Peter,

Thank you for your visit to Pooled Energy. We would like to make a formal submission as follows:-

INTRODUCTION

Pooled Energy is an Electricity Retailer authorised under the National Energy Customer Framework to operate in NSW, S.A., ACT, Tasmania and Queensland, and currently in its third year of operations in Sydney. Pooled Energy sells a bundle of electricity, pool automation services and energy management technology to swimming pool owners only. There are ~1.4M pool owners in Australia with some 15,000 new pools p.a.

The Pooled Energy system makes a drastic reduction in pool energy consumption that far exceeds any achievable by a "high efficiency" pump. It does this by using proprietary control systems and algorithms on standard 'low-star' single speed pumps. This is confirmed via an independent study operated by the New South Wales Government Office of Heritage & Environment (Attached). Further improvement beyond that found by the study is being achieved and more is expected as the technology matures.

Pooled Energy sustomers are supplied with a complete Energy Management & Pool Automation System (Including chemistry management) for a five year service contract.

This comprises Supply and Installation of:

- Intelligent Pool Controller™ * (IPC) for local automation of equipment and pool control (communicates to the internet via the home WiFi)
- Variable Speed Drive upgrade* for the fixed speed filter pump for energy management
- Smart power devices to enable control of your pool equipment
- (Proprietary) sensors for ORP (sanitiser), pH, Salinity, Temperature, water flow
- Energy sensors, and

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- (Proprietary) Advanced Water Chemistry technology ($235 up front for the chemicals for an average 50KL pool)
- Pool App
- Software updates for App & IPC as required
- Maintenance of the IPC

Unlike conventional pools which operate on time-clocks doing the same thing every day, irrespective of use and environment or the state of the grid, Pooled Energy pools can respond to the time-of-day, time-of-year, holidays, the amount of swimming, the quality and state of the water, the cost and price of power, the state of the Grid, the weather, the productivity of solar panels and other things.

The system is operated from a central NOC (Network Operating Centre) in the Internet cloud, and is connected the Weather Bureau, the NEM (National Energy Market) and the Grid.

The Pooled Energy automation system includes a comprehensive SCADA (Supervisory Control & Data Acquisition) system linked with a distributed IOT (Internet of Things) local control system with high communications security achieved via a VPN (Virtual Private Network) to each location. It has an integrated relational data base and Big Data capabilities with billions of data points collected so far. Multiple parameters in each pool are monitored every 2 minutes. The business is run through a CRM (NetSuite) and customer response software (FreshDesk).

From the customer perspective, the ~30% of total household electricity used by the pool is reduced by 50%-70%, depending on the pool and the equipment fitted. Chemical usage is also substantially reduced in most pools (in some cases by 30x) and the equipment, pool and surface lasts longer with fewer problems. The automation also eliminates the regular pool technician visits in most cases, or else eliminates customer testing, most chemical additions, green pools and a great deal of hassle.

The water quality is genuinely spectacular….startlingly improved, healthier and much more reliable. It is continually managed via the Internet from Pooled Energy's Central Network Operating Centre (NOC).

This overall proposition has been and continues to be very well received by customers. Customer churn is <1%, which compares very favourably with the usual 25-30% p.a. of the major Electricity Retailers.

COMMENTS

Survey

1. The survey of the industry done by questionnaire for the CRIS on swimming pool pumps does not agree with our data, and is in error in some important cases by 2:1. The survey noted that many people had no idea about their equipment and not much idea when it ran. We agree with this last comment. The survey data is not accurate and we found that the same errors with earlier census data on pools for the same reason. They were surveys and not real data.

2. We have detailed records of hundreds of pools as they were before we automated them and subsequently something like 3 billion data points of operation, after we automated them. We have also had our data evaluated by a third party paid for by the NSW Government as part of their ESS program. Much of the pre-installation data is photographic and includes time-clock settings and pump nameplate data.

3. As noted, the NSW Government Office of Environment & Heritage recently commissioned a study of Pooled Energy operations (attached), confirming, on a sample of 150 swimming pools, that the Pooled Energy system provided significant reductions (50%-70%) in energy consumption of swimming pools. The 1,400,000 pools in Australia today consume the electricity output of two very large power stations, just for cleaning and sanitising. Pooled Energy halves the energy use of pools and then uses the other half as a discretionary load to help stabilise the grid in real-time. By using the installed base of pools, an energy reduction equal to an entire a power station could be achieved. This **CANNOT** be achieved by 'more efficient pumps' which at best only contribute approximately a 1-3% efficiency improvement (see below for details)

E3 Program

We know that a great deal of work has gone into the star rating program, however, technology has passed this system by in the case of swimming pools. If you proceed with outlawing the importation of inexpensive, fixed-speed pumps into Australia, you will ***INCREASE*** the energy consumption of pools by blocking the deployment of new technology and having the opposite effect to that desired. We object strongly to such a ban on imports.

Our Specific Comments are:-

1. The test for star rating is technically **INCORRECT.**

It was derived many tens of years ago for:-

a) an idealised pump driving into an idealised filter,
b) where the pump is precisely matched to the filter,
c) where the filter resistance to water flow never changed.

This does not come ***close*** to representing the real world situation in any of those categories for the following reasons:-

a) Firstly, there are many filters on the market and they are all very different. Following is an extract of US data showing the flow resistance of a small selection of filters. The variation in pump load (head loss) is nearly 20:1 as you can see. How is one pump supposed to deal with that?

Approximate Head Loss vs Filter Type					
Filter Type	Mutiport Valve Size (in)	Head Loss @ 25 GPM (ft)	Head Loss @ 50 GPM (ft)	Head Loss @ 75 GPM (ft)	Head Loss @ 100 GPM (ft)
Pentair Clean & Clear RP	None	0.2	0.9	2.1	3.7
Sta-Rite System 3 Cart	None	0.5	2.0	4.4	7.9
Pentair Clean & Clear	None	0.5	2.1	4.7	8.3
Hayward SwimClear	None	0.6	2.6	5.8	10.4
Pentair Quad DE	None	0.6	2.6	5.8	10.4
Sta-Rite System 3 DE	None	0.7	2.9	6.5	11.6
Hayward StarClear C750	None	0.8	3.1	6.9	12.3
Hayward StarClear C500	None	0.9	3.5	7.8	13.9
Hayward StarClear C250	None	1.2	4.6	10.4	18.5
Pentair FNS DE	None	1.2	4.6	10.4	18.5
Sta-Rite System 2 Cart	None	1.4	5.8	13.0	23.1
Pentair Quad DE	2	1.5	6.1	13.6	24.3
Pentair TR140 Sand	2	1.6	6.2	14.0	24.9
Sta-Rite System 3 DE	2	1.6	6.4	14.3	25.4
Pentair TR100 Sand	2	1.6	6.6	14.7	26.2
Pentair FNS DE	2	2.0	8.1	18.2	32.3
Hayward ProGrid DE	None	2.0	8.1	18.2	32.3
Pentair TR60 Sand	2	2.1	8.4	19.0	33.7
Pentair TR50 Sand	2	2.4	9.6	21.6	38.3
Pentair Quad DE	1.5	2.5	9.8	22.1	39.3
Pentair TR140 Sand	1.5	2.5	10.0	22.4	39.9
Sta-Rite System 3 DE	1.5	2.5	10.1	22.7	40.4
Pentair TR100 Sand	1.5	2.6	10.3	23.2	41.2
Hayward ProGrid DE	2	2.9	11.6	26.0	46.2
Pentair FNS DE	1.5	3.0	11.8	26.6	47.4
Pentair TR60 Sand	1.5	3.0	12.2	27.4	48.7
Pentair TR40 Sand	2	3.3	13.2	29.7	52.7
Pentair TR50 Sand	1.5	3.3	13.3	30.0	53.4
Hayward ProGrid DE	1.5	3.8	15.3	34.4	61.2
Pentair TR40 Sand	1.5	4.2	16.9	38.1	67.8

a. All pumps are designed to be matched to their respective loads. By selecting one arbitrary load as the test standard for pumps, you are FORCING a mismatch between the pump and the many types of load in filters alone. This GUARANTEES inefficient running. It's the equivalent of specifying one engine for all uses, be it in a lawn mower, or a Rolls Royce.

b. The pressure load presented to a pump does not simply consist of the filter, but the hydraulic resistance of all the plumbing, nozzles, skimmer boxes (and the highly varying leaf-load in them), the water level and all the other equipment in circuit. This can also add at least a 10:1 variation in the back-pressure on the pump, making it impossible for one pump to 'match' the load.

c. The difference between a clean and dirty a filter's back-pressure is at least 2:1. (Note: A clean media (sand/glass) filter is not the most efficient at filtering. You actually need a somewhat dirty one to function correctly and so more regular backwashing is not the answer. Too much back-washing leads to longer running times, wastes a lot of water (and wastes the energy to purify it and pump it to your house), wastes the chemicals in the water, along with their implicit manufacturing and transport energies, and require additional flocculant and coagulant chemicals).

d. The key issue on pump selection is load matching. The most efficient pump in the world cannot perform if it is mismatched. The above discussion proves that mismatches are not just likely but inevitable.

e. Below is a link from the Victorian Government, which is highly relevant to the dialogue on pump efficiency. Below is the extracted table summarizing where the gains are to be made. As they correctly identify, you only get a few % from making pumps more "efficient". Most of the gains are achieved by implementing variable speed control that can respond to load changes. There's a lot of quality engineering analysis in the document but fundamentally it shows the gains from "energy efficient" pumps are trivial while the gains from using a control system to adapt the pump system to varying load requirements are major.

http://www.sustainability.vic.gov.au/services-and-advice/business/energy-and-materials-efficiency-for-business/resources-and-tools/energy-efficiency/energy-efficiency-best-practice-guidelines

Summary of benefits of different approaches to pump efficiency.

Pumping systems

Pumping applications are currently estimated to account for around 10.8% of electricity in the industrial and commercial sectors.

Through simple techniques such as those shown below, you can significantly cut this energy use.

Energy savings method	Savings
Replace throttling valves with speed controls	10-60%
Reduce speed for fixed load	5-40%
Install parallel system for highly variable loads	10-30%
Replace motor with a more efficient model	1-3%
Replace pump with a more efficient model	1-2%

This document is a step-by-step guide to improving energy efficiency in pumps and pumping systems for industry. It provides best practice information on pumps and pumping systems and outlines where opportunities for improving system performance and efficiency will lead to reduced energy use and benefit your business.

2. VARIABLE SPEED

a. As indicated by the previous couple of points, a key part of matching pumps to their loads is to have variable speed pumps, where the speed of the pump is varied continually to match the varying load. ***While the high star rating pumps promoted by the pool industry and considered in the CRIS are labelled 'Variable Speed,' this is NOT TRUE. It is a misnomer.*** The so-called 'variable speed' pumps are only variable speed if someone sits there continuously and presses the up and down-buttons, while looking at sensors and varying the speed, when and as required by the system. That class of pump really should be called "***Settable-Speed"*** pumps, because that is what they are. What happens in practice is that the pump owner selects the highest speed required by the pump for the season and sets it to that. The pump then simply

becomes a single speed pump which is set at a particular (usually high) speed. There are manufacturing variations where the pump can step between a couple of speeds, but the principle still holds. The pump is basically 'dumb' and runs at usually arbitrarily preset speeds, usually wasting considerable energy and unmatched to its load

b. To achieve true energy savings and load matching, the pump needs to be part of a control system that ***senses*** what needs to be done and then controls the pump ***intelligently*** according to that requirement. The filter pump needs to vary its speed to suit the cleanliness of the filter, the amount of rubbish in the skimmer box, how the plumbing was set up, and also to suit the various other pool equipments running at any point of time. Filters running alone, clean, filters running alone, dirty, filters with partially blocked skimmers and strainers, with pool sweeps on and off, with gas heaters, with heat pumps, with solar heaters, with waterfalls and so on, all need to run ***adaptively*** at various speeds that need to change as required. Settable speed pumps do not do this and can often make things worse

3. VARIABLE TIME AND ADAPTABILITY

a. Pool energy use is not just the filter but the energy consumed by the electronic chlorinator in 92% of pools, the pressure sweep in 30% of pools, the heaters in another 30% of pools, and other devices. These are very substantial consumers of energy in their own rights. These other devices, and the filter and its pump, need to run for different ***lengths of time*** depending on the time-of-day, time-of-year, season, weather, forecast, state of water chemistry, amount of swimming and the cost and price of power. Pooled Energy pools do this and this is achieved by sensors and an Intelligent Pool Controller (IPC) at the pool, and a Central computer system at Pooled Energy's Network Operating Centre. This computer communicates with the IPC at the pool, with the National Electricity Market, the Weather Bureau and the Grid at a technical level (see below). The difference is energy use is **HUGE** compared with a conventional pool system running on time-clocks and doing the same thing every day, irrespective. Again, the difference here is between ***Settable*** time-clocks and an ***adaptive, truly-variable control system that uses sensors and intelligence.*** This adaptability and energy saving does NOT depend on a high star pump.

4. SYSTEM EFFICIENCY

a. Pool energy use depends on other things than pumps. For example, when the chlorinator runs at high pH, its energy use is up to 33x more than it needs to be. When the solar systems run in the rain , as they often do to take a roof temperature, they are wasting energy. When the sweep runs too much in winter and too little in leaf-shedding season, it is wasting energy. These things are managed by the Pooled Energy system and not by the pump.

b. Pooled Energy uses sensors and true variable speed pumping. The individual pool is optimally run by our on-line system which incorporates both a full SCADA system and an Internet of Things. That individual pool can be set by the system to respond to the time-of-day, the time-of-year and season, the chemical state of the water, the cleanliness of the filter and skimmer boxes, the cost and price of power, the weather and sunshine, and the amount of swimming.

5. **STABILISING THE GRID**
    a. In Pooled Energy's system, the electricity used by groups of pools is aggregated via the Internet cloud under the control of Pooled Energy's Central Computer, and their combined electricity demand is used to help stabilise the Grid and help mitigate events such as the recent Grid collapse in South Australia. This has large energy reduction implications in the Grid whereby the amount of generation equipment kept at full power as spinning reserve, can be reduced. I am happy to send you some papers we have written on that aspect of you wish.

A key element in the system is a truly variable speed pump which responds to the service requirements. It must be electronically controllable to achieve this. ***None of the current high-star multi/settable-speed pumps in the market are truly variable. Nor can they be electronically controlled*** to our knowledge. We trialled quite a number and were obliged to remove them from service. They either have no interfaces (most) or proprietary interfaces.

Pooled Energy uses inexpensive (low-star), single speed pumps and converts them to truly variable speed pumps using external electronics. This gives them de-facto star ratings when operated inside the Pooled Energy system, far, far beyond that achieved by the settable speed pumps. If you ban these inexpensive pumps, you will cripple our ability to do all the above and very substantially reduce the energy savings we are achieving with standard pumps. Our energy savings are far beyond what is possible with settable speed pumps used at the wrong settings with unknown and varying loads, running under dumb time clocks and with no sensors. It's not about the pump as a stand-alone item, but about the system.

We have no particular objection to star ratings on pumps, however it should be made clear that in actual service the efficiency gains are typically only 1-3% as per the Sustainability Victoria table above and numerous other analyses by a range of authorities around the world for techniques to improve pump efficiency.

Under no circumstances should low cost single speed pumps that do not meet particular energy rating be prohibited imports.The engineering fact is that combined with a proper control system as used by Pooled Energy, the efficiency achieved dramatically exceeds any achieveable by the highest star rated pump. Restricting import of such pumps could be seen as simply a form of standards mandated protectionism which defeats the efficiency objective you are trying to achieve.A concern with high star rated pumps is that they may not have the appropriate IGBT ratings & other factors required to make them suitable for external variable speed drive systems required for a proper flow control system.

We would again point out that the pump star rating tests are highly misleading as they use a test method that does not in any way represent the actual service conditions that the pump will be required to serve.We have seen a number of recent examples in other industries of misleading results confounding the intent of the desired real world performance.

Swimming pools as you know are major consumers of electricity.The Pooled Energy system drastically reduces this consumption while improving the overall cost of pool operationand the quality and health of the pool water. If the Pooled Energy system was mandated across Australia it would remove at least one very large coal fired power station from the Auustralian Generation fleet.

Regards

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