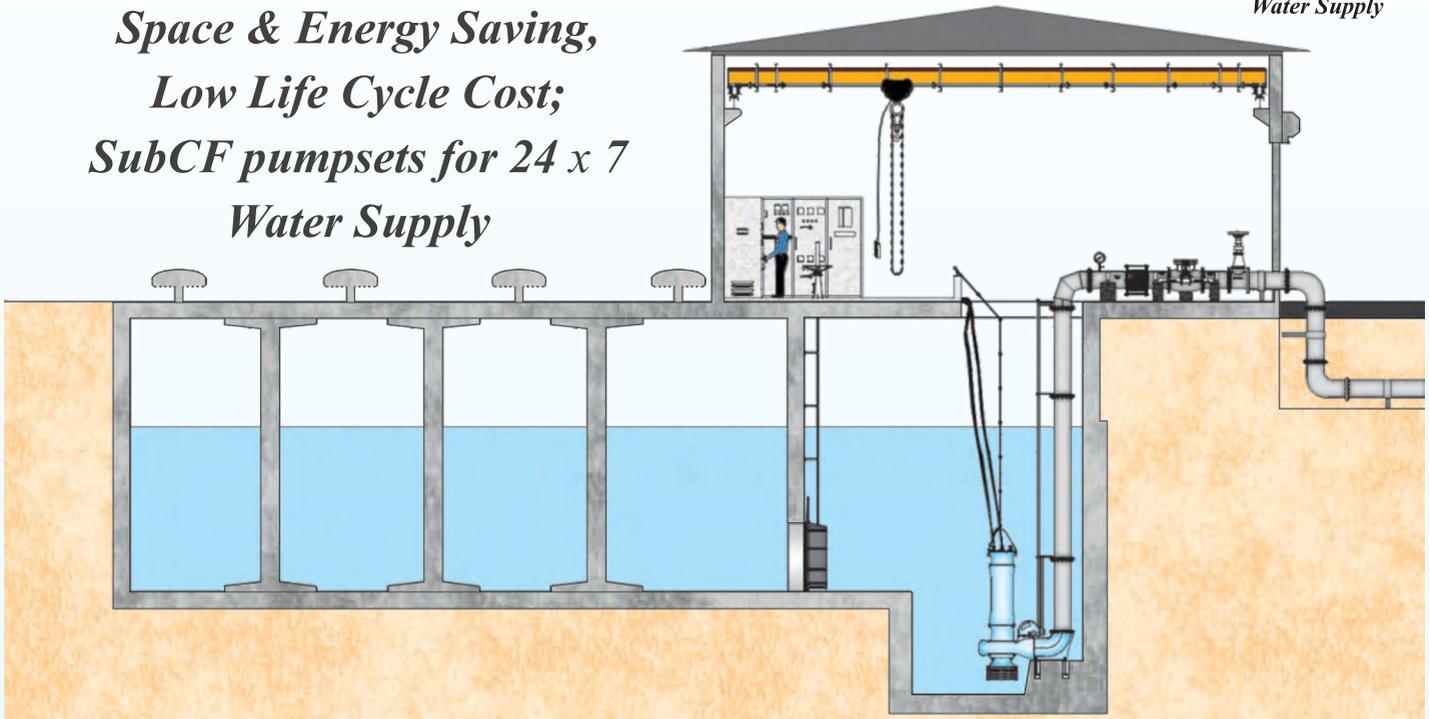


*Space & Energy Saving,
Low Life Cycle Cost;
SubCF pumpsets for 24 x 7
Water Supply*



In **Intermittent** Water (Distribution) Supply, water is Lifted (pumped) from Underground Tanks (**CWR**) to Elevated Service Reservoirs (**ESR**) & Supplied (released) at odd hours (typically for just 2-4 hours in Morning (& sometimes 1-2hours in the Evening)).

- i) Hence the Pumps have to pump against a **Fixed** (mostly Static) **High Head** (of the ESR) thereby consuming (wasting) a lot of Energy.
- ii) Due to Receipt of water in a short span at odd hours; public has a Physiological tendency to Store water increasing it's wastage
- iii) The Distribution Pipe Network is Non Pressurized during Non Supply hours which may lead to the unfortunate accidental Ingress of Waste Water (like sewage, effluent, etc.) adversely impacting Public Health.

In **24 x 7** systems; water is supplied Round the Clock which :

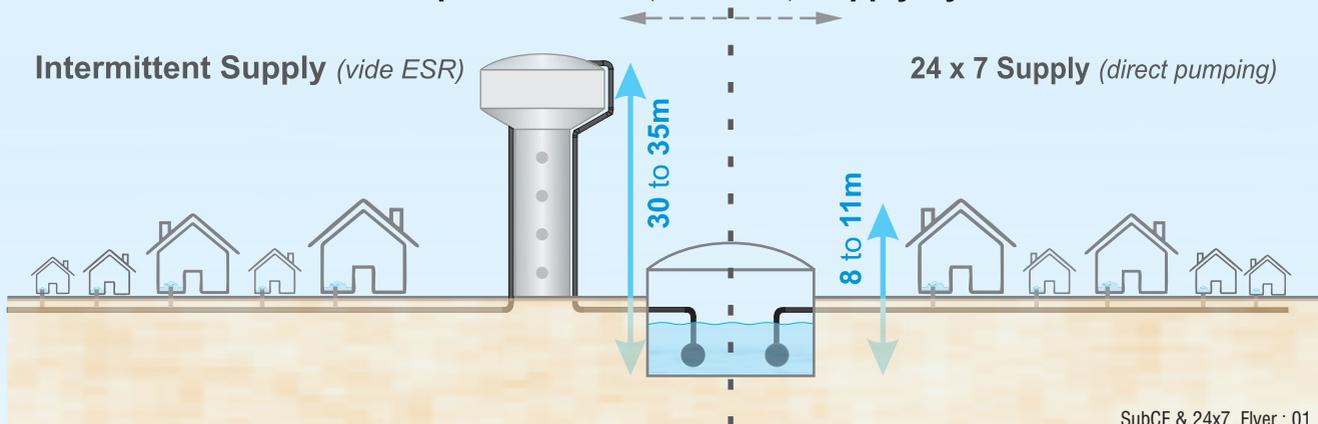
- a) eliminates the need of ESRs (as pressurized (vide pumps) water is fed Directly into Pipelines) hence instead of pumping all the way 30-35m (to an ESR), now water is to be pumped just upto 1 or 2 Floor (8m to 11m) thereby **reducing Static Head**.
- b) reduces Instantaneous Flow Rate (as people use water as & when required instead of concentrated time zones).

Since System's Frictional Head is Squarely Proportional to the Flow Rate; there is a **great reduction in the Required Total Head** to be pumped - also there is a **reduction in Rate** of water to be pumped (albeit variable during the 24hour clock cycle).

This subsequently opens up an lucrative potential of using VFD driven pumps which apart from **varying Pump's Discharge Flow & Head** (in accordance with system's requirement) **can result in huge Energy savings**.

Of course, the above presumes that End Users don't waste water (mostly ensured by water metering)

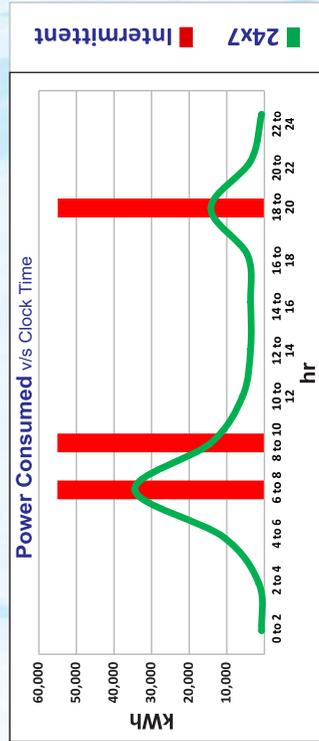
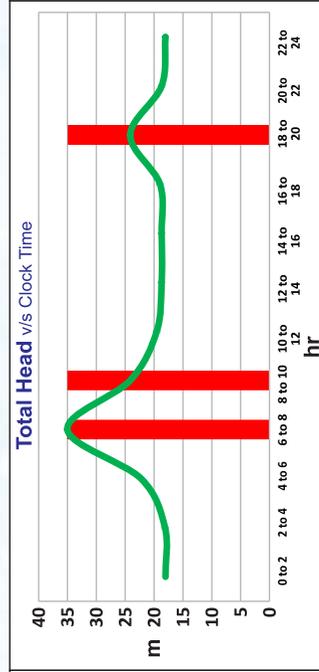
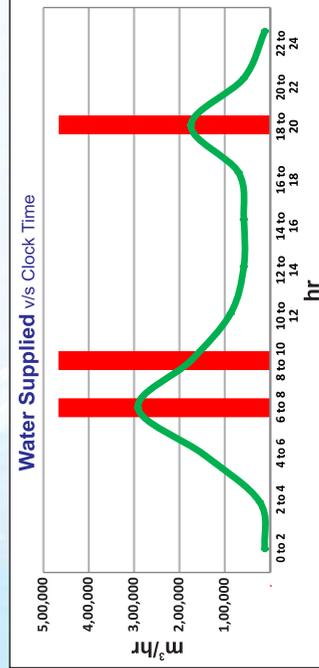
Optional Water (Distribution) Supply Systems





Comparison of Pumping : Intermittent v/s 24 x 7

Salient Features		Intermittent (vide ESRs)												24x7 (vide Direct to Piped Network)											
		75%												90%											
		140												140											
		7,500,000												7,500,000											
Population		Souls												7,500,000											
Per Capita Consumption		lpcd												140											
System of Supply		Intermittent (vide ESRs)												24x7 (vide Direct to Piped Network)											
Utility (1/Wastage) Factor		%												90%											
Total Water (Supplied) Pumped/day		m3/day												1,166,667											
		MLD												1,167											
Clock Time		6												24											
Supply (Pumping) On/ Off		0 to 2												0 to 2											
		12 to 14												12 to 14											
		16 to 18												16 to 18											
		20 to 22												20 to 22											
		24												24											
Clock duration (hr)		2												2											
1=On, 0=Off		0												1											
Cumulative hr		-												709											
Supply (Pumping) Rate		m3/hr												-											
		32												11											
Static / Pressure		m												m											
Demand Variation Factor		%												%											
Piping Frictional & Station Losses		m												m											
Total Head to be Developed by Pump		m												m											
Power Consumed by Pump Motor Sets (assuming Constant Efficiency (85% Ep, 95% Em) & Constant Station Losses & Ancillary Auxiliary Power Consumption)		kWhr												kWhr											
		-												-											
		165,254												97,979											
		100%												55%											
0 to 2	2 to 4	4 to 6	6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	18 to 20	20 to 22	22 to 24	0 to 2	2 to 4	4 to 6	6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	18 to 20	20 to 22	22 to 24		
-	-	-	466,667	466,667	-	-	-	-	466,667	-	-	11,667	23,333	145,833	291,667	175,000	87,500	58,333	70,000	175,000	58,333	70,000	175,000	58,333	11,667
32	32	32	32	32	32	32	32	32	32	32	32	11	11	11	11	11	11	11	11	11	11	11	11	11	
1.0%	2.0%	12.5%	25.0%	15.0%	7.5%	5.0%	6.0%	15.0%	5.0%	1.0%	1.0%	7.03	7.11	11.25	24.02	13.13	8.53	7.68	7.98	13.13	7.68	7.98	13.13	7.68	
0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	18.0	18.1	22.3	35.0	24.1	19.5	18.7	19.0	24.1	18.7	19.0	24.1	18.7	
-	-	-	55,085	55,085	-	-	-	-	55,085	-	-	709	1,425	10,945	34,443	14,239	5,764	3,675	4,481	14,239	3,675	4,481	14,239	3,675	709

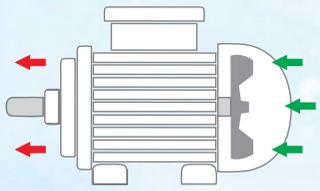


The use of VFD driven pumpsets for 24 x 7 water supply systems is a promising Opportunity to Save Energy between 25% to 40% (& Regulate Flow too)

VFDs & their Side Effects on Pumpsets : Motor Cooling



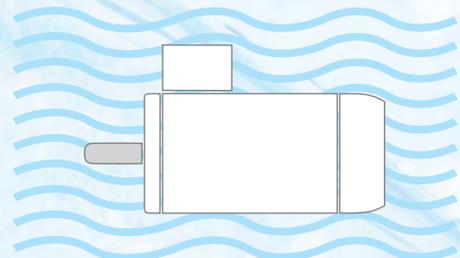
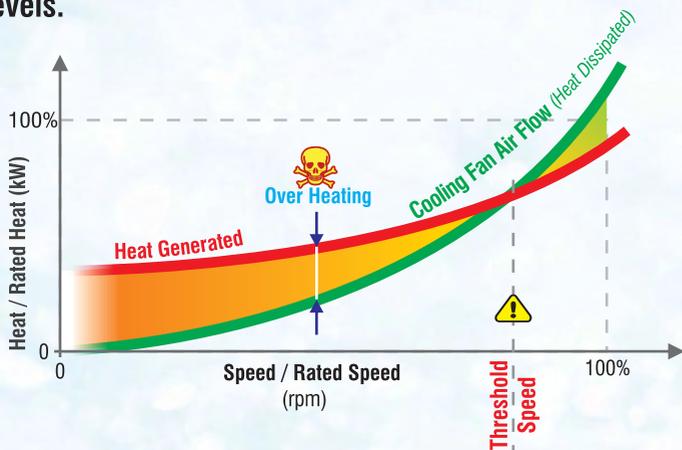
Satisfactory operation of any Motor depends upon its (*Stator Insulation*) Temperature which in turn relies upon the rate of Heat Dissipation always being more than that of Heat Generation



Totally Enclosed
AIR Fan Cooled (TEFC)
(Squirrel Cage Induction) motor
(Shaft Mounted Fan - IC4A1A1)

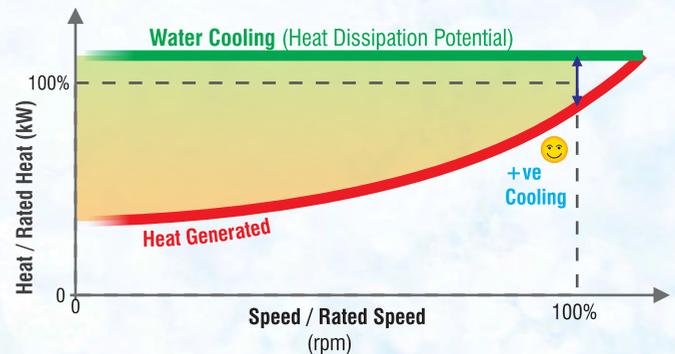
In case of typical Air Cooled (TEFC) motors, Heat Dissipation (Cooling) is by mode of Forced Air blown by a (*centrifugal axial*) **Fan** mounted on the motor shaft itself. As per the basic law of centrifugal machines, the **Fan's Output** (*heat dissipation*) is proportional to the **cube** of its **speed**.

Hence when such motor's speed is slowed down by VFDs, the Cooling Fan (*being mounted on the motor's shaft*) **also slows down** & subsequently the motor's **Cooling Air Flow** (*heat dissipation*) **reduces drastically** - so much so that below a **threshold** speed; the motor can **Overheat to unacceptable levels**.



Totally Enclosed (IP68) **WATER Cooled (TESWC)**
(Squirrel Cage Induction) **Submerged** motor
(Self surface water cooled - IC4A1W0)

Totally Enclosed (IP68) **Water Cooled (TESWC)** (Squirrel Cage Induction) **Submerged** motors are cooled (*quenched*) by **Surrounding Water** - hence **it's cooling effectiveness is not dependent on the speed** (or VFD).



Typical effects of VFD on Various Types of Pump-Motor sets

(rated parameters 125kW, 1500rpm (sync) 4P; 35m x 1000m³/hr @ 50Hz)

Frequency		Hz	50	45	40	35	30
Pump	Speed (sync)	rpm	1500	1350	1200	1050	900
	Head	m	35.0	28.4	22.4	17.2	12.6
	Flow	m ³ /hr	1000	900	800	700	600
	bkW	kW	112.1	86.9	61.0	50.3	34.3
Motor	Total Heat Generated	kWh	11.39	8.60	6.70	4.98	3.48
TEFC Air Cooled motor	Cooling Fan Flow (Heat Dissipated)	cfm (kWh)	11.75	8.57	6.70	4.97	3.48
	Heat Dissipated / Heat Generated	%	103%	100%	90%	81%	73%
		Condition	Cool	Cool	⚠ Heats up	⚠ Heats up	⚠ Heats up
Submerged Water Cooled motor	Water Cooling (Heat Dissipation Potential)	kWh	11.75	11.75	11.75	11.75	11.75
	Heat Dissipated / Heat Generated	%	103%	137%	175%	236%	337%
		Condition	Cool	Cool	Cool	Cool	Cool

Thanks to Unchanged cooling effect of Surrounding Water; Submerged motors can be blindly used with VFDs while still being always effectively cooled at any Speed.



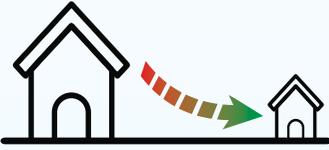
Fully Compatible



Vacuum Pressure Impregnation Treatment (VPI) for Superb VFD Compatibility



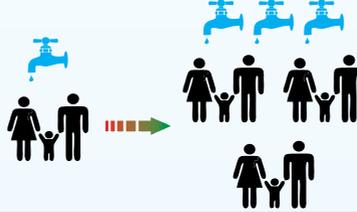
Can be safely operated (via VFD) at any (lower) Frequency / Speed



SubCF pumpsets can be immersed directly in to Wet Pit (CWR); hence **eliminating** the need of Pump room resulting in **upto 55% Land** requirement*.



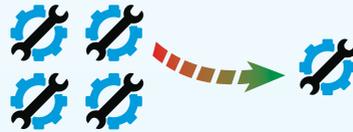
The **Saved Space** can be used to make a **Larger CWR** thereby thereby serving a **Larger Population** (in same available total land).



Low Energy Cost : Due to Elimination of Suction Losses, Ancillary & Auxiliaries; **Wire to Water Power Consumption** of SubCF based Pumping Station is **slightly Lower** (compared to other pumpsets)*.



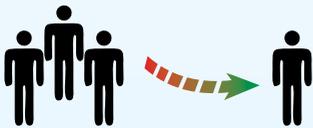
Low Life Cycle Costs



Saves (upto 75%) Spare Parts & Consumables*



Saves (upto 45%) Capital Cost of Pumping Stations*



Saves (upto 66%) O&M Staff*



User Friendly

- No risk of Cavitations.
- No damage due to Flood or Rains.

- No need of Suction Priming (during Pump StartUp).
- No need of Dewatering (to water leakage from Seepage, Glands, Piping Leakage, etc).

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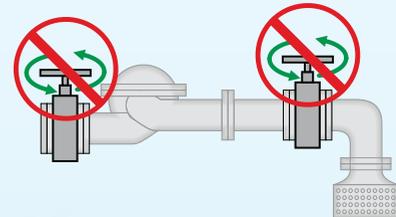
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No need of Valve Opening / Closing (during Pumpset Start / Stop)



No Suction Piping & it's associated Friction Head losses

No need for Frequent Periodic....



Shafts/Sleeves &/or Coupling

Gland Packing

Oil &/or Grease

*** Contact us for details**

Aqua Machineries Private Limited

Survey No. 504/1-2, 442/2, Near Haridarshan Estate, Near Express Highway, Ramol, Ahmedabad-382 445. Gujarat, India.