it's not much good if you destroy the engine in the process.

A turbo unit can be fitted to a carburettor-equipped car in two ways: the more popular is to put the turbocharger between the carburettor and the engine, so that the turbo is supplying air already charged with petrol vapor to the engine. The turbo unit can also be used to boost the air supply before it gets to the carburettor, then the engine. When fitted to a car with fuel injection, the turbo unit pumps air straight into the cylinder.

Since any great increase in exhaust back-pressure threatens the efficiency of the system, very large exhaust pipes are used. Suttons in Sydney have a motor which looks capable of powering QE2. They've taken a Torana A9X and fitted the high-performance 5-litre V8 with a turbo unit which takes the output to around 460bhp. The addition of a variation valve on the waste gate is expected to lift the power again, perhaps by as much as 20 percent.

We were given a chance to test the A9X around Sydney's Oran Park circuit, in company with another car Suttons have put on the market — a Torana SL 3.3-litre Hatchback with a \$1700 turbo option and other extras to sell for \$11,299.

The Hatchback is very lively indeed, but the A9X is a fire-breather of the first order. Flattening the accelerator in second is an invitation to go sideways. Plant the right foot about 3000rpm in third and it's may-the-Force-be-with-you thrust. All this, and for less fuel than the car would use in standard guise.

Back in the world of the sane, we find sales of turbo units growing at an astonishing rate. Lucas reports a rise of about 200 percent in the past 14 months, and other suppliers and fitters talk about the same surge in interest.

It's obviously not the performance freaks alone who are powering this sort of boom, but drivers who are sick of stuffing ever-increasing amounts of dollar notes down the fuel tanks of their family sedans. After all, you don't need another 100bhp to sit in the peak-hour traffic — but if you are thinking about your health and economic sanity, then turbocharging is one way to go.

