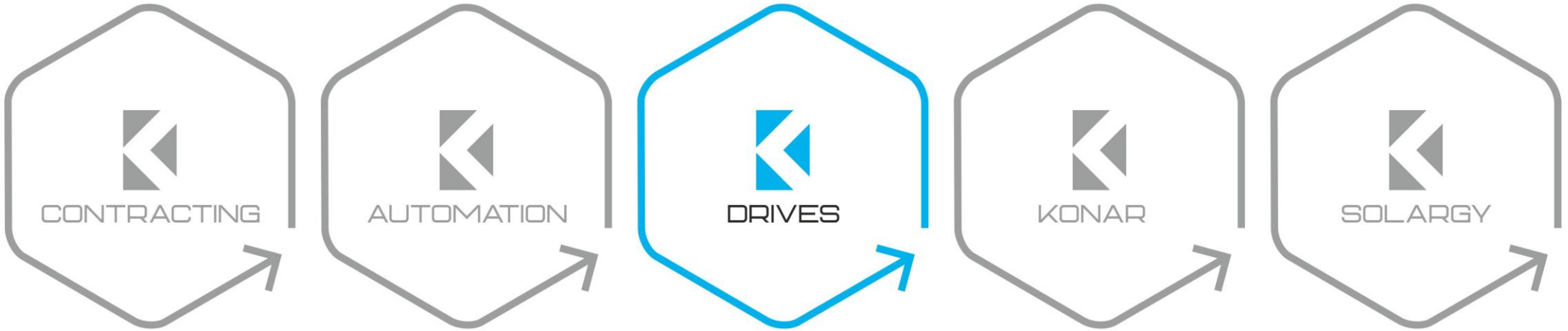
# KONTEK



# DRIVES

"ÜRÜN SATIŞ"

- Confidence
- Experience
- Honesty
- Responsibility
- Dynamism

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# Contents of Energy Savings with VFD
# &
# New Efficient Motors

1) Idea

2) Engineering Background

3) Typical Applications

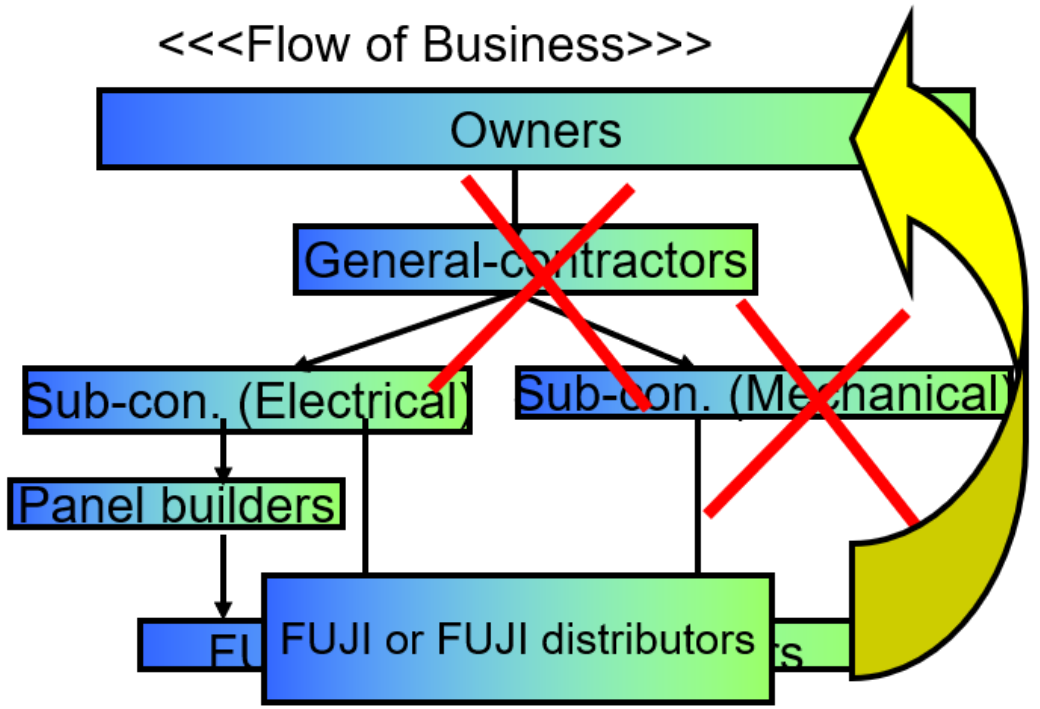
4) Roadmap

5) References & Applications

# 1) Idea

We are able…

- To make relationship with owners not through contractors, and obtain more profit, and relevant information.
- To receive replacement business of Facility (Inverter has limited life span)



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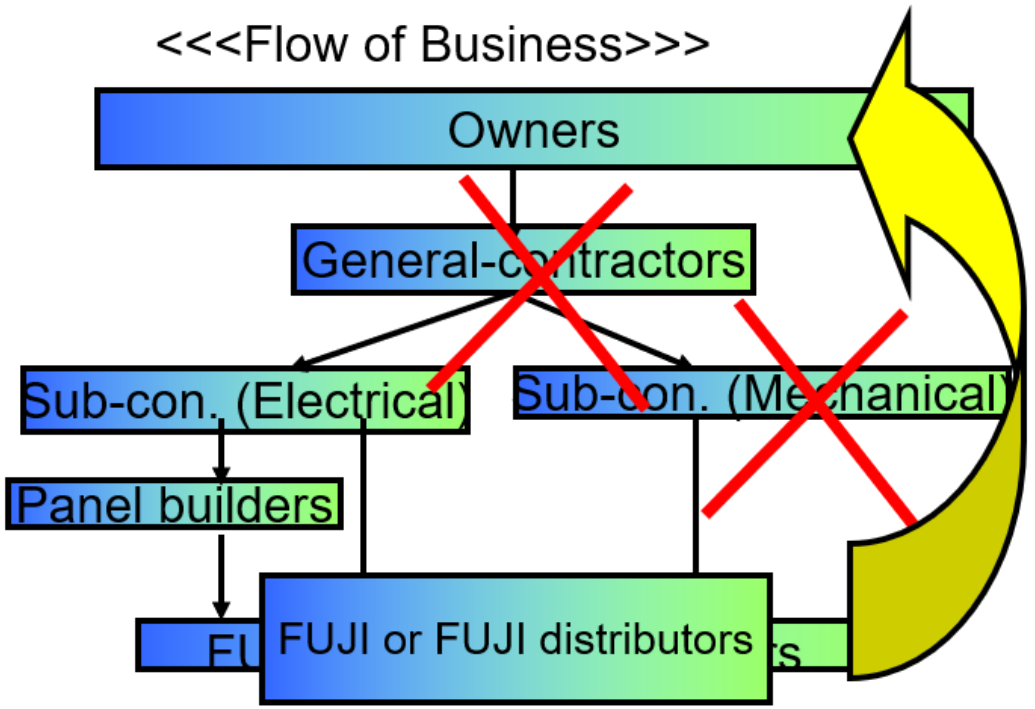
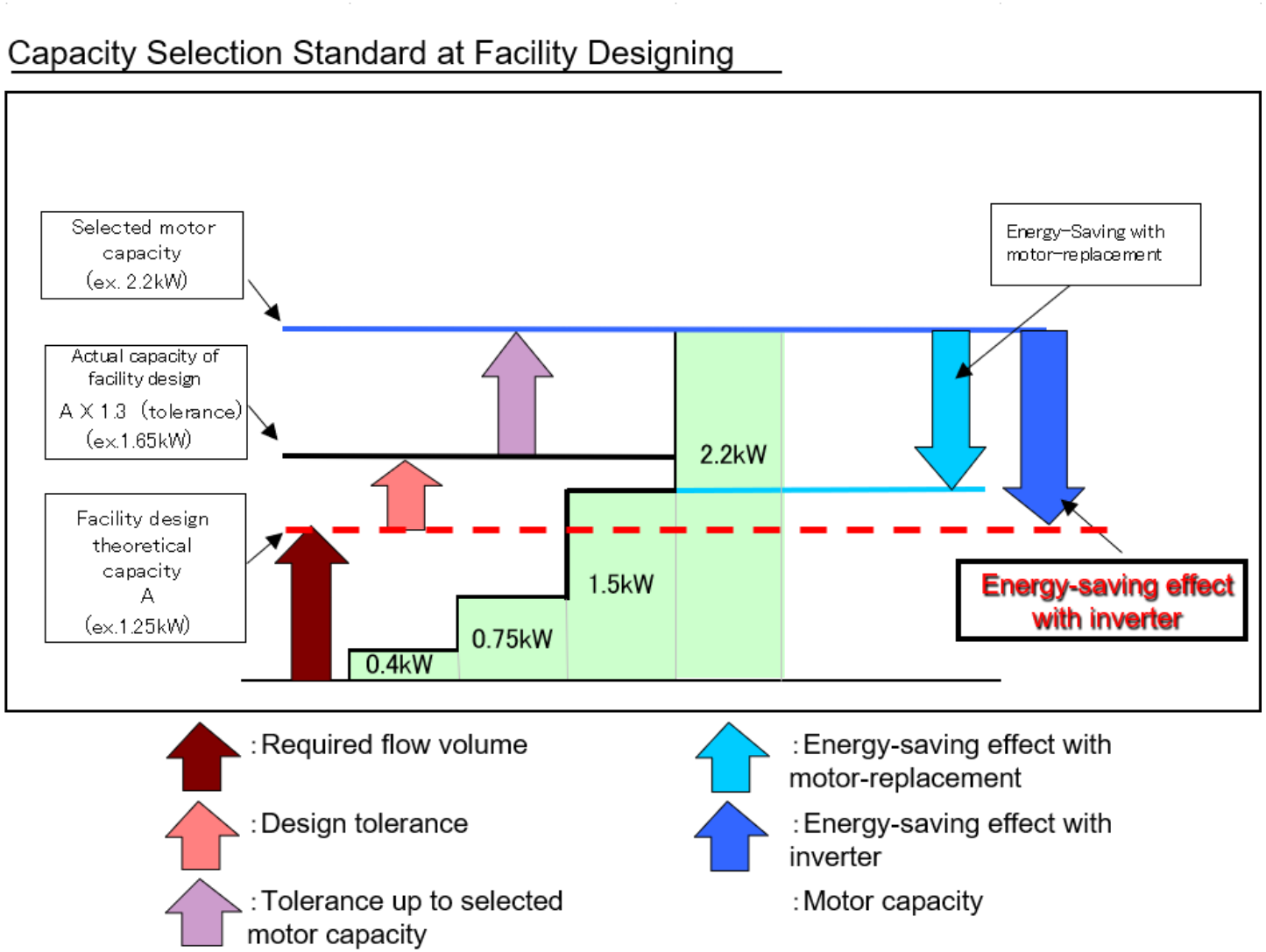
# 1)Idea

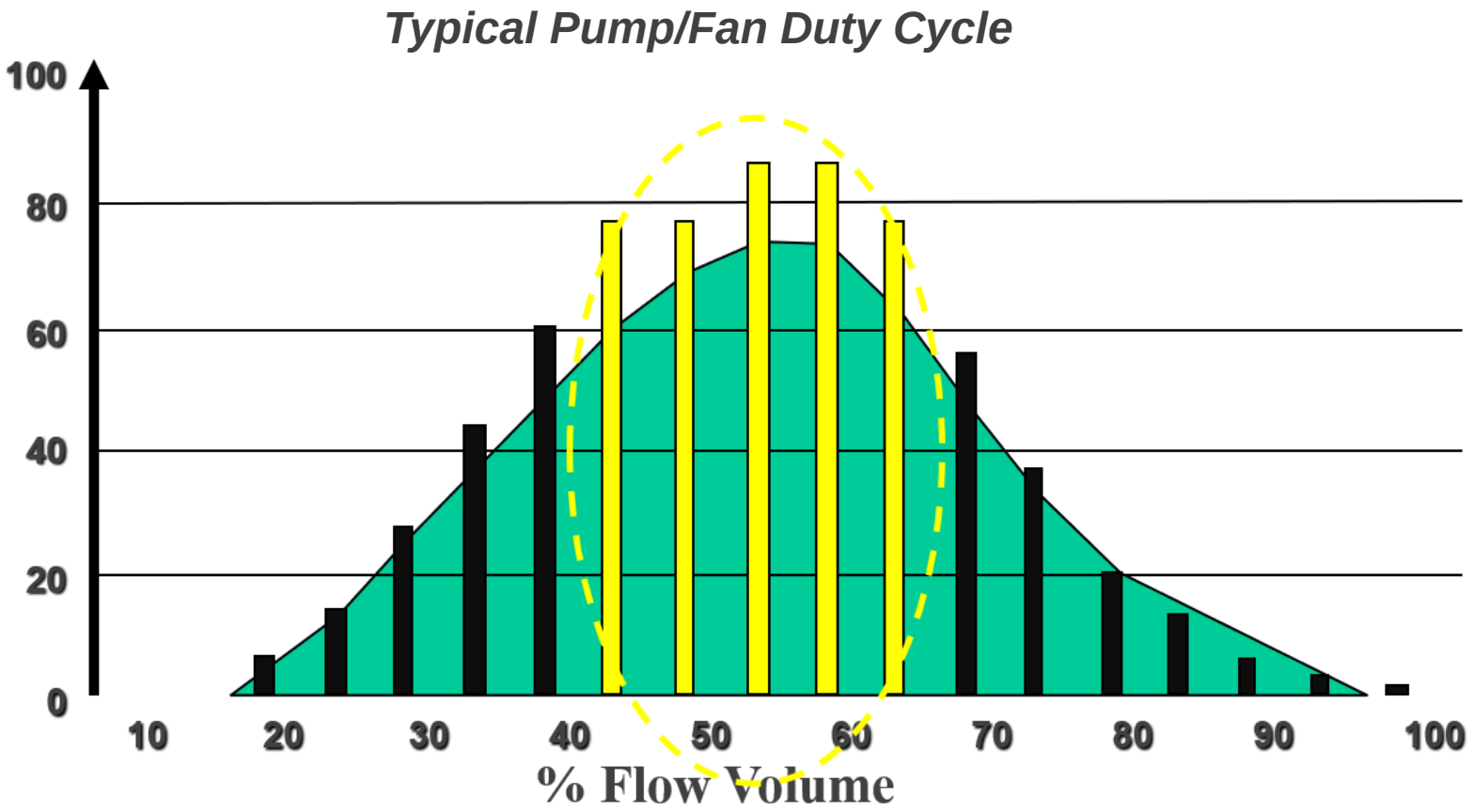
- Direct business to owners (existing factories)
- Owners get profit after saving electricity charge
- We provide panel with Inverter, DC Reactor and others



# 1)Idea


Capacity Selection Standard at Facility Designing
Selected motor capacity (ex. 2.2kW)
Actual capacity of facility design A X 1.3 (tolerance) (ex.1.65kW)
Facility design theoretical capacity A (ex.1.25kW)
Energy-Saving with motor-replacement
2.2kW
1.5kW
0.75kW
0.4kW
Energy-saving effect with inverter
: Required flow volume
: Design tolerance
: Tolerance up to selected motor capacity
: Energy-saving effect with motor-replacement
: Energy-saving effect with inverter
: Motor capacity

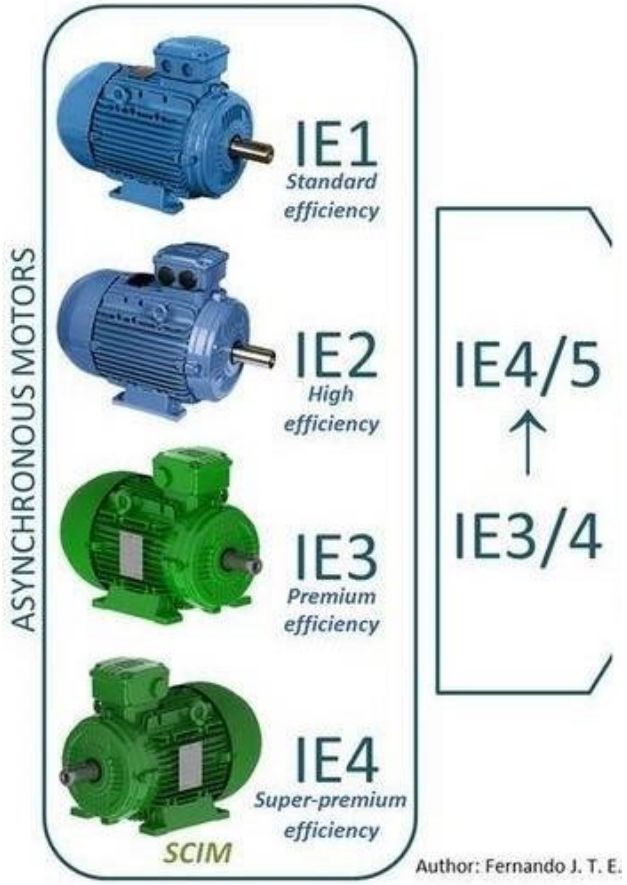
# 1)Idea




Source: Electric Power Research Institute

# 1)Idea

**New Efficiency Motors**




Efficiency optained with the replacement of **IE1/IE2 motors** with **IE4 motors** would be probably more than % 15-%20

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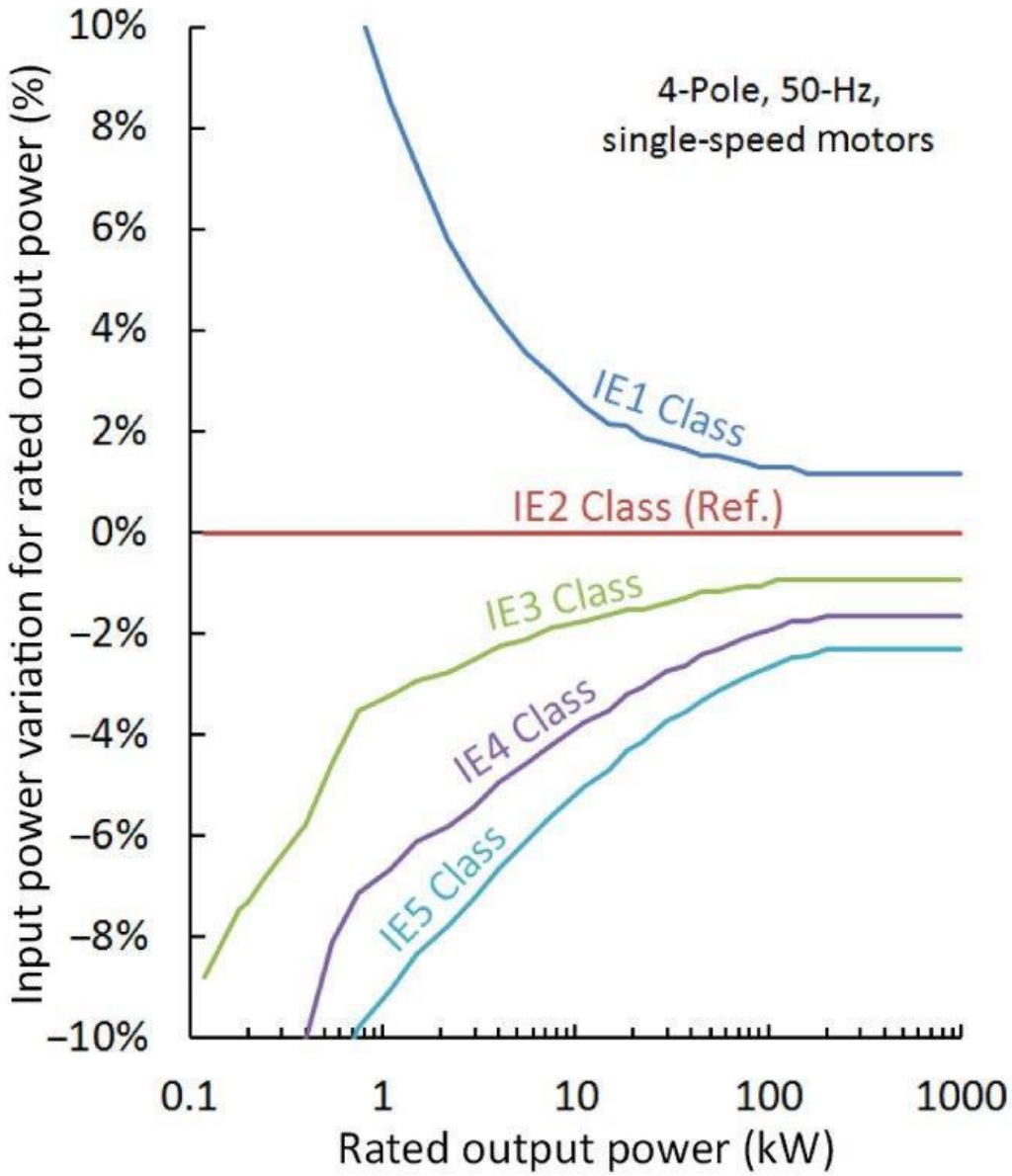
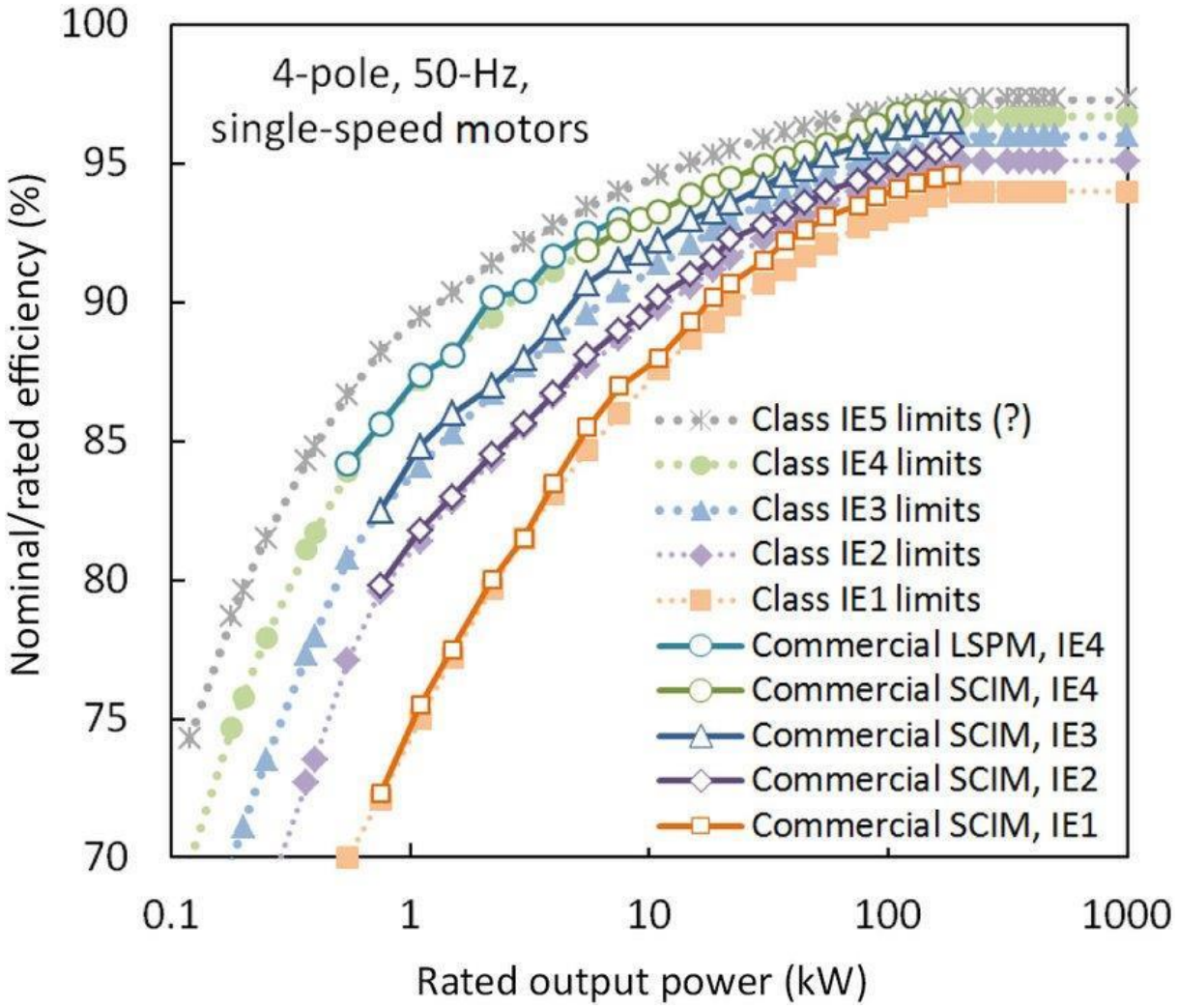
# 1)Idea

**New Efficiency Motors**



# 1)Idea

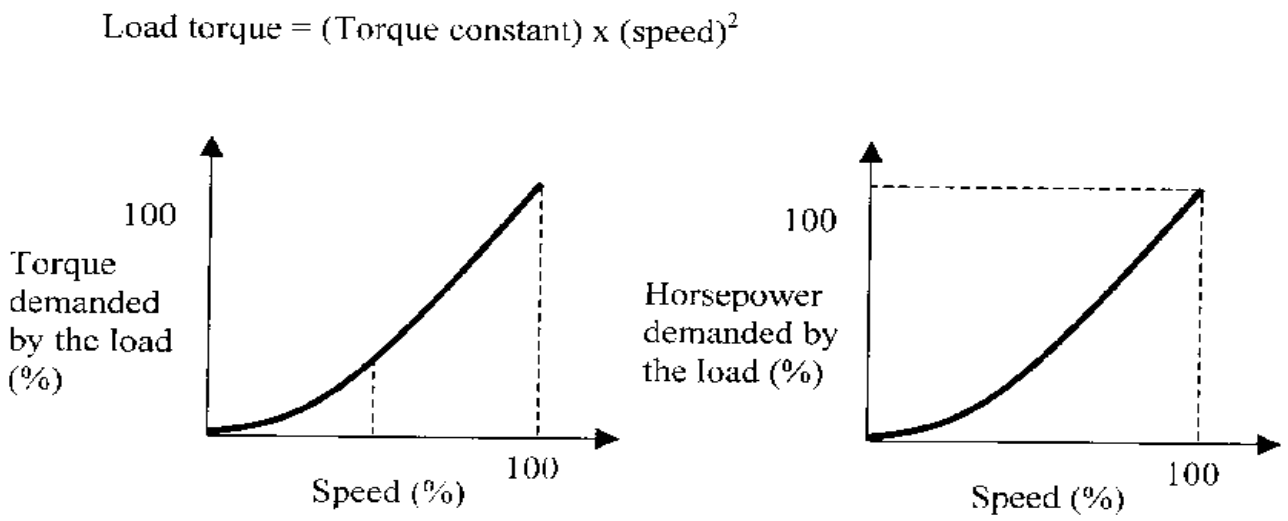
**New Efficiency Motors**




Most of the fan and pump motors could be easily replaced with Super-Premium efficient motors of **IE4**.

# 2. Engineering Background

- **Variable Torque Load Applications; Centrifugal Fans/Pumps, Blowers**



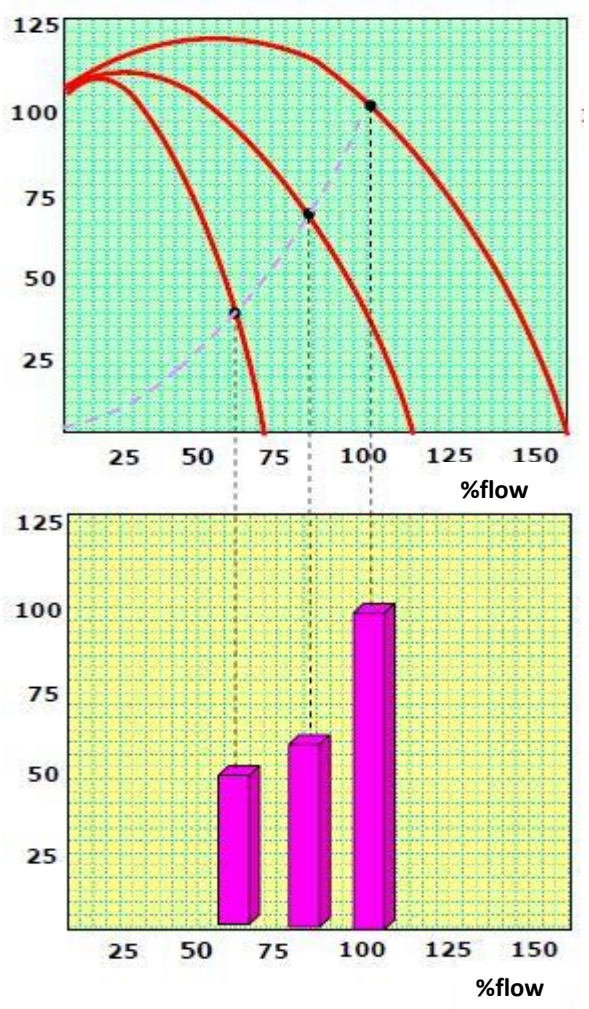

- $Q_1 / Q_2 = n_1 / n_2$
- $T_1 / T_2 = (n_1 / n_2)^2$
- $P_1 / P_2 = (n_1 / n_2)^3$

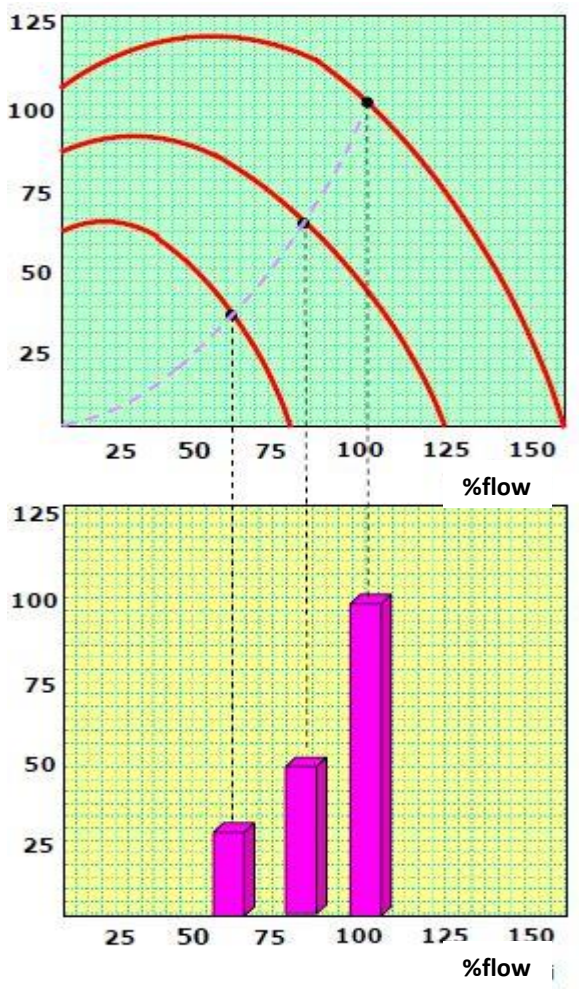
- Q = Flow
- T = Torque
- P = Power

- Torque varies directly with speed squared - Power varies directly with speed cubed

# 2. Engineering Background

Load Characteristic of Centrifugal Fans/Pumps

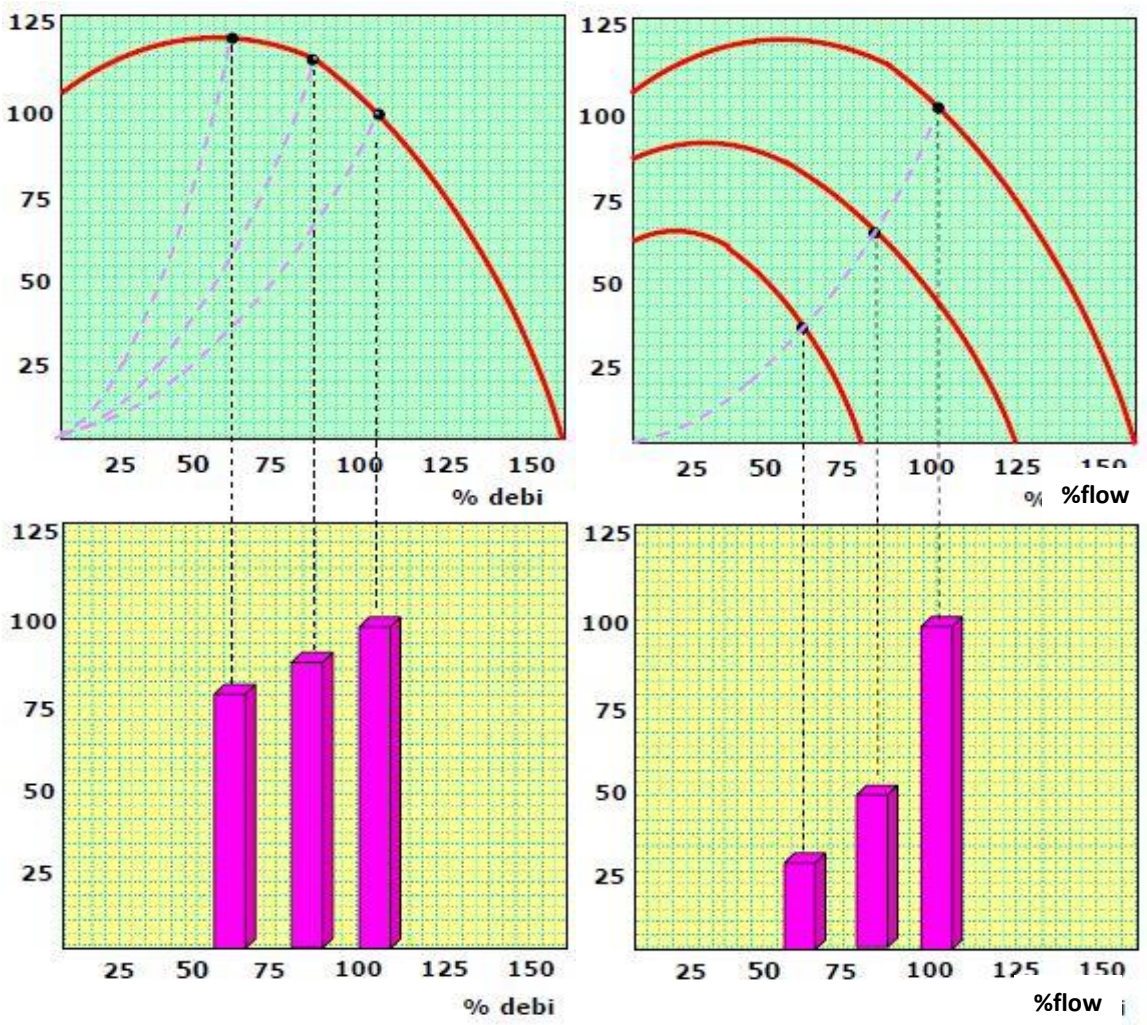



- Reducing a system by using a valve or damper is an inefficient method of control because the those devices dissipates energy which has been imparted to the fluid. A VFD simply reduces the total energy into the system when it is not needed.

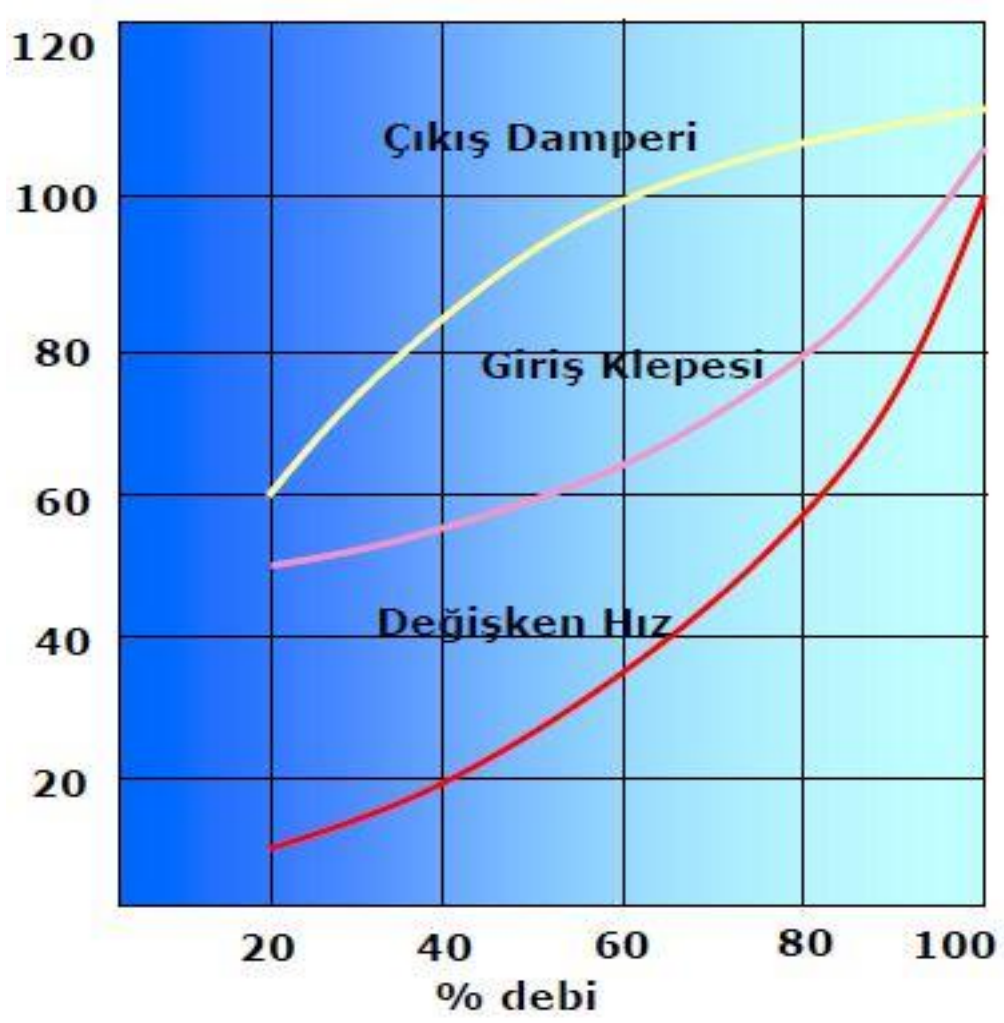
# 2. Engineering Background

Load Characteristic of Centrifugal Fans/Pumps




- In addition to the major energy saving potential, a drive also offers the benefits of increased process control often impacting on product quality and reducing scrap.

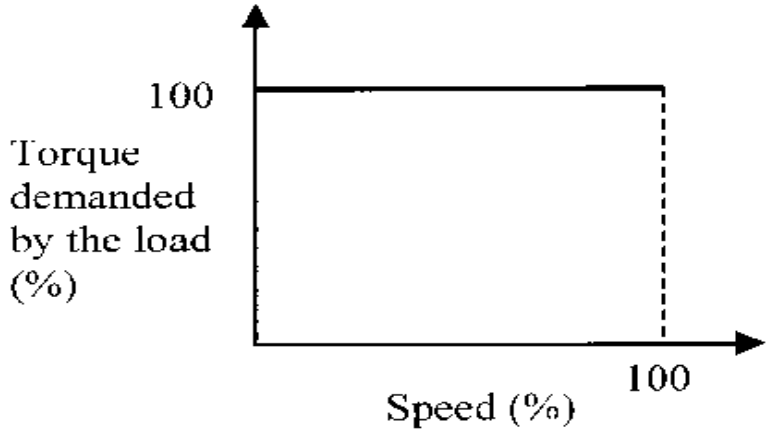
# 2. Engineering Background

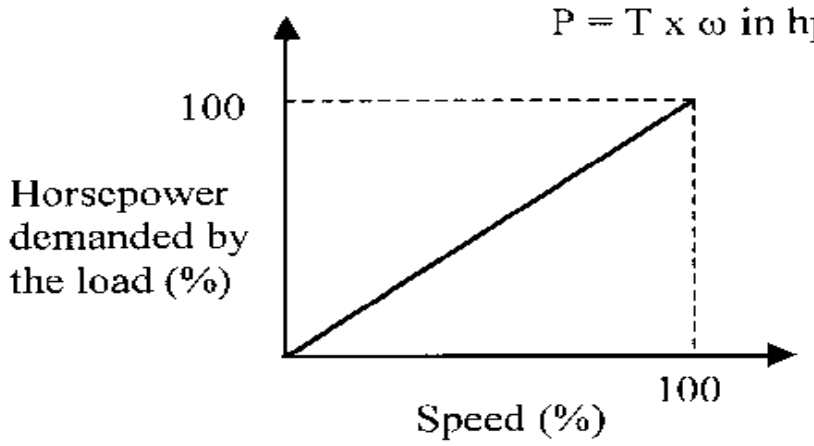



- If we summarize the control methods which mentioned previous slides, this graphic in the left side shows the differences of Energy Saving volume of the control method.

# 2. Engineering Background

- Constant Torque Load Applications; Mixers, Conveyors, Screw Compressors,Hoisting

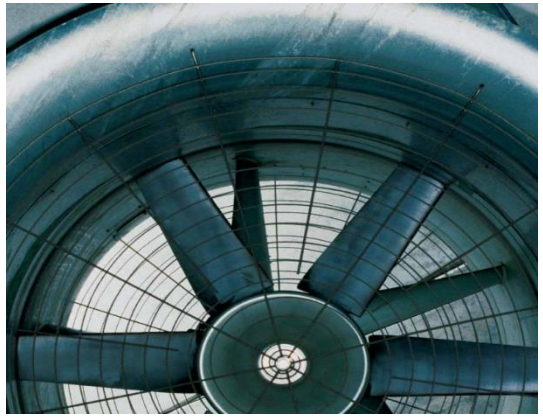



- $P_1 / P_2 = n_1 / n_2$
- In this group, the torque demanded by the load is constant throughout the speed change

- The application of a VFD to a constant torque or constant power load can cause motor overheating at reduced speeds because there is less air flow over the motor.

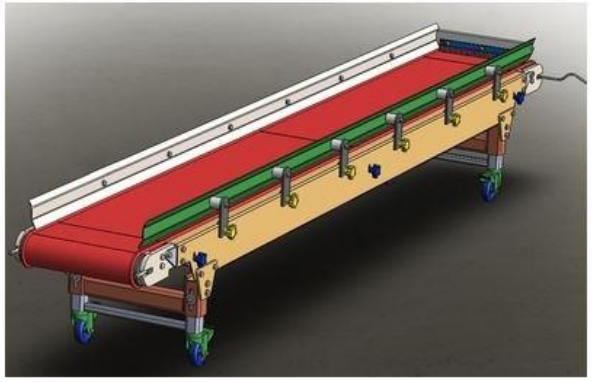
# 3. Typical Applications



Fans

Pumps

Screw Compressors



Conveyors

Industrial Mixers

# 3. Typical Applications

**The applications which suited for Energy Saving with VFD ;**

- **Variable Torque Load  Applications**
- **Constand Torque Load Applications**

# 3. Typical Applications

**Which applications we will consider?**

Water cooling towers

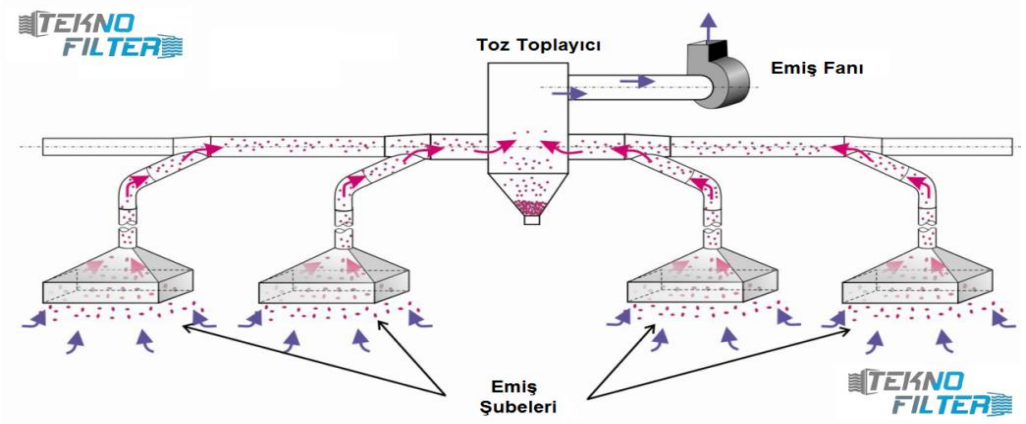
Water cooling towers can be one of the big applications in the facilities. According to factory requirements or ambient temprature, we can reduce the speed of the cooling fan motors with VFD solution. Besides the energy saving, the system can achieve lots of extra functionalities for the process like PID control, auto/manual operating switch or tracing the water temp on the drive display..

VFD controlled Cascade Cooling Fan Applications ( P.Feedback : T )
VFD controlled Circulation Pump Applications ( P.Feedback : P )

# 3. Typical Applications

## Which applications we will consider?

Dust Collector System

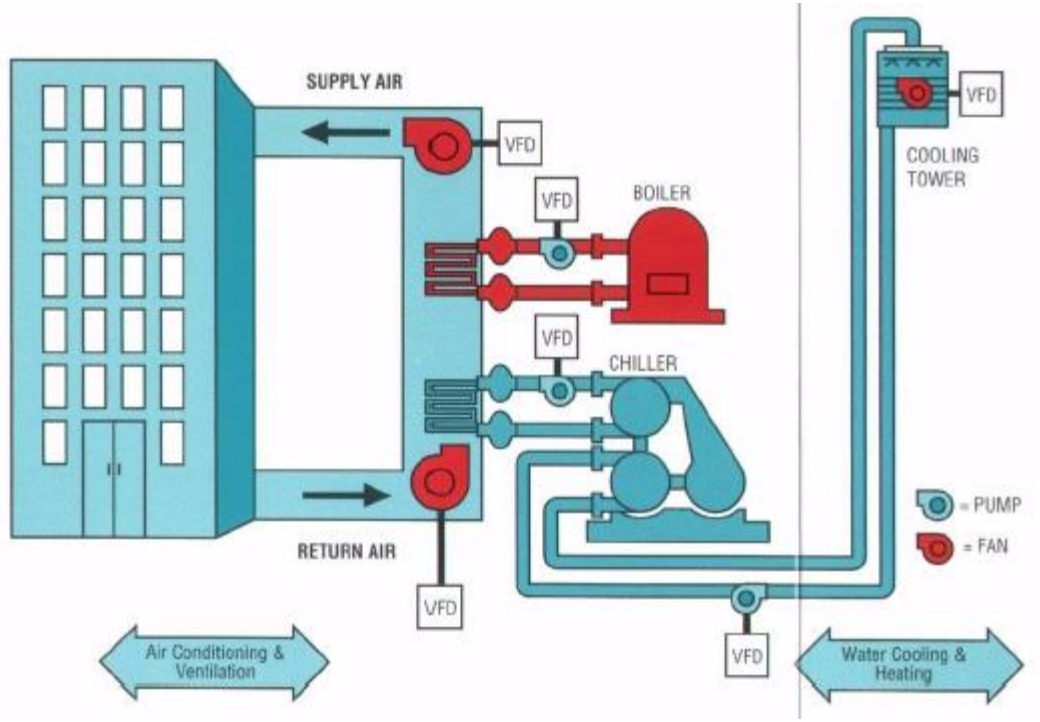



Any facility that handles materials in the solid form will generate dust by abrading the solid. But some periods of producing the system do not need the suction too much. With VFD solution the factory can get energy saving for this application. Additionality to energy saving, the system can achieve lots of extra functionalities for the process like warning of full of the dust collector, output for the changing the filters..

P.Feedback : P

# 3. Typical Applications

**Which applications we will consider?**




HVAC System

The acronym, HVAC, is an abbreviation for Heating, Ventilation and Air Conditioning. These are the various systems responsible for ventilating, heating and cooling commercial or residential facilities. The primary purpose of this system is to improve indoor air quality and provide the perfect temperature for comfortable living.

Besides the energy saving, the system can achieve lots of extra functionalities for the process like fire mode, ageing the fan or pump motors in the same period and protect the pump from dry operating..

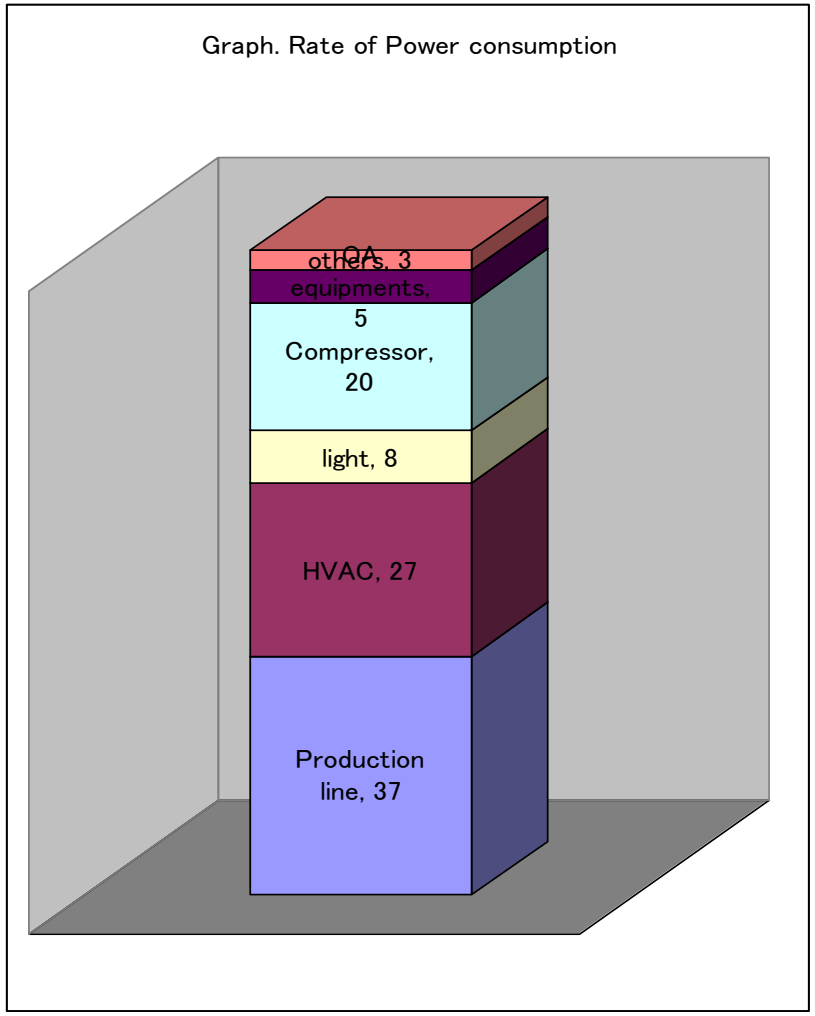
# 3. Typical Applications

## Which applications we will consider?

Pump System

Applications with highest energy savings potential are centrifugal pumps and fans (power is proportional to speed cubed), pumping applications (water systems, centrifugal chillers, chemical/petrochemical industries, pulp and paper plants and food industries) and replacing damper controls in air handling and ventilation applications.
Instead of operating a second pump for temporary service when extra pressure is required, using a larger capacity single pump under VFD control to meet the exact requirements at all times.

# 3. Typical Applications




Electrical Energy Consumption Characteristic of an Industrial Factory from the figure we see almost %50 of the electrical Energy mostly consumed in HVAC and compressor loads

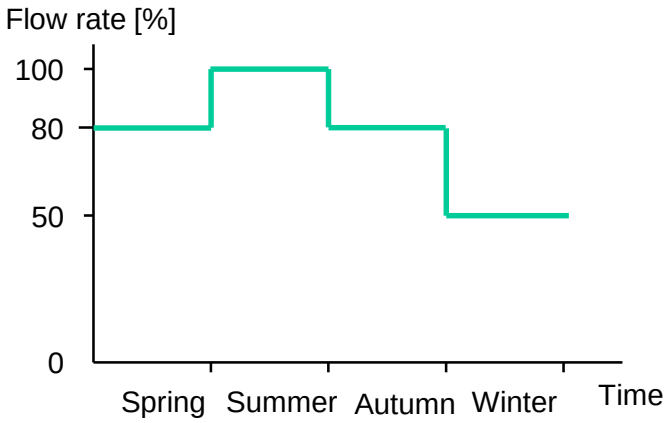
# 3. Typical Applications

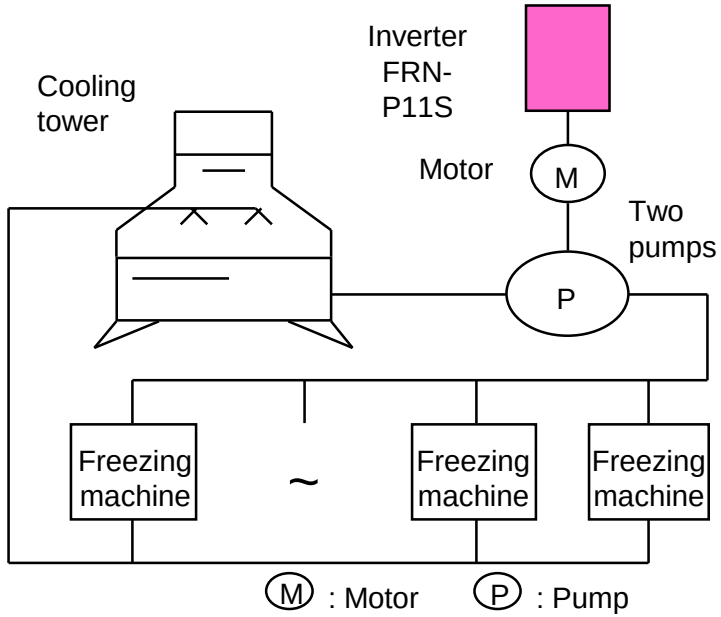
| Application to showcase cooling water circulating pumps | Inverter |
|---|---|

## Content of improvement

The control of cooling water flow is changed from the conventional valve to the control of the rotational speed of the pump by the inverter.

- Pump
  7.5kW x 2 units
- Compressor for freezing machine
  1.5kW x 3 units
  7.5kW x 3 units
- Operation pattern



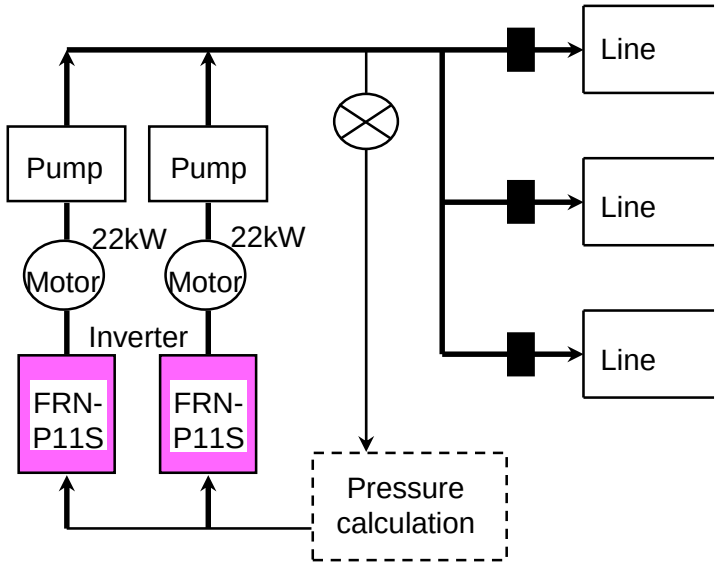

| Energy saving effect | |
|---|---|
| Energy saving amount | 274,173kWh/year |
| Energy saving rate | 37.5% |
| Money saving effect | US$41,126/year<br>(US$0.15kWh) |
| Equipment investment cost | US$59,020 |

# 3. Typical Applications

## Application to concentrated coolant pumps — Inverter

Content of improvement

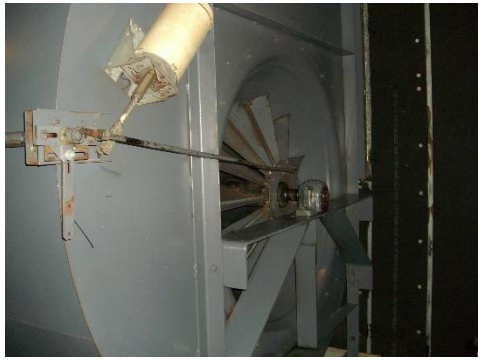
- Though the coolant pump has been driven at the constant speed (by commercial power supply) even when the processing device has stopped so far, the rotational speed of the pump can be decreased by using the inverter when the processing work is not done.
- To supply the coolant fluid from one place to two or more processing lines collectively, the rotational speed of the pump can be controlled according to the processing work status of each line. Install magnetic valves in each line for this purpose, and connect a pressure sensor on the coolant pump side piping.
- The piping pressure rises when the magnetic valves attached to each line are closed while stopping the processing working. The inverter can automatically decrease the frequency to make this pressure constant, and as a result energy saving be achieved.



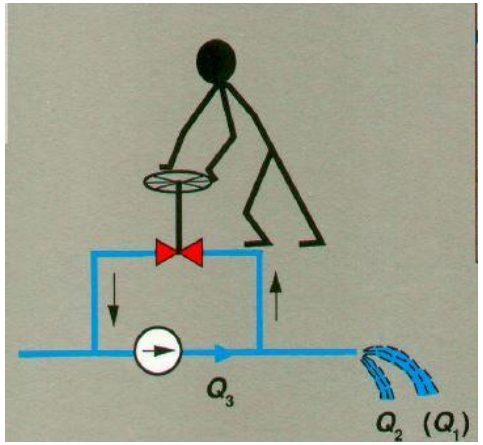

| Energy saving effect | |
|---|---|
| Energy saving amount | 700,000kWh/year |
| Energy saving rate | 40% |
| Money saving effect | US$10,500/year (US$0.15kWh) |
| Equipment investment cost | US$19,070 |

# 4. Roadmap

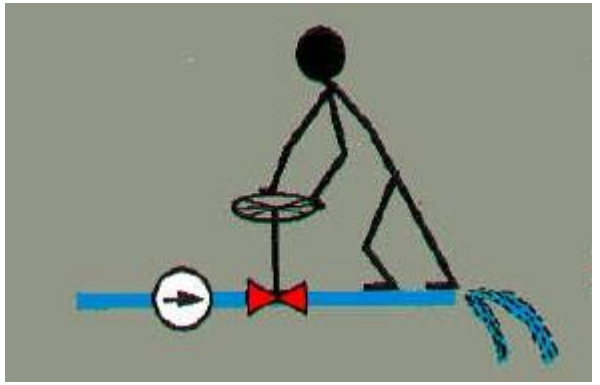
1) **Determination of the pumps/ fans, compressors which because of the process requirement have been operating with the variable flow and with a conventional method.**



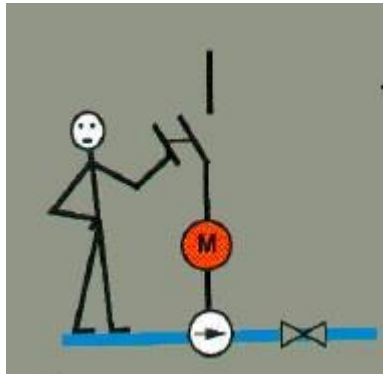
Inlet vane fan control




By-pass vane pump control



Outlet vane pump control




On-off pump control

Outlet damper fan control

# 4. Roadmap

**2) Logging the data of energy consumption of the system that added the energy saving solution (VFDs, pressure switch, flow switch ..etc) with analyzer**

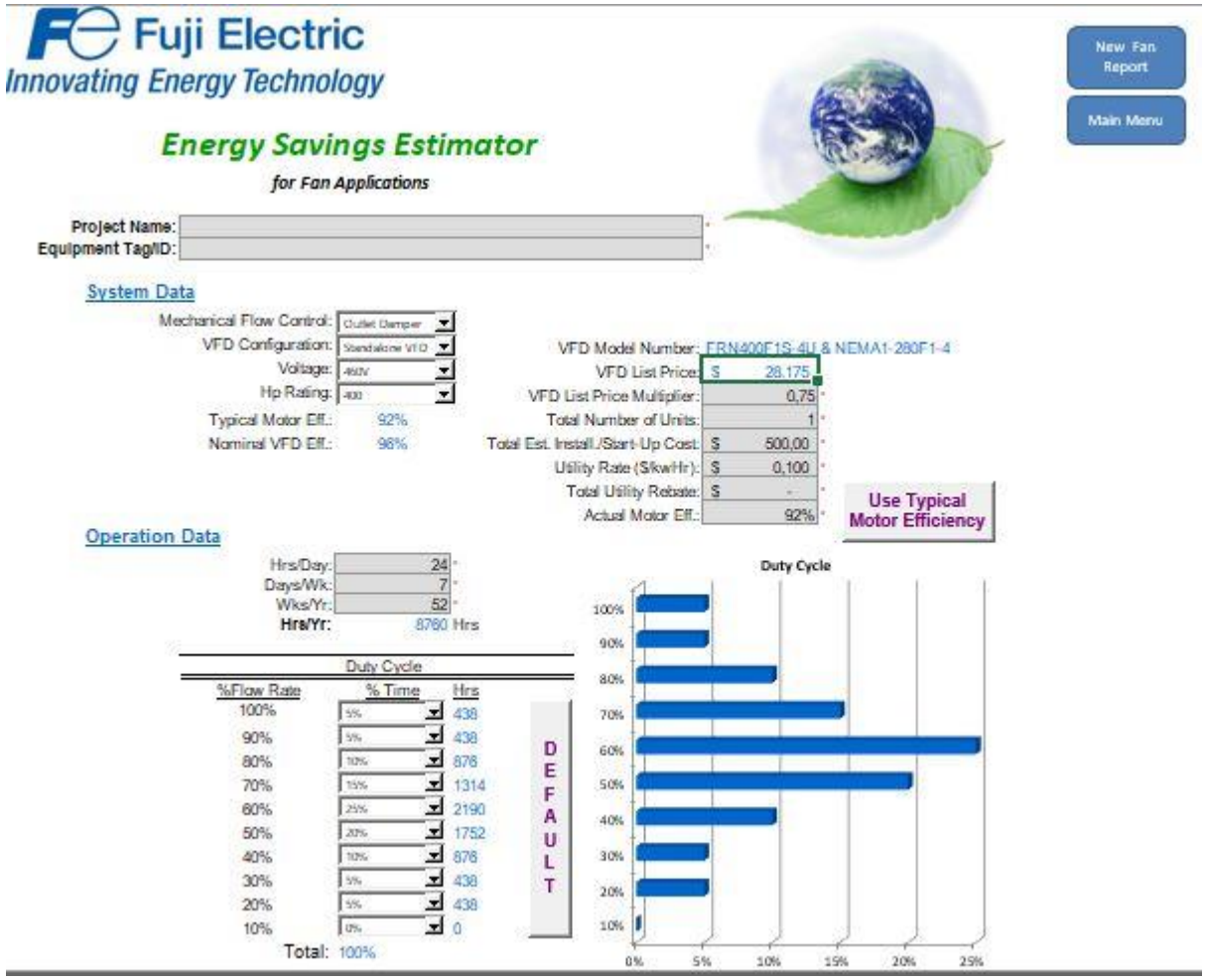

# 4. Roadmap

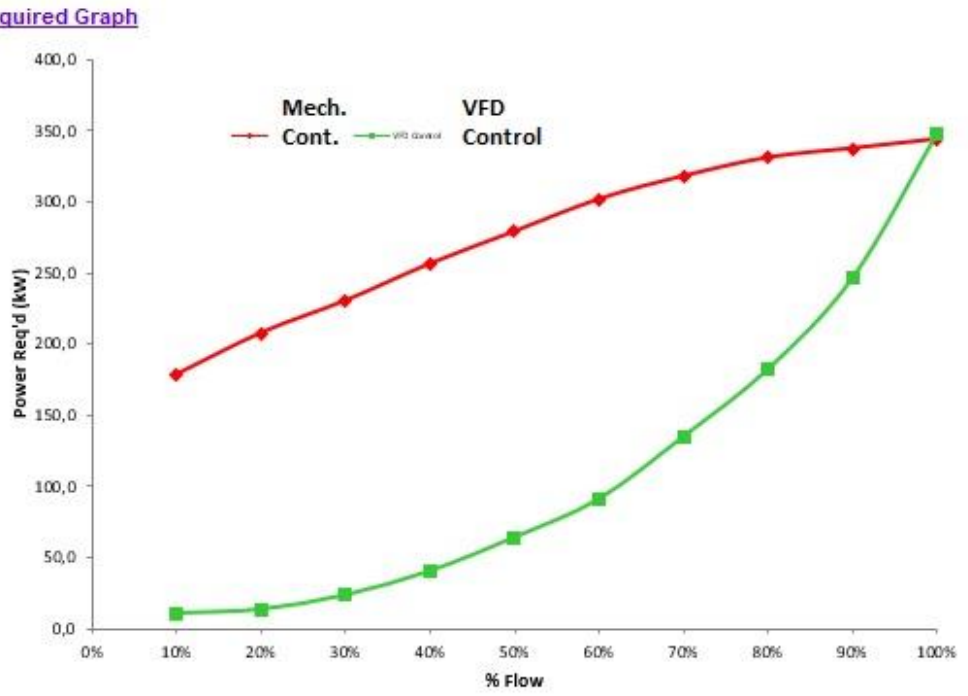
### 3) Logging the data of energy consumption of the existing system with analyzer


- Electrical consumption data will kept in the analyzer during the related period

# 4. Roadmap

## 4) Comparing /analyzing the reports and calculating annual energy saving.



# 4. Roadmap

**5) Presenting the investment cost (energy saving products, installation and start-up costs)**

**Payback Analysis**

| | 1st Year | 2nd Year | 3rd Year |
|---|---|---|---|
| Mechanical System(s) Annual Energy Cost: | $ 1.285.682 | $ 1.285.682 | $ 1.285.682 |
| VFD System(s) Annual Energy Cost: | $ 480.947 | $ 480.947 | $ 480.947 |
| Annual Energy Savings: | $ 804.735 | $ 804.735 | $ 804.735 |
| VFD Cost: | $ 105.656 | $ - | $ - |
| Installation/Start-up Cost: | $ 500 | $ - | $ - |
| Utility Rebate: | $ - | $ - | $ - |
| **Total Savings:** | **$ 698.579** | **$ 804.735** | **$ 804.735** |
| **Simple Payback:** | **0,13** Years | | |

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# 5. References & App.Infos

- **Zorlu Textile** (Bursa and Çorlu city facilites): The VFD solutions has adopted to HVAC, water pumps , Turbocharger coolant pumps applications. 15 kW – 160 kW

ZORLU HOLDİNG TEKSTİL GRUBU

- **Beksa / Enerji-Sa** (İzmit city facility): Cooling water pump groups and cooling tower fans of machines. Cooling fans and compressors. 7,5kW – 200 kW

ENERJİSA

# 5. References & Applications

- **Philip Morris**; İzmir facility

Cooling fans

7,5 kW – 18,5 kW

PHILIP MORRIS INTERNATIONAL

- **Yeniköy Thermal Power Plant**; İzmir facility

Water Pumps

45 kW – 160 kW

# 5. References & Applications

- **Kroman Steel&Iron**; İstanbul facility

Rolling Mill applications

515 kW – 1000 kW

- Lots of DC system has switched to AC solution. When we consider the power factor of the DC motor at low speed, this factory has saved their energy thanks to an almost constant power factor AC motor during all speed.

# 5. References & Applications

- **Çayırova Boru**; İstanbul facility

Water Cooling Tower

7,5kW

ÇAYIROVA BORU

All proces handled by the VFD (no need controller). Only one temprature (PTC) sensor was used for two drives.

- Sleep/wake up
- Tracing the temp of water on the display
- With PID control energy saving.