Anticipated Motor Replacement

Methodology/Methodologies

PA lead (Organisation)

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PA#3 – Anticipated motor replacement

- Definition:
  - *Replacement of old inefficient electric motors before their end-of-life.*

- Scope:
  - **Sector:** Industry / Tertiary
  - 3-Phase Motors in the scope of The Ecodesign Regulation (EC Regulation 2019/1781)
    - Only between 0,75kW and 1000kW (exclude “small motors”)

PA#4 – Anticipated motor replacement

- <u>Methodology:</u>
  - *Article 7 =>*

$$\mathrm{TFES} = n \times P_n \times h \times \left(\frac{1}{\eta_c} - \frac{1}{\eta_{he}}\right) \times LF \times 100$$

$$\mathrm{TFES}_{VSD} = n \cdot \frac{P_n}{\eta_{he}} \cdot 100 \cdot h \cdot f_{VSD}$$

TFES	Total final energy savings [kWh/a]
$TFES_{vsd}$	Total final additional energy savings from VSD [kWh/a]
n	Number of motors replaced [dmnl]
P_n	Nominal power as indicated in the nameplate [kW]
h	Annual operating hours [h]
η_c	Efficiency of conventional motor [%]
η_{he}	Efficiency of high-efficiency motor [%]
LF	Load factor [dmnl]
f_{VSD}	Factor to account for additional savings generated by the installation of a variable speed control (VSD) [dmnl]

PA#4 – Anticipated motor replacement

- Indicative values: Motor power and efficiency

Power range [kW]	Avg. Power	IE1-IE2 Avg	IE3	IE4
0,75 - 7,5	3.2	81.9	86.5	89.1
7,5 - 75	34.3	91.2	93.3	94.6
75 - 375	201.5	94.3	95.7	96.4
375 - 1000	587.5	94.5	95.9	96.6

PA#4 – Anticipated motor replacement

- Indicative values: Load Factor and Lifetime

Load Factor	
Load factor	0.60
Lifetime of savings	[a]
Lifetime of savings	10 years

PA#4 – Anticipated motor replacement

- Indicative values: annual operating hours

Type of activity	[h/a]
Industry, 1 shift, 5 days/week	1,920
Industry, 2 shifts, 5 days/week	3,840
Industry, 2 shifts, 6 days/week	4,608
Industry, 2 shifts, 7 days/week	5,376
Industry, 3 shifts, 5 days/week	5,760
Industry, 3 shifts, 6 days/week	6,912
Industry, 3 shifts, 7 days/week	8,064
Industry, 3 shift, continuously	8,760
Tertiary	1,480

PA#4 – Anticipated motor replacement

- Indicative values: VSD average default savings factor

End-Use	f_{VSD}
Pumps	0.28
Fans	0.28
Air Compressors	0.12
Cooling compressors	0.12
Conveyors	0.12
Other Motors	0.12

PA#4 – Anticipated motor replacement

- <u>Methodology:</u>
  - *Article 3 =>*

$$EPEC = FEC_{Baseline} \cdot \sum_{ec} \left(share_{ec,Baseline} \cdot f_{PE,ec} \right) - FEC_{Action} \cdot \sum_{ec} \left(share_{ec,Action} \cdot f_{PE,ec} \right)$$

EPEC	Effect on primary energy consumption [kWh/a]
FEC	Annual final energy consumption [kWh/a]
$share_{ec}$	Share of final energy carrier on final energy consumption [dmnl]
$f_{PE,ec}$	Final to primary energy conversion factor of the used energy carrier [dmnl]
Baseline	Index for the baseline situation of the action
Action	Index for the situation after the implementation of the action
ec	Index of energy carrier

PA#4 – Anticipated motor replacement

- <u>Methodology:</u>
  - *Greenhouse gas savings =>*

$$GHGSAV = \left[FEC_{Baseline} \cdot \sum_{ec} \left(share_{ec,Baseline} \cdot f_{GHG,ec} \right) - FEC_{Action} \cdot \sum_{ec} \left(share_{ec,Action} \cdot f_{GHG,ec} \right) \right] * 10^{-6}$$

GHGSAV	Greenhouse gas savings [t CO_2e p.a.]
FEC	Annual final energy consumption [kWh/a]
share	Share of final energy carrier on final energy consumption [dmnl]
f_{GHG}	Emission factor of final energy carrier [t CO_2/kWh]
Baseline	Index for the baseline situation of the action
Action	Index for the situation after implementation of the action
ec	Index of energy carrier