

GROUND-MED PROJECT

Circulators

(Based on EuP Study)

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Circulators – Present and Future

Circulators in buildings are used primarily for pumping water in central heating systems, with <4% used for other applications such as solar water heating or chilling systems.

There are an estimated 140Million circulators in the EU-25, with few used outside of Europe. The total energy use of circulators in EU-25 is 53.2 TWhpa

The revised efficiency levels (represented by Energy Efficiency Index or EEI values) are as follows:

www.energypluspumps.eu

Class	Energy Efficiency Index (EEI)
A**	$EEI < 0.20$
A*	$0.20 \leq EEI < 0.30$
A	$0.30 \leq EEI < 0.40$
B	$0.40 \leq EEI < 0.60$
C	$0.60 \leq EEI < 0.80$
D	$0.80 \leq EEI < 1.00$
E	$1.00 \leq EEI < 1.20$
F	$1.20 \leq EEI < 1.40$
G	$EEI \geq 1.40$

ECONOMIC AND MARKET

Country	Production Quantity	Value (Euros)		
	Units pa	Production	Export	Import
France	10,262,534	270,146,000	238,885,040	59,901,510
Netherlands			2,073,900	20,607,740
Germany	1,516,504	313,831,916	245,329,390	165,604,050
Italy	694,556	30,246,000	27,160,290	97,894,800
United Kingdom	2,584,894	917,434	41,590,270	37,404,050
Ireland			11,546,270	7,438,830
Denmark	3,898,139	150,414,125	149,440,880	10,445,180
Greece			10,544,210	15,673,440
Portugal			110,480	4,617,170
Spain	5,438	1,628,808	697,130	12,216,000
Belgium			1,351,780	13,031,820
Luxemburg			143,060	3,428,780
Sweden	173,258	83,832,309	9,640,720	20,373,550
Finland			332,280	1,767,380
Austria			1,373,340	15,369,130
Estonia			165,950	1,067,920
Latvia			870,110	2,003,580
Lituania			372,010	2,417,950
Poland			938,450	27,547,100
Czech Republic			1,791,320	12,799,260
Slovakia			735,060	15,022,120
Hungary			15,460,260	13,320,860
Romania			1,778,110	11,058,420
Bulgaria	189	85,898	41,480	2,690,880
Slovenia			7,106,380	4,227,820
EU-27 Total	19,135,512	861,478,642	135,219,460	16,334,830

The annual market for circulators is considered to be 14M pa, comprising:

- Standalone (small) circulators 5.5M
- Boiler integrated circulators 7.5M
- Standalone (Large) circulators 1.0M

It is estimated that the circulator market will increase at the rate of 1.4%pa to 2020.

Circulators Technologies

Range in size from 25W – 2500W, and are always sold as an integrated pump: motor assembly.

Three different improved technologies identified;

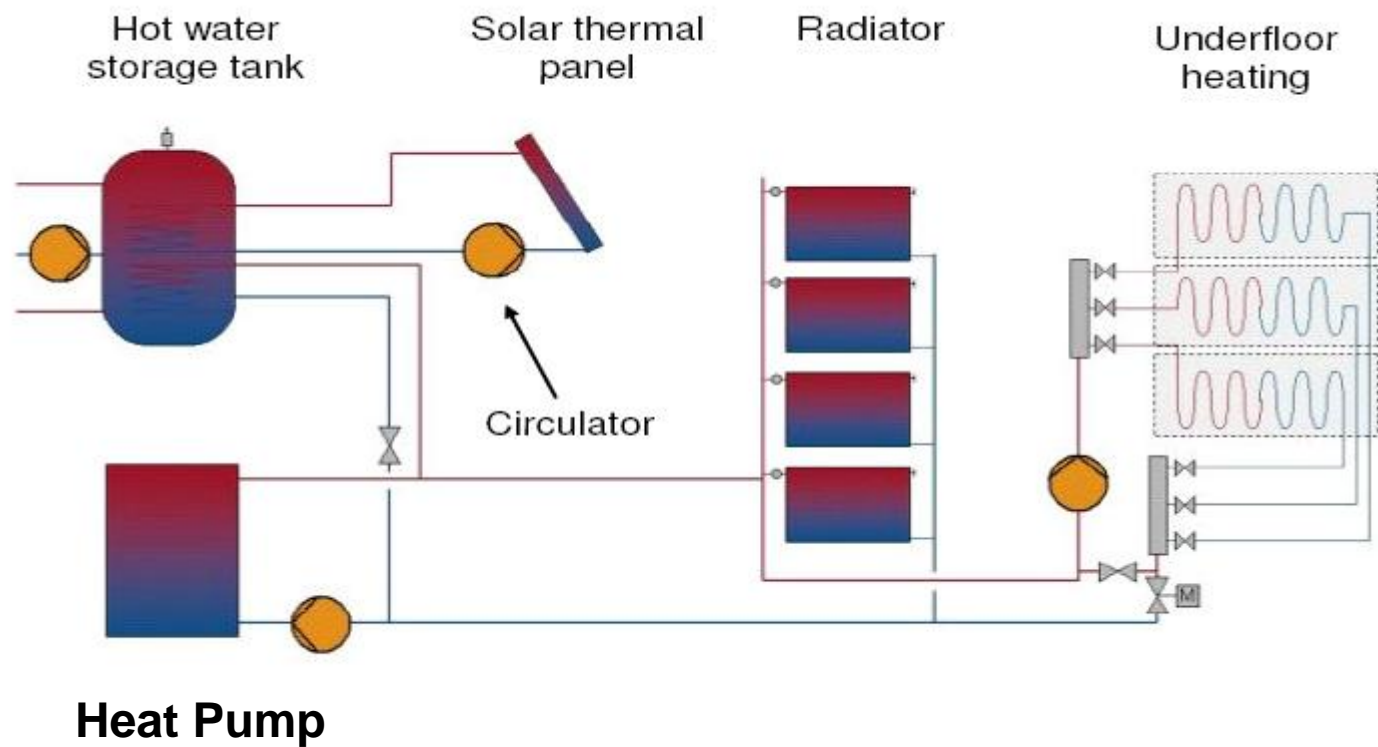
- Improved (standard) circulator

- Variable speed (induction motor)

- Variable speed (permanent magnet motor).

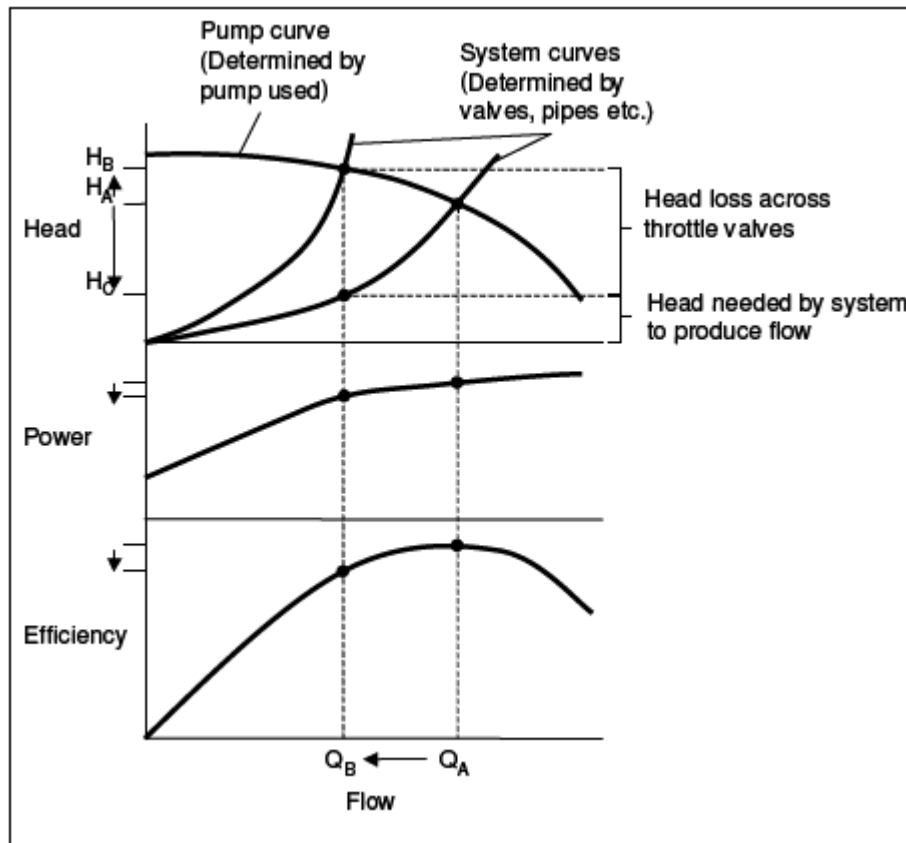
Consumer Behavior and Local Infrastructure

- **System Topology**



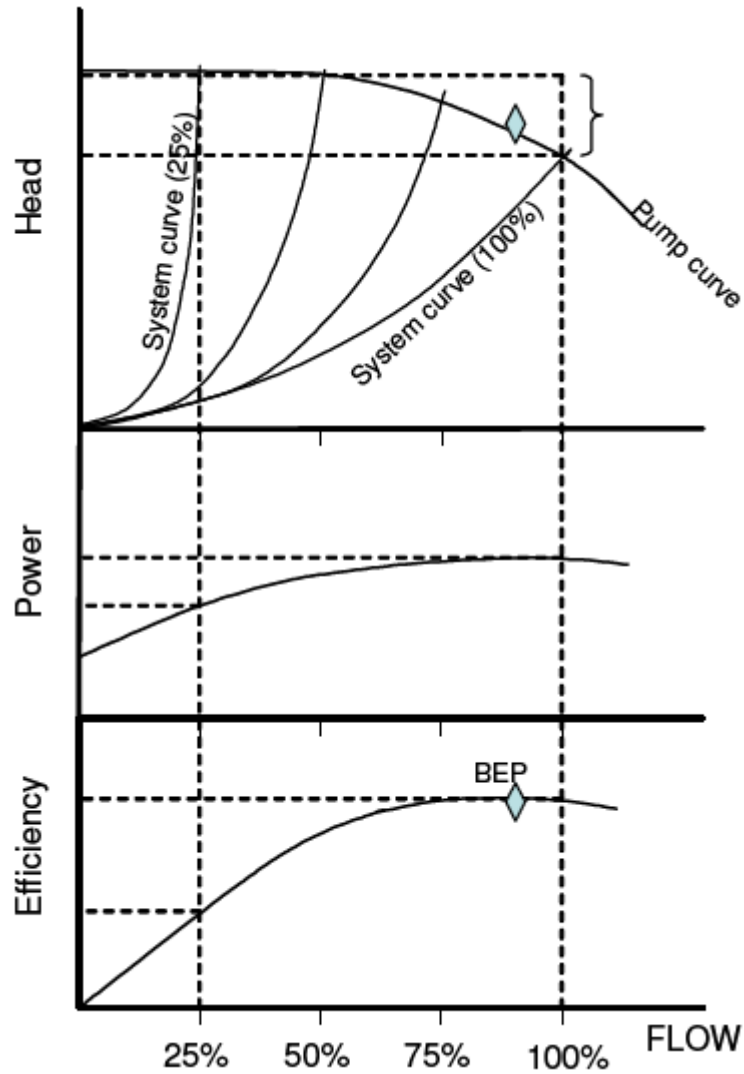
Real Life Efficiency

- Hydraulics and control devices

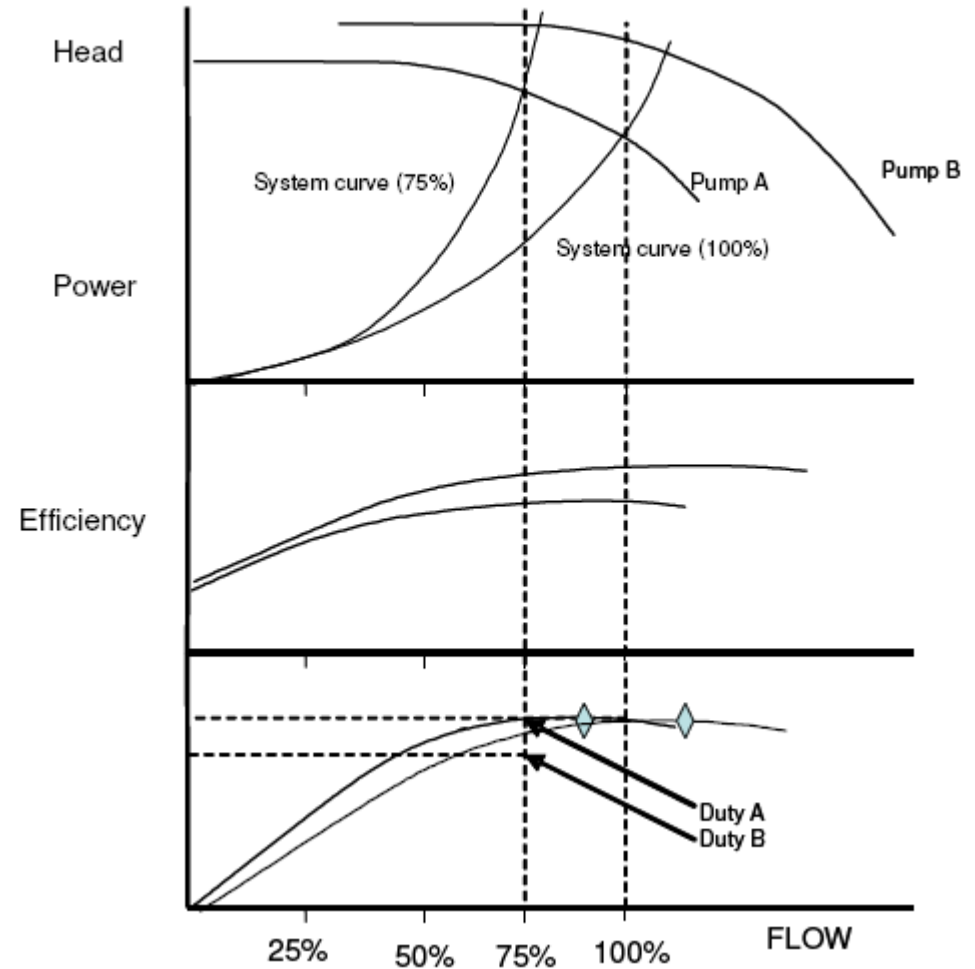


Regional climatic variations within the EU will affect heating demand.

System Hydraulics and Circulator Sizing



Circulator performance characteristics with varying load



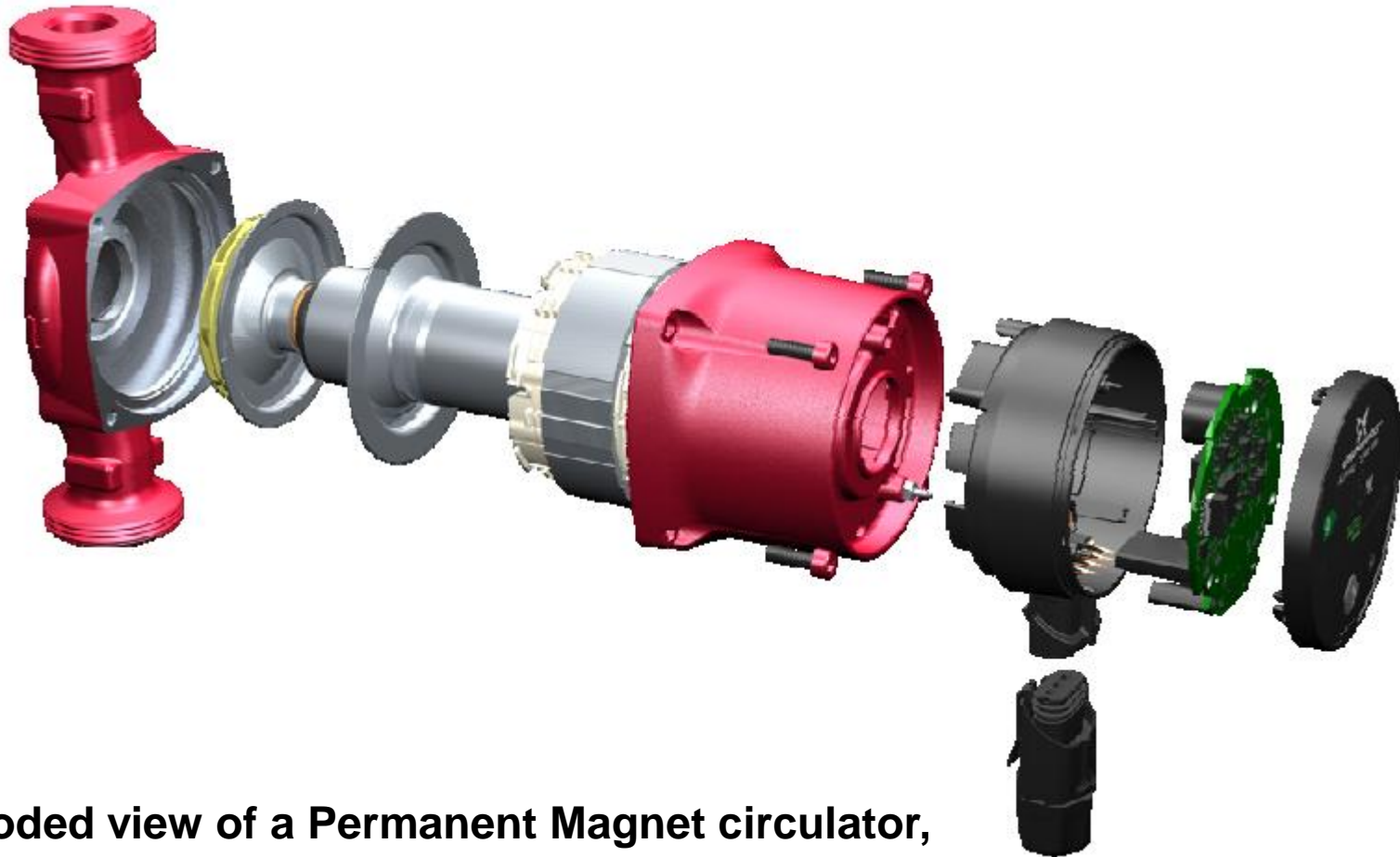
Affect of circulator sizing

Circulator Typical Load Profiles

Small standalon	Boiler integrated	Large standalon	Control mode	25 % flow	50 % flow	75 % flow	100% flow	Split, by type of control (%)	Operating Hours pa
X	X	X	Continuous (Blauer Engel Distribution)	44	35	15	6	70	5000
X	X		On/Off control - room thermostat controlled	0	0	0	100	15	2300
X	X		On/Off, TRV controlled	44	35	15	6	15	2300

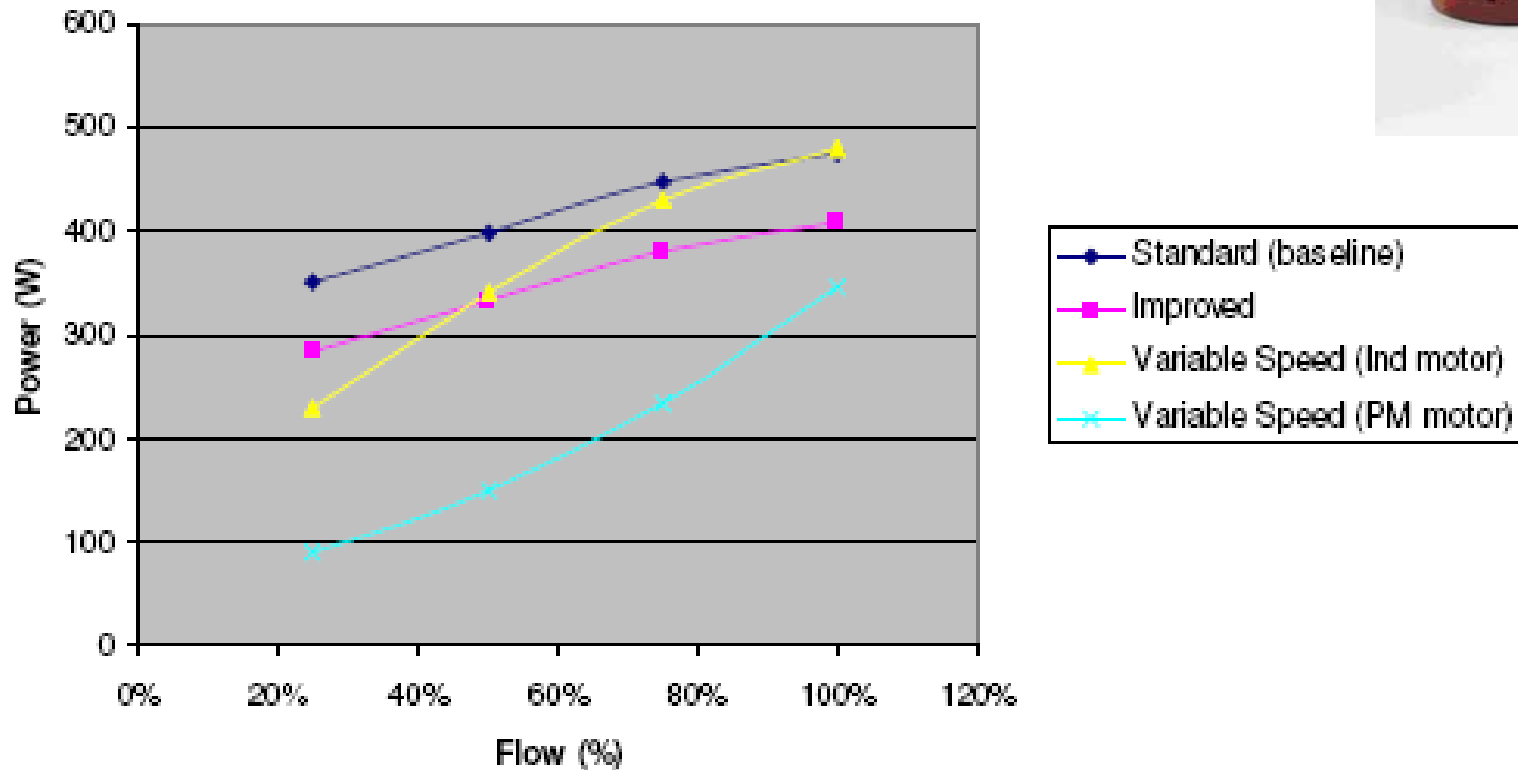
Flow pattern data used in the model and relative energy consumption

Permanent Magnet Circulator

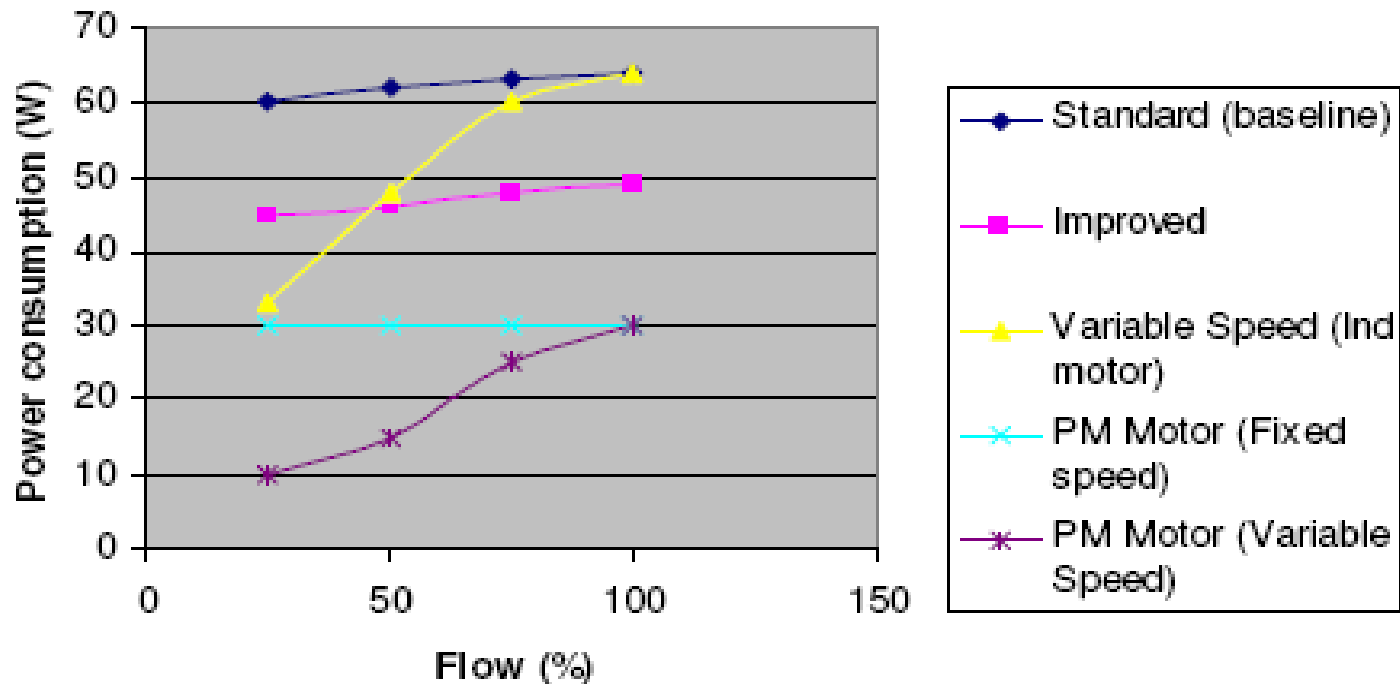


Exploded view of a Permanent Magnet circulator, showing the additional electronics and PM motor.

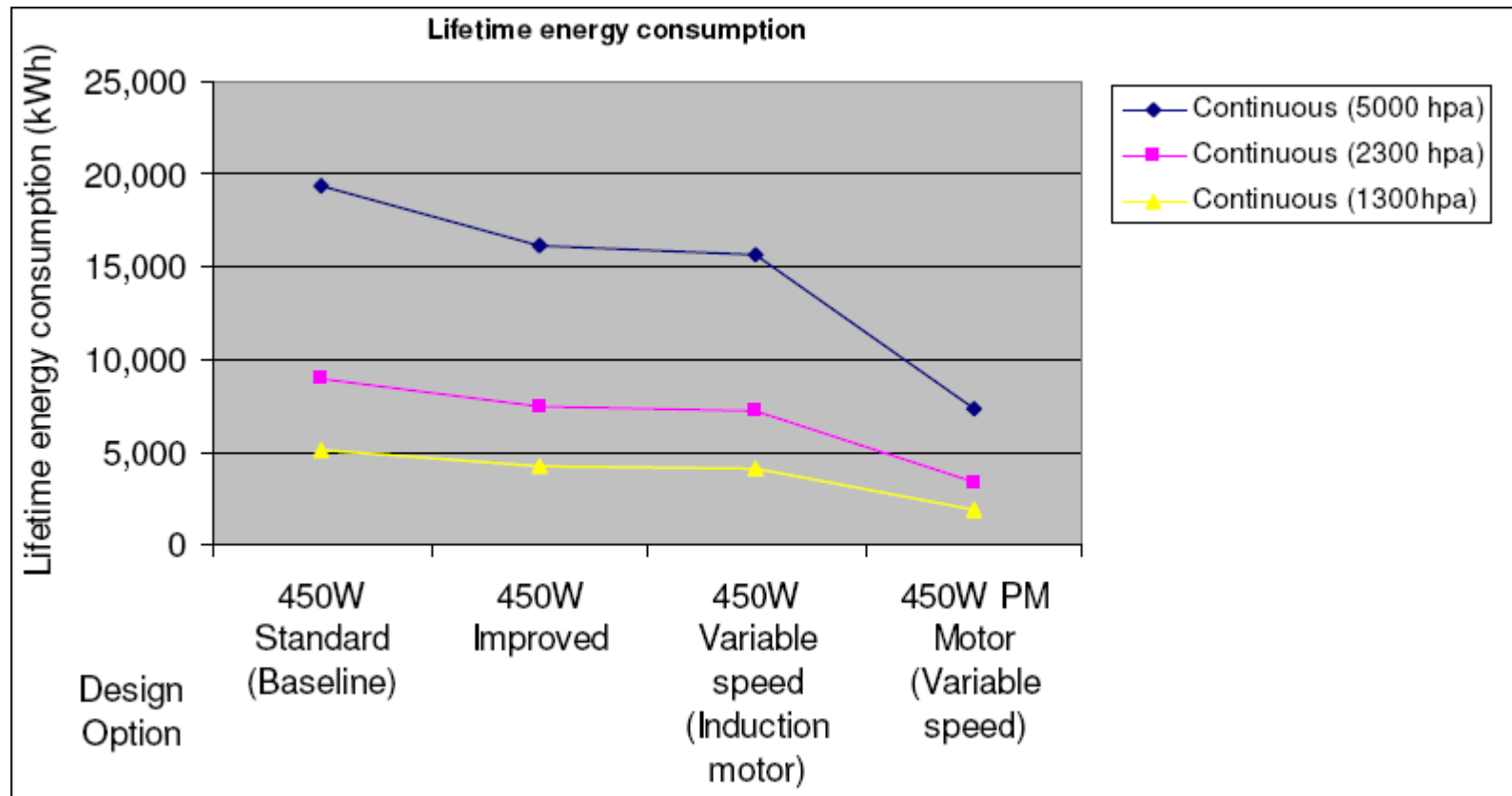
Large Circulator (450W) Performance



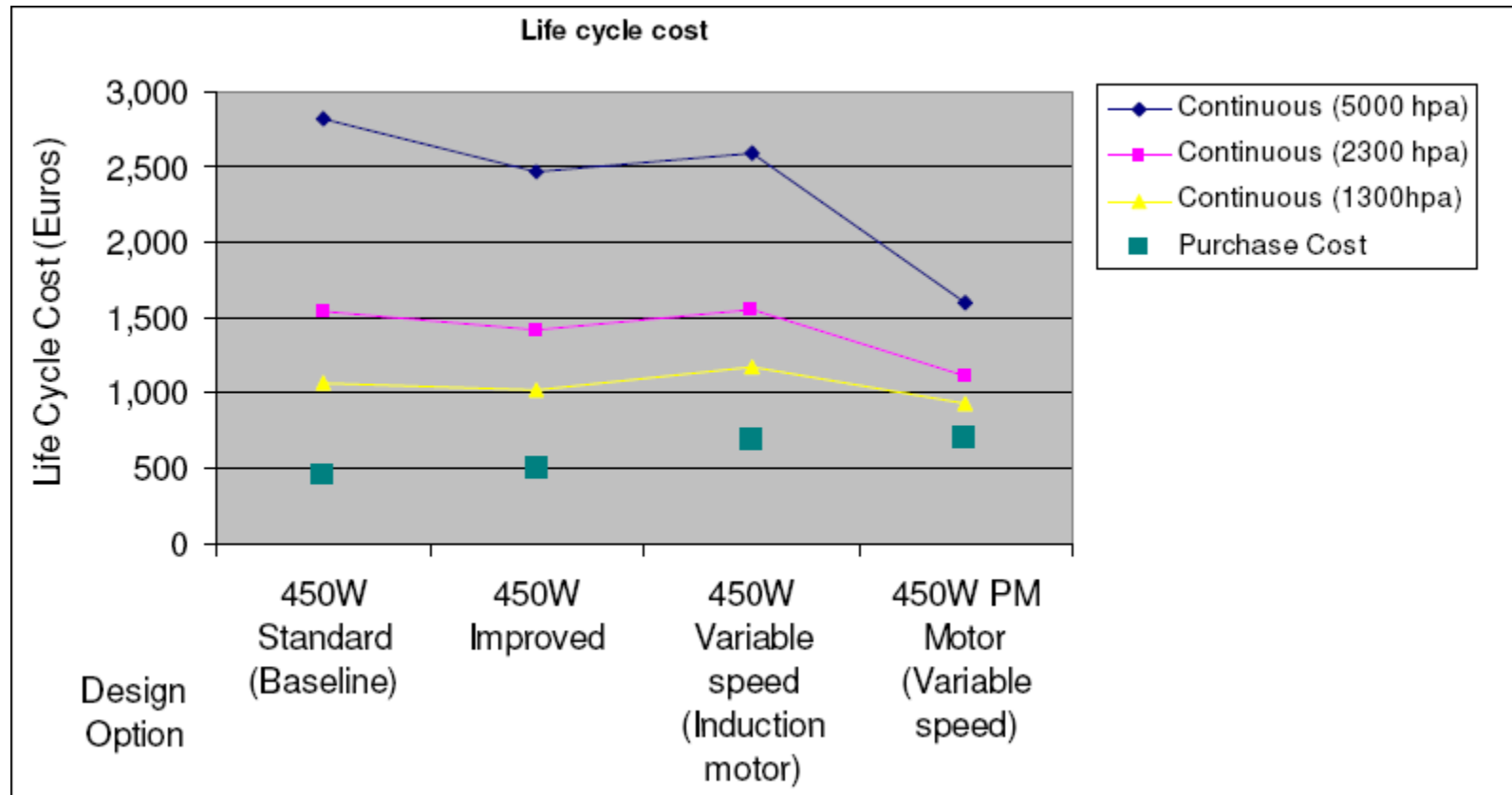
Small Circulator (65W) Performance



Lifetime Energy Consumption (450W)



Life Cycle cost (10 years)



Life cycle cost curves for different circulator options under different operating scenarios, 0.135 euros/kW. 10 year life