PUMP INVERTER TECHNOLOGY

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Maximising efficiency to save energy & money

Will Dando F.I.S.P.E.

Introduction

- Will Dando – Plastica Limited
- Variable Speed Pumps – motor control
- Selecting and selling the correct pump
- SPATA Workshop & CPD points
- Questions? - Stand D34

Topics

- Circulation
- Controlling speed of flow
- Variable Frequency Inverters
- Choices
- Set up
- Payback

What does pool circulation do?

- Circulation is an integral part of a swimming pool
  - Filtering
  - Disinfecting
  - Heating
  - Protect from freezing

What does pool circulation do?

- It stops it being a POND!

What actions does a pool pump do?

- Prime
- Filter
- Backwash filter
- Flush filter
- Circulate
- Vacuum
- Waste
- Frost protection

The perfect pump

- Circulate daily - slow economical speed
- Blast dirt from the filter – fluidise sand bed
- Give control when vacuuming
- Tick over during Winter - frost protection

Can one pump do is all?

- Filter – 60% - 80%
- Waste – 80% - 100%
- Backwash & Flush – 100%
- Vacuuming – 40% - 100%
- Circulate
  - After backwash – 40% - 70%
  - Frost protection – 10% - 20%

Can one car do is all?

- Motorway driving – constant 70mph
- Delivering bricks – large load
- Popping to the shops – stop start, small load
- Sunday drive out – economic & efficient

The perfect car / pump

Altering pump speed

- Over rev a small pump?
  - Not a good idea to go faster than top speed!
  - Pipework, filter and equipment is chosen to handle maximum flow
- Slow the flow

The ways to alter the pump flow

- Choke the flow by closing valves
  - Like driving with handbrake on
- Alter impeller efficiency, size or shape
  - Would entail re-build
  - Only possible to pick one new flow

The ways to alter the pump flow

- Choke the flow by closing valves
- Alter impeller efficiency, size or shape

- Pump motors all spin at same speed 2800 rpm
- Bigger motor allows it to maintain speed while shifting more water

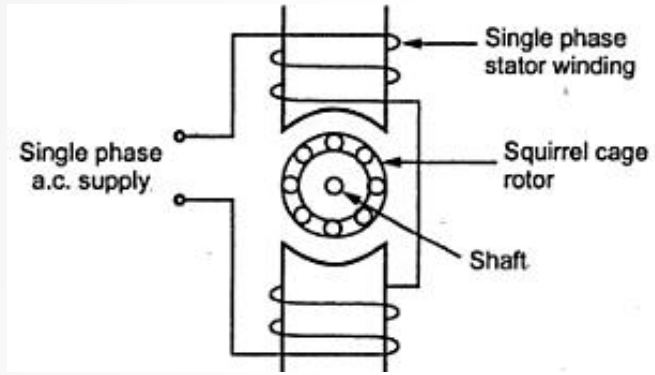
WET END v MOTORS

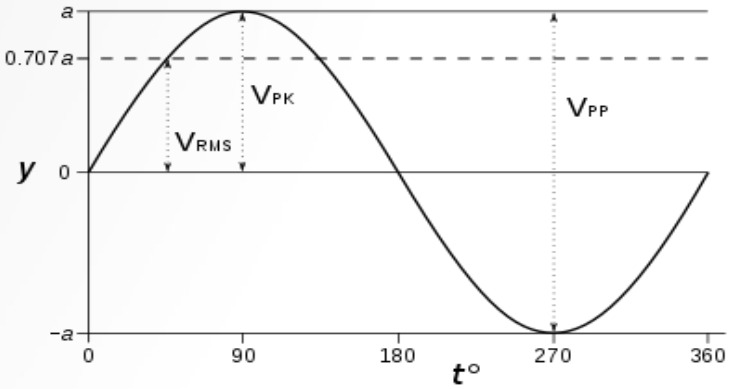
Direct current (d.c.) motors

- Reduce or increase voltage
- Variable resistor - HEAT
- If motor is slowed by load, amps increase
- Large dc motors need huge control unit

Alternating current motors– Single phase

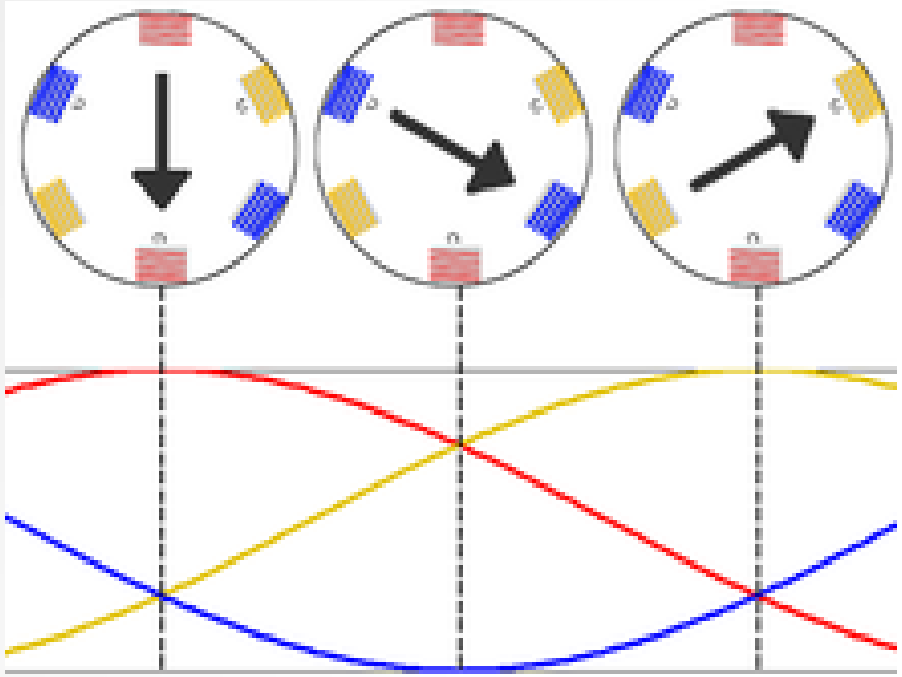
- Asynchronous A. C. Induction Motors
- Single phase requires second start winding



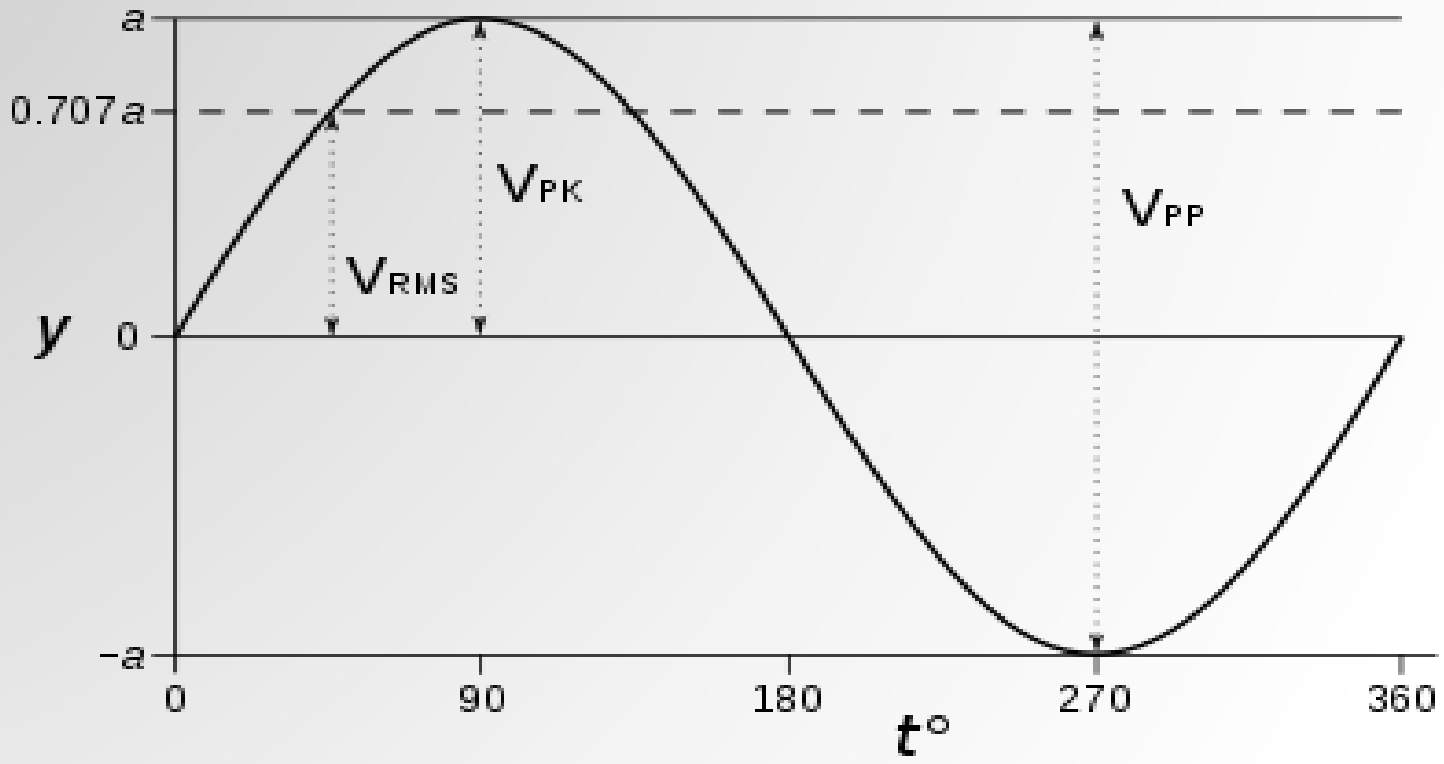


Alternating current motors– Three phase

- Asynchronous A. C. Induction Motors
- Three phase



50Hz Alternating current



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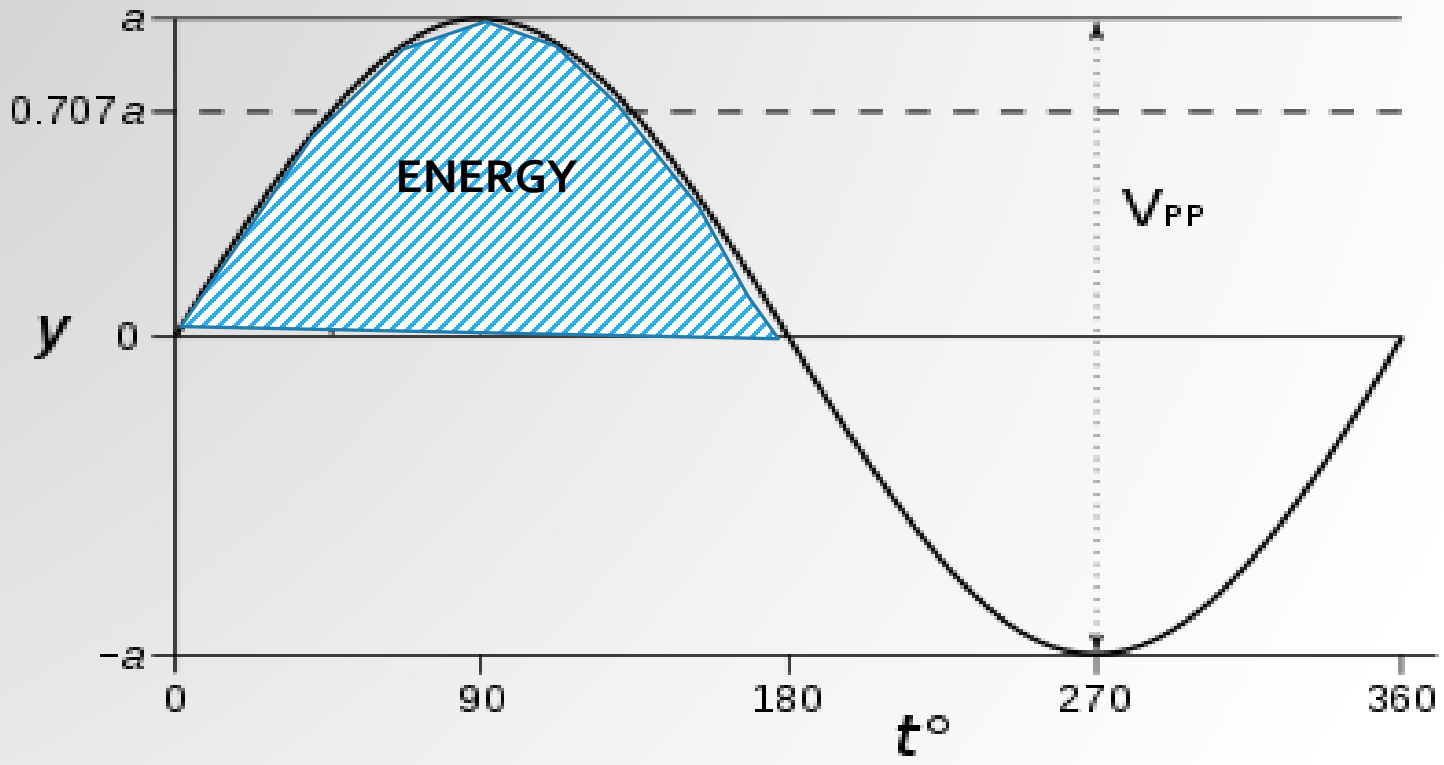
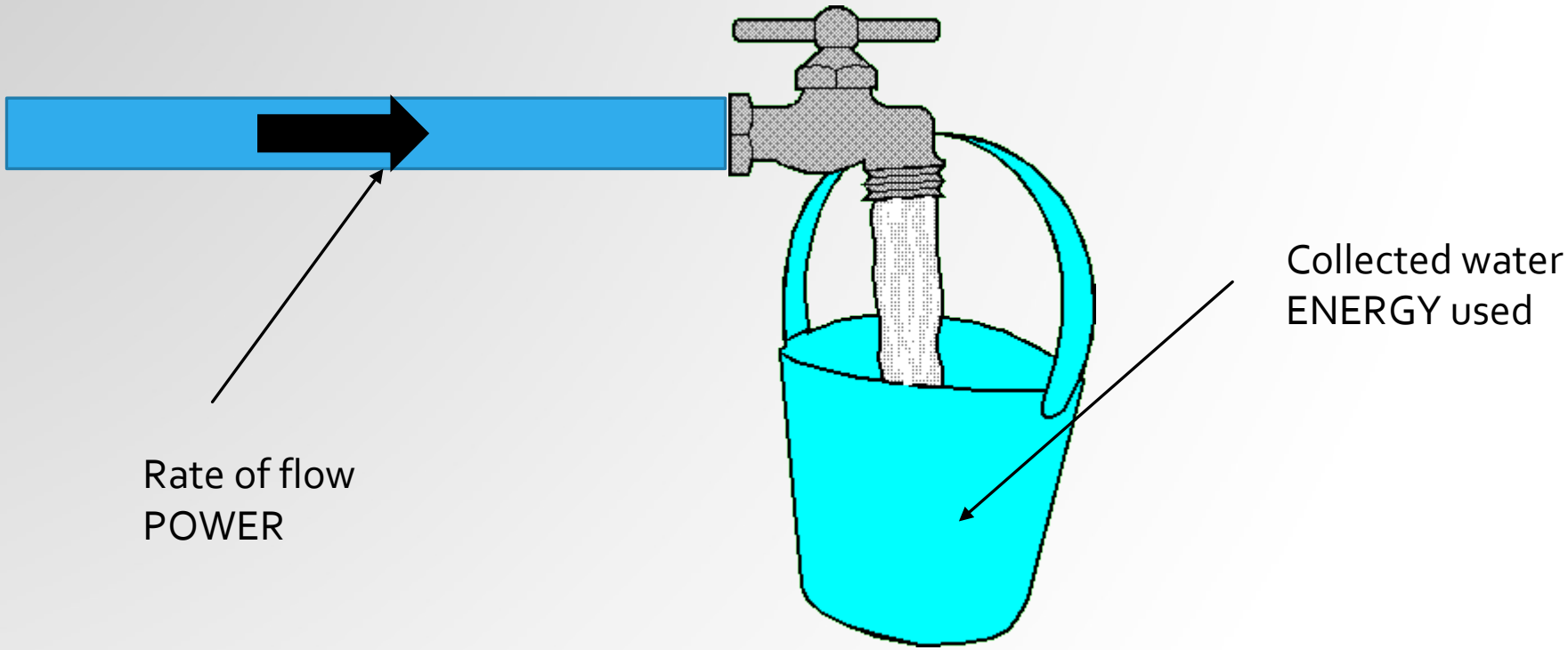


Power & Energy

- kW – Kilowatts
- A rate of POWER

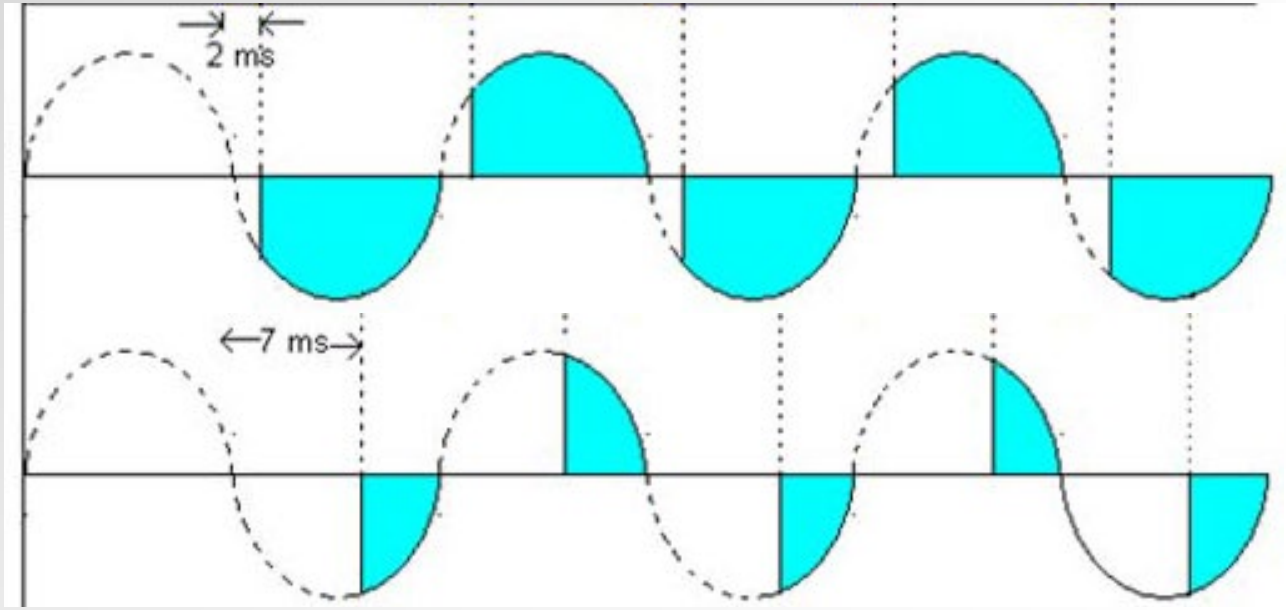
- kW/h – Kilowatt hours
- A physical amount of ENERGY used

Power & Energy

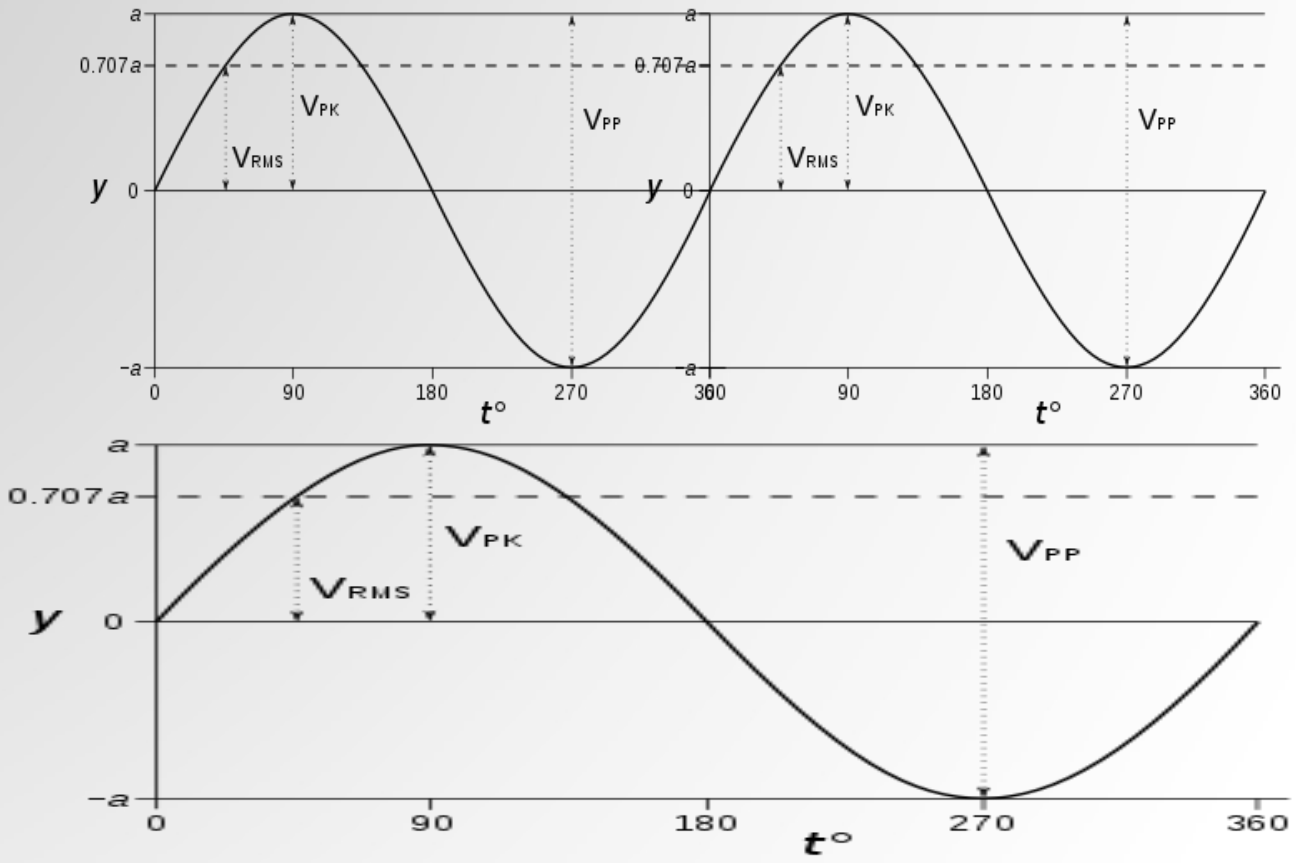


Alternating current

- Throttle the supply using thyristor



Variable Frequency Inverters



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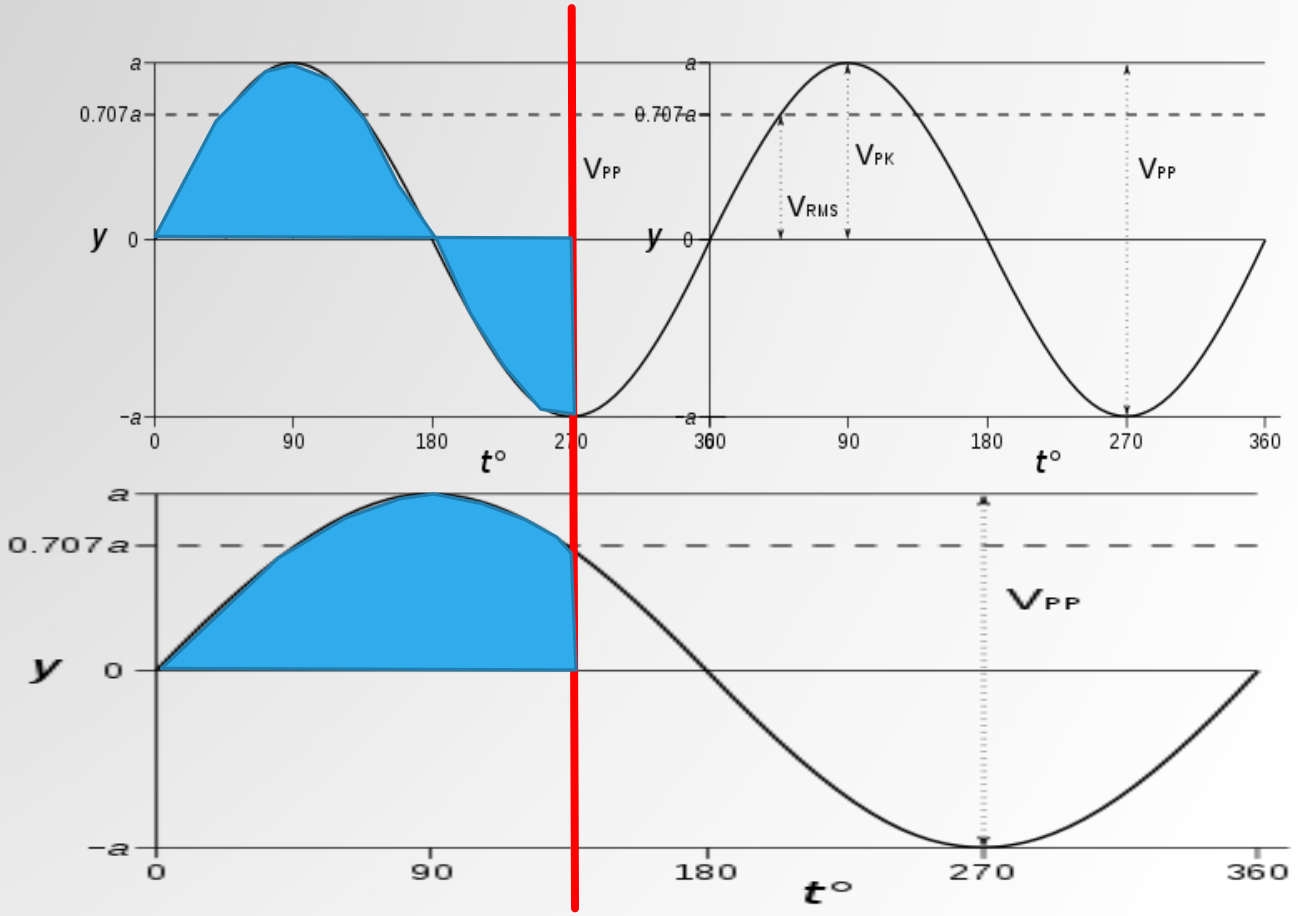
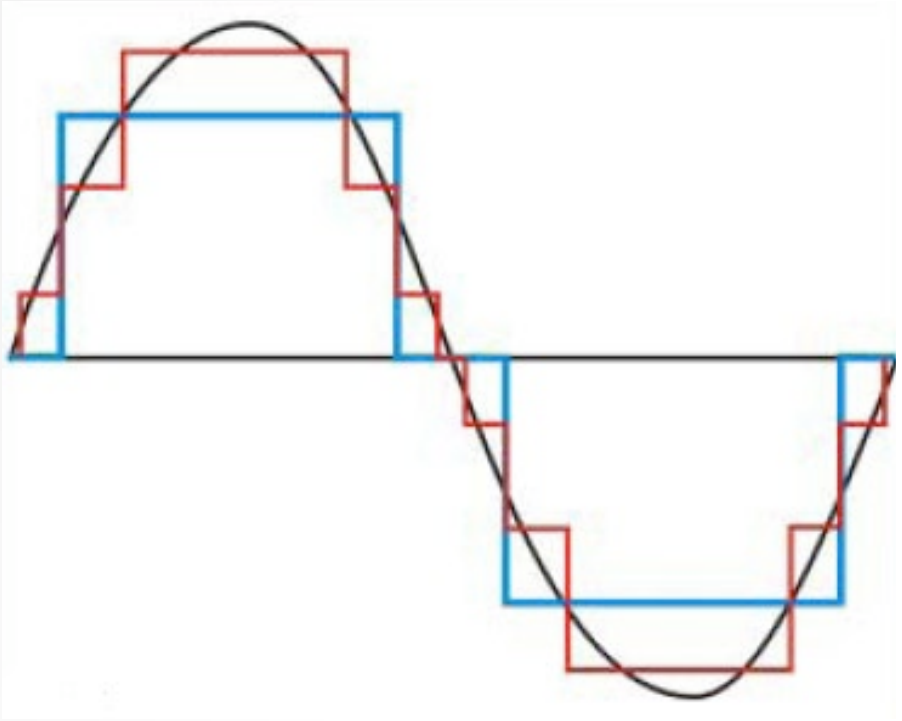


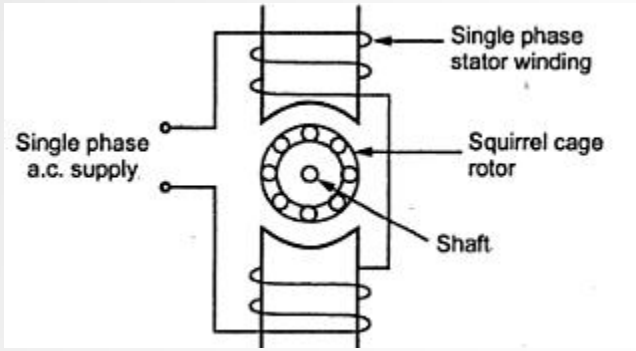
Variable Frequency Inverters

- A.C. is smoothed to D.C.
- Pulsed out to mimic a sine wave A.C. #
- Three phase or single phase current

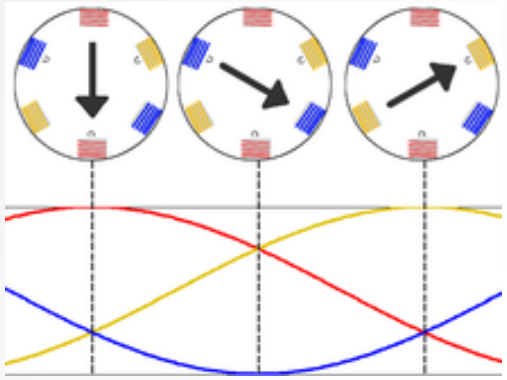


Variable Frequency Inverters

- Single phase



- Three phase
  - Much more efficient at slower speeds



Variable Frequency Inverters

- Why now?
  - Compact Disc technology
  - Digital Analogue conversion
  - Digital file to sound waves
  - Same but handles much more power

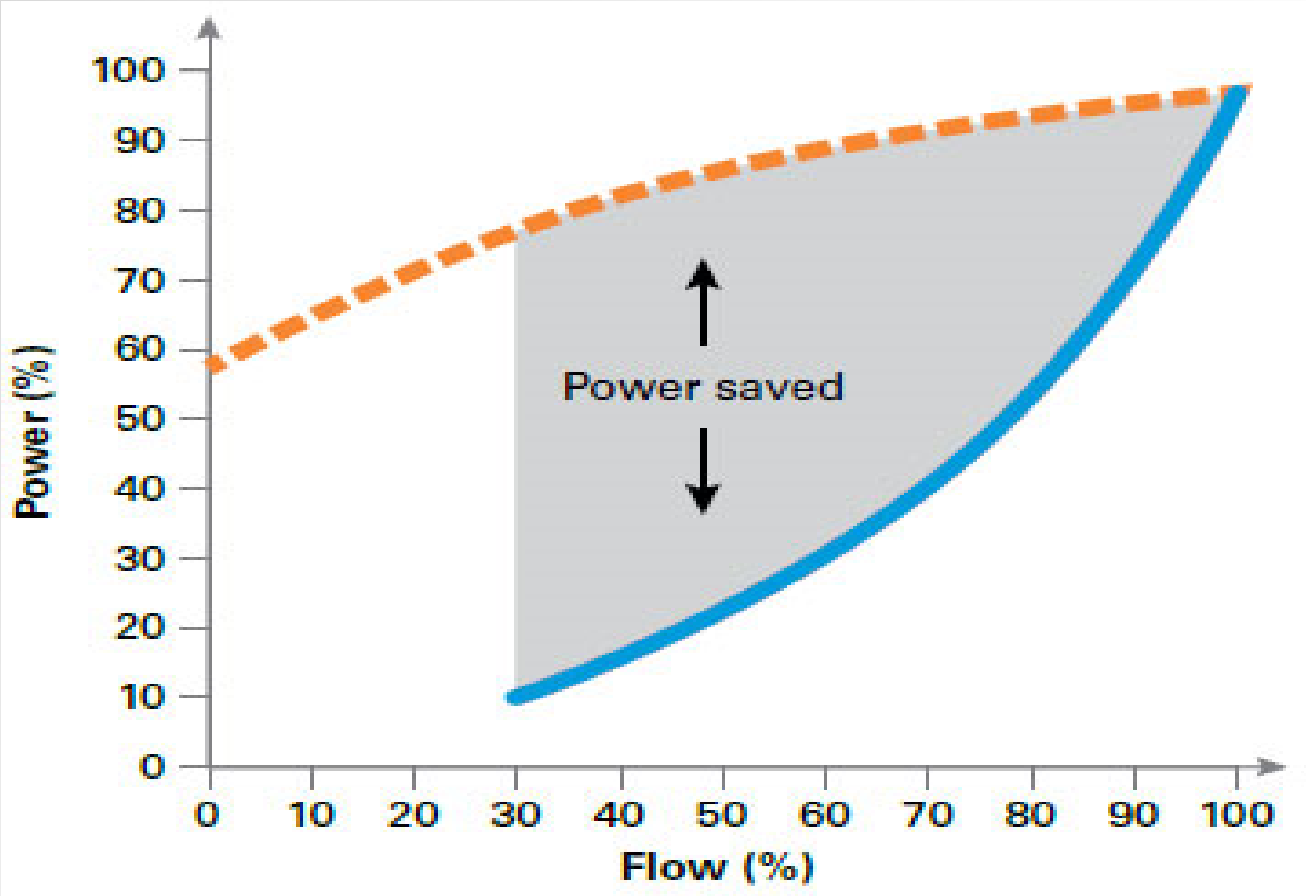
Variable Frequency Inverters

- Micro-processor controlled
- Software makes it programmable
- Can be as simple or adaptable as required
- Advanced features

Advanced features

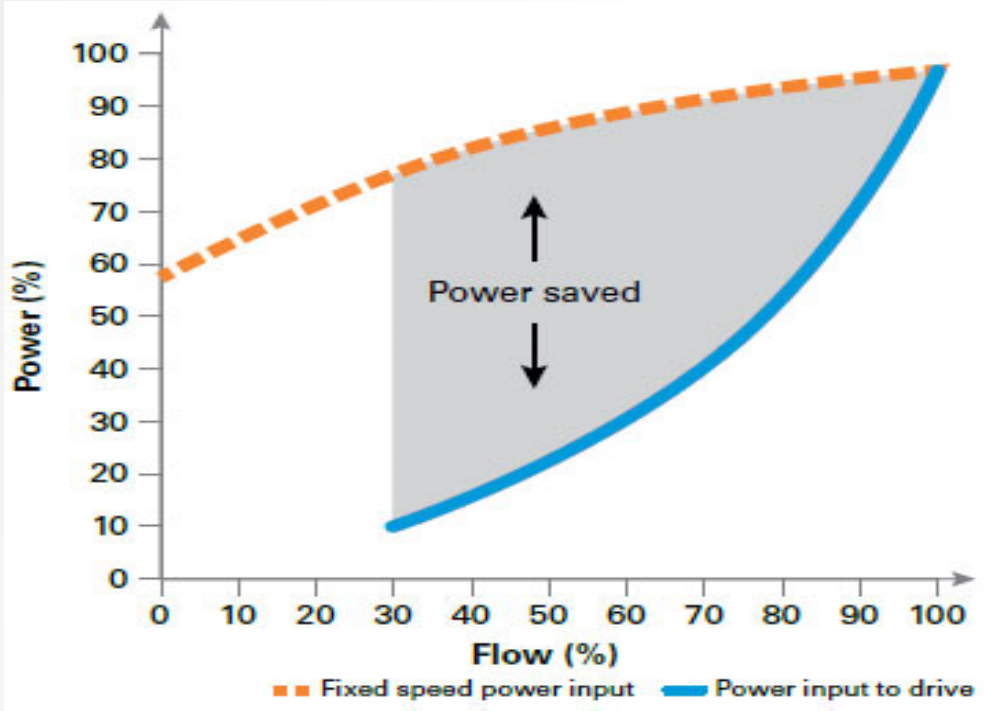
- Multiple set speeds to variable speed
- Soft start & soft stop
- Overload protection
- Power boost on start up or in the waveform
- Very advanced features!

The Advantage



The Advantage

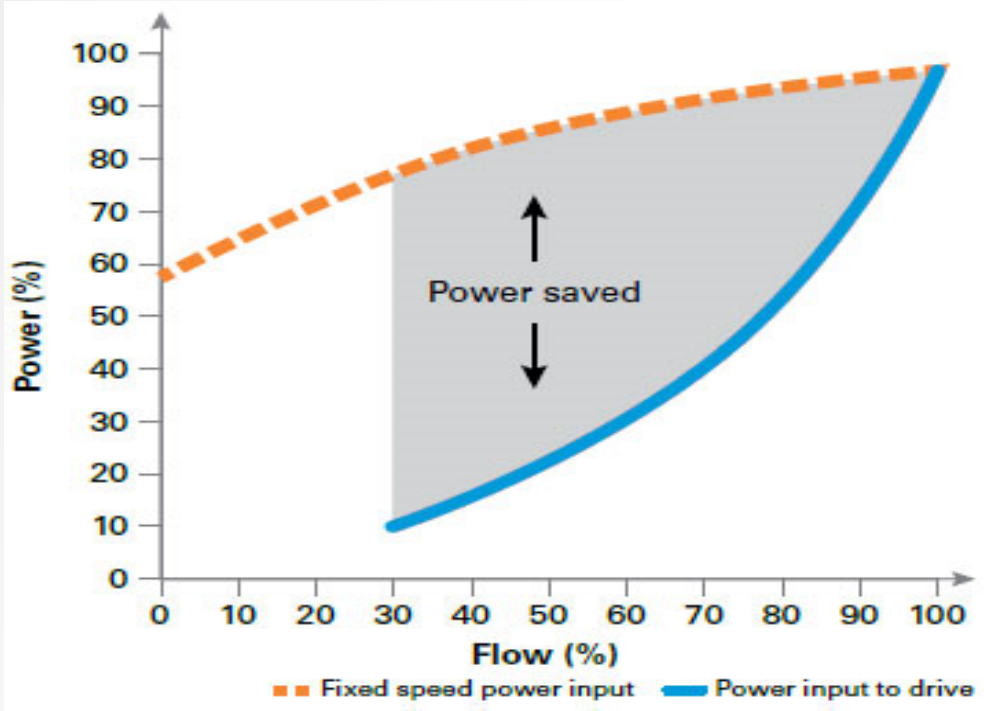
- Power saved
- = Energy saved
- = Money saved
- Never 100% efficient
  - Energy cannot be created or destroyed, it can only be changed from one form to another. — Einstein



The Advantage

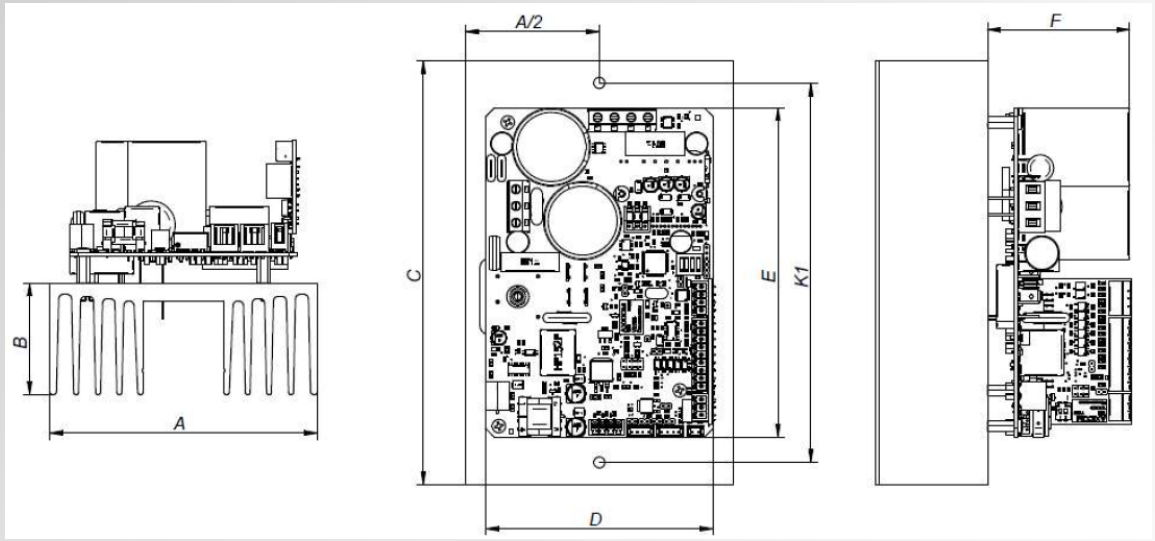
- Power saved
- = Energy saved
- = Money saved

- To be revisited……



What is available?

What is available?



The importance of Set Up

- What is the routine now?
- What does the pool require?
  - Filtration
  - Heating
  - Disinfecting
  - Protection
- Changes may be beneficial

Balancing the tasks

- Filtering
- Heating
- Disinfecting
- Protection from freezing

Balancing the tasks

- Filtering
  - Slower is better but turnover must be maintained
- Heating
  - Must be sufficient to hold shut the flow switch
- Disinfecting
  - Flow times will affect erosion feeders
- Protection from freezing

Payback

- Filtration volume must be maintained
  - The correct rate for the filter and turnovers have been set to keep pool clean and safe
  - Flow switches will need sufficient flow to operate
- Efficiency
- Example

Payback

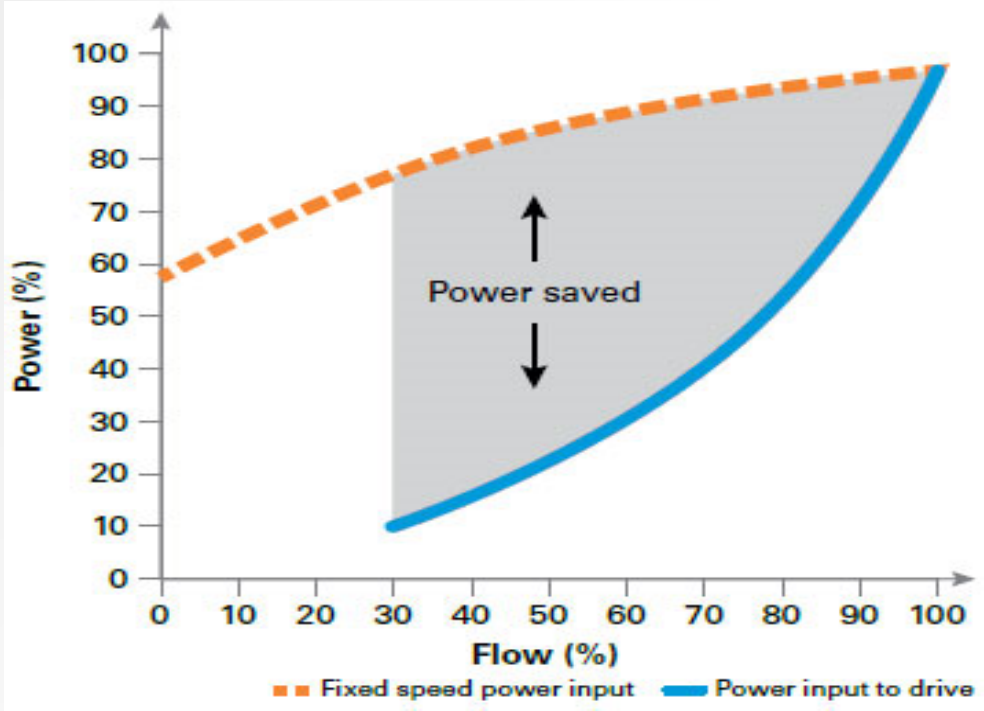
- Filtration volumes must be maintained
  - Slower rate does give increased filtration efficiency
  - 4-6 hour turnover
  - Two turnover in 24 hours

Payback

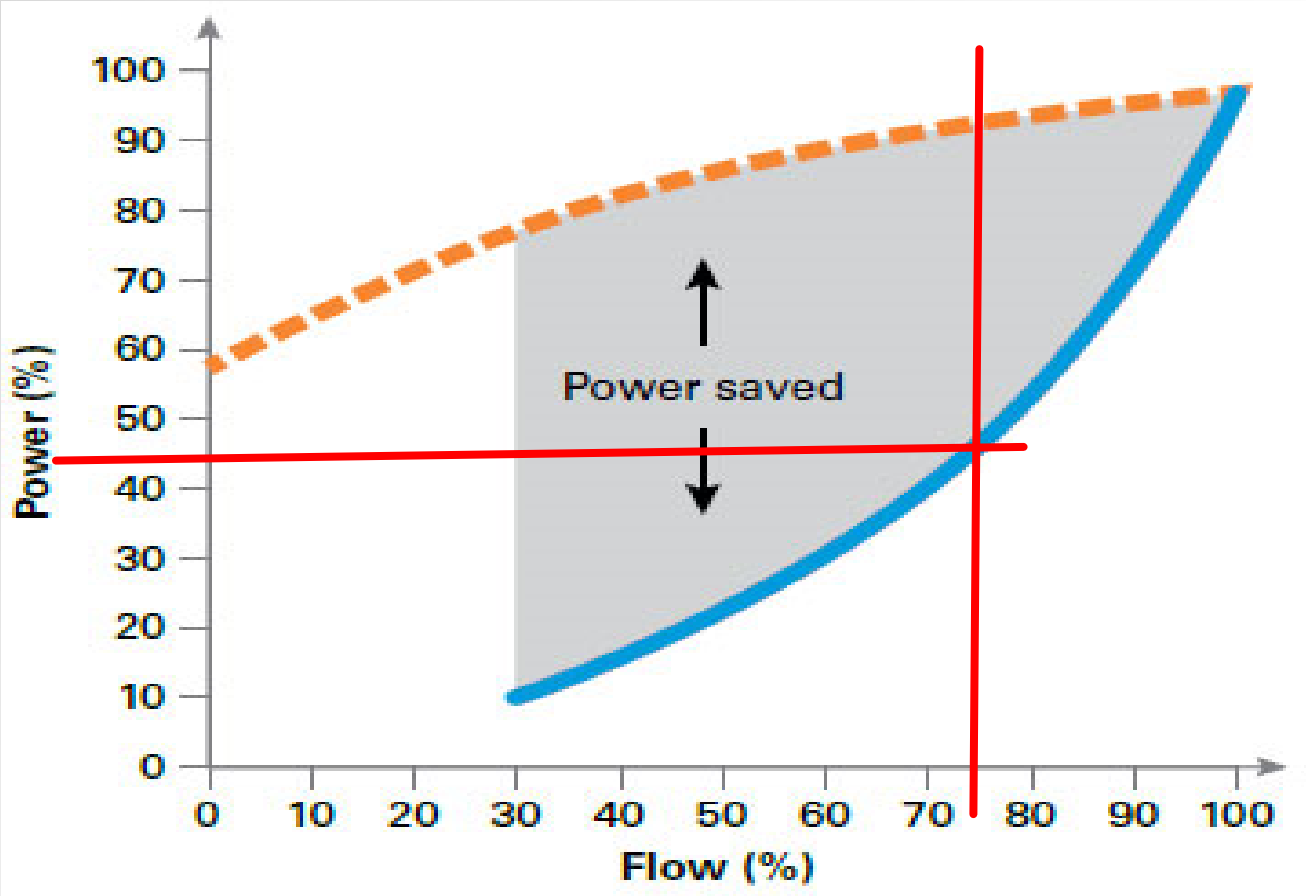
- Six hour turnover
  - Pump runs 12 hrs per day
  - Two turnover in 24 hour period
- Drop pump to 75% flow
  - Run for 16 hours
  - Pump draws ?

The Advantage

- Power saved
- = Energy saved
- = Money saved



The Advantage



Payback

- Six hour turnover
  - Pump runs 12 hrs per day
  - Two turnover in 24 hours
- Drop pump to 75% flow
  - Run for 16 hours
  - Pump draws 42% of original power

Payback

- Drop pump by 25% flow
- Pump drops by 58% of original power

Why is it difficult to go FAST?

- Car
  - Aerodynamics
- Pool Flow
  - Pipe friction etc.
- Sound
  - Two x Watts input power for 10% increase in sound volume

Payback

	Hours Per Day	Pump RPM	KW	Per Hour	Per Day	Days per year 365
Standard pump	12	2800	1.04	£ 0.15	£ 1.75	£ 637.73
Pump with inverter	4	2800	1.04	£ 0.15	£ 0.58	£ 212.58
	0	2100	0.76	£ 0.11	£ -	£ -
	4	1700	0.60	£ 0.08	£ 0.34	£ 123.29
		1400	0.40	£ 0.06	£ -	£ -
	8	1200	0.31	£ 0.04	£ 0.35	£ 127.55
price per unit of electricuty	0.14			Total	£ 1.27	£ 463.42

Savings per Day	£ 0.48
Savings per year	£ 174.31

£174.31

Payback

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Standard pump	12	2800	1.04	£ 0.15	£ 1.75	£ 637.73
Pump with inverter	0	2800	1.04	£ 0.15	£ -	£ -
	0	2100	0.76	£ 0.11	£ -	£ -
	0	1700	0.60	£ 0.08	£ -	£ -
	16	1400	0.40	£ 0.06	£ 0.89	£ 323.12
	0	1200	0.31	£ 0.04	£ -	£ -
price per unit of electricuty	0.14			Total	£ 0.89	£ 323.12

Savings per Day	£ 0.86
Savings per year	£ 314.61

£314.61

Conclusion

- Emission and energy conscious regulations
- Cost of the technology decreasing
- Smart technology – remote control - USP

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Thank you for listening

Questions

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Thank you (again) for listening

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COME AND SEE US ON STAND D34