What are key success factors of financial incentive programmes for efficient electric motor systems?

ICA Europe Motors Academy
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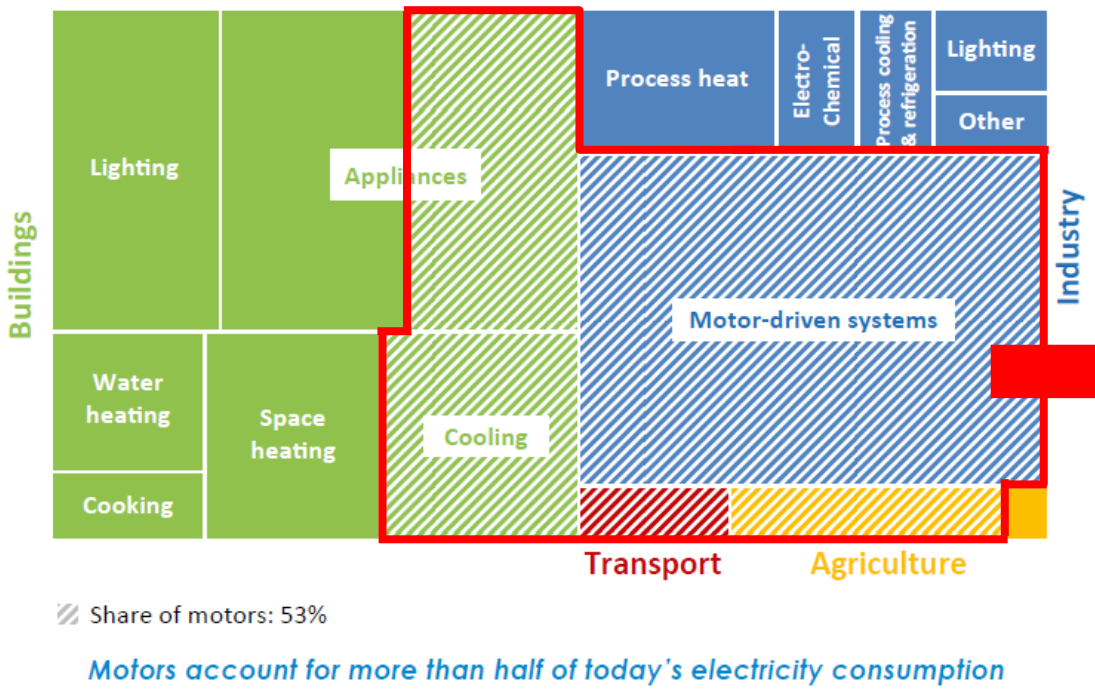
Content

- Introduction
- Swiss competitive tenders: evaluation
- Key success factors
- Programme design & building blocks
- Modalities for subsidies
- Energy efficiency obligation scheme
- Conclusions

Introduction

Motor systems

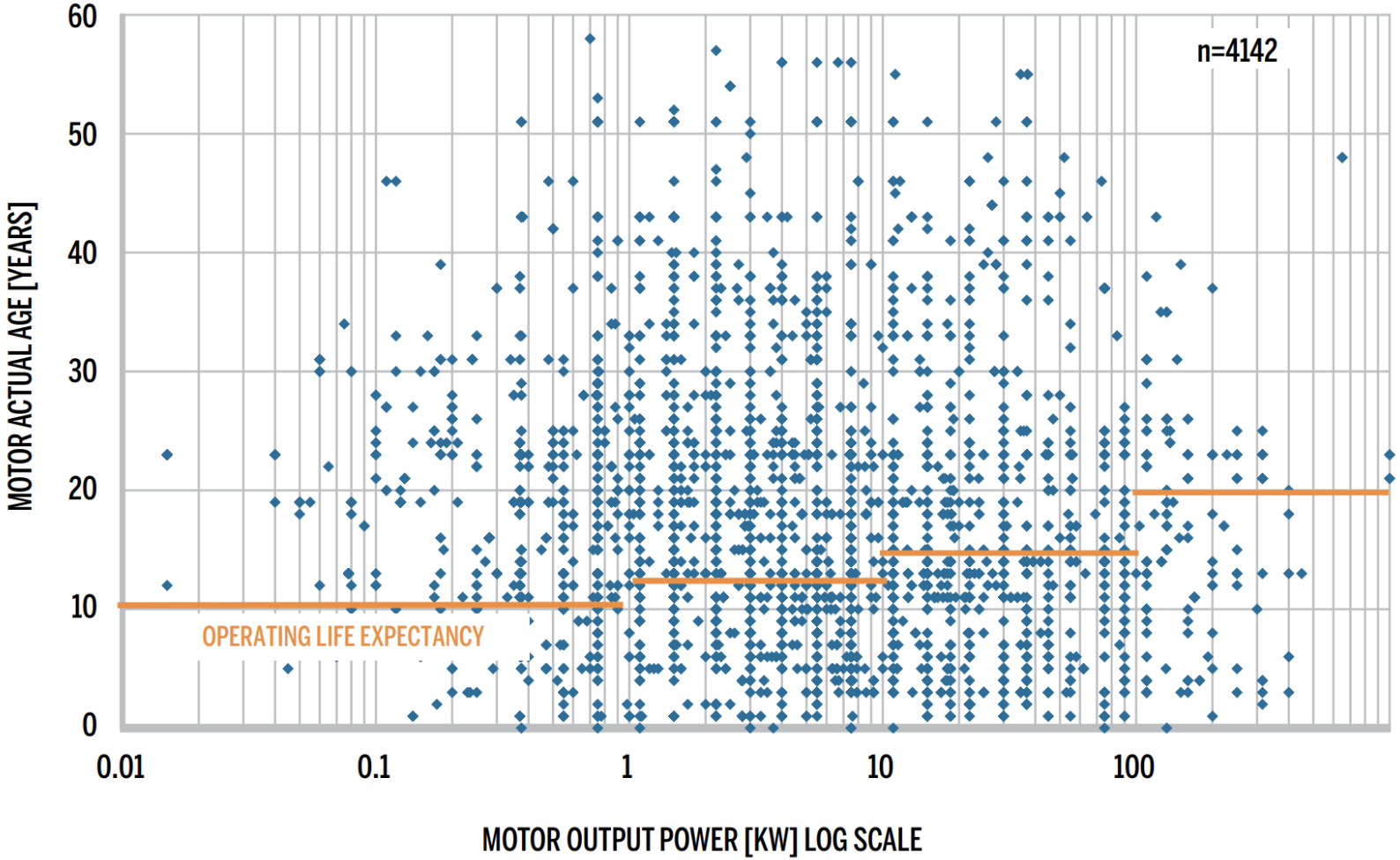
Figure 7.9 ▷ **Global total final electricity consumption by end-uses, 2014**



Motors represent 74% of electricity consumption in industry
Source: IEA World Energy Outlook, 2019

Motors are mainly used in industry, large buildings and infrastructure systems. Also transport, agriculture and household appliances include motors.
Source: IEA World Energy Outlook, 2016

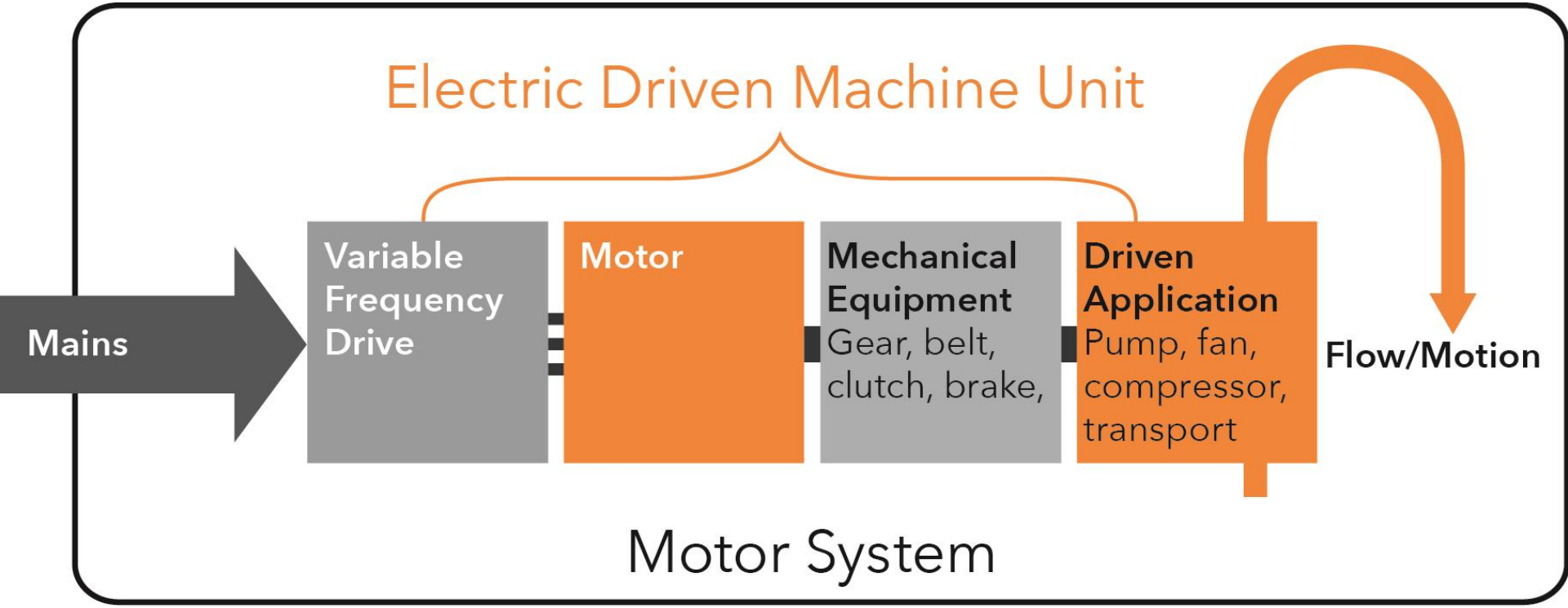
Motors get twice as old as their expected operating life!



Source: Swiss Agency for Efficient Energy Use, 2012

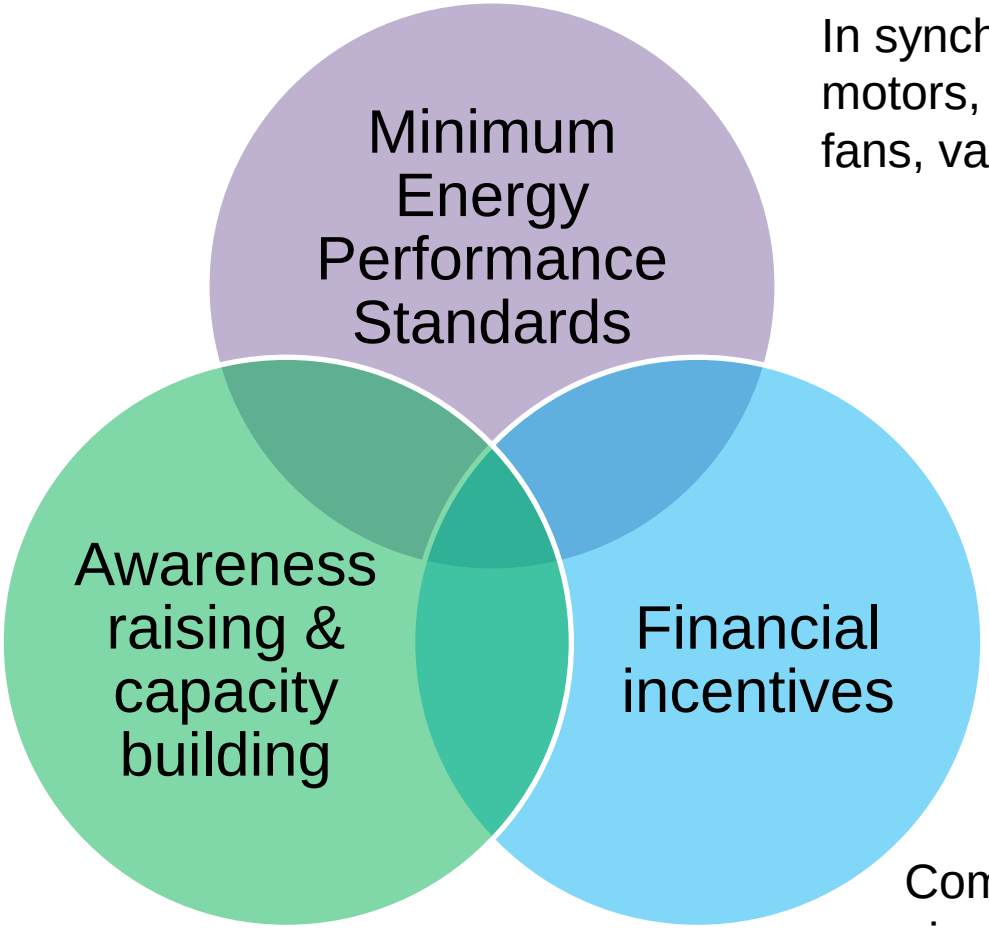
Savings potential

Average savings potential on system level: 20 – 30%



$$\eta_{System} = \eta_{VFD} * \eta_{Motor} * \eta_{Gear} * \eta_{Belt} * \eta_{Driven\ application}$$

Policies for electric motor systems in Switzerland



In synch with the EU: for motors, pumps, circulators, fans, variable speed drives

Competitive tenders since 2010

Swiss competitive tenders

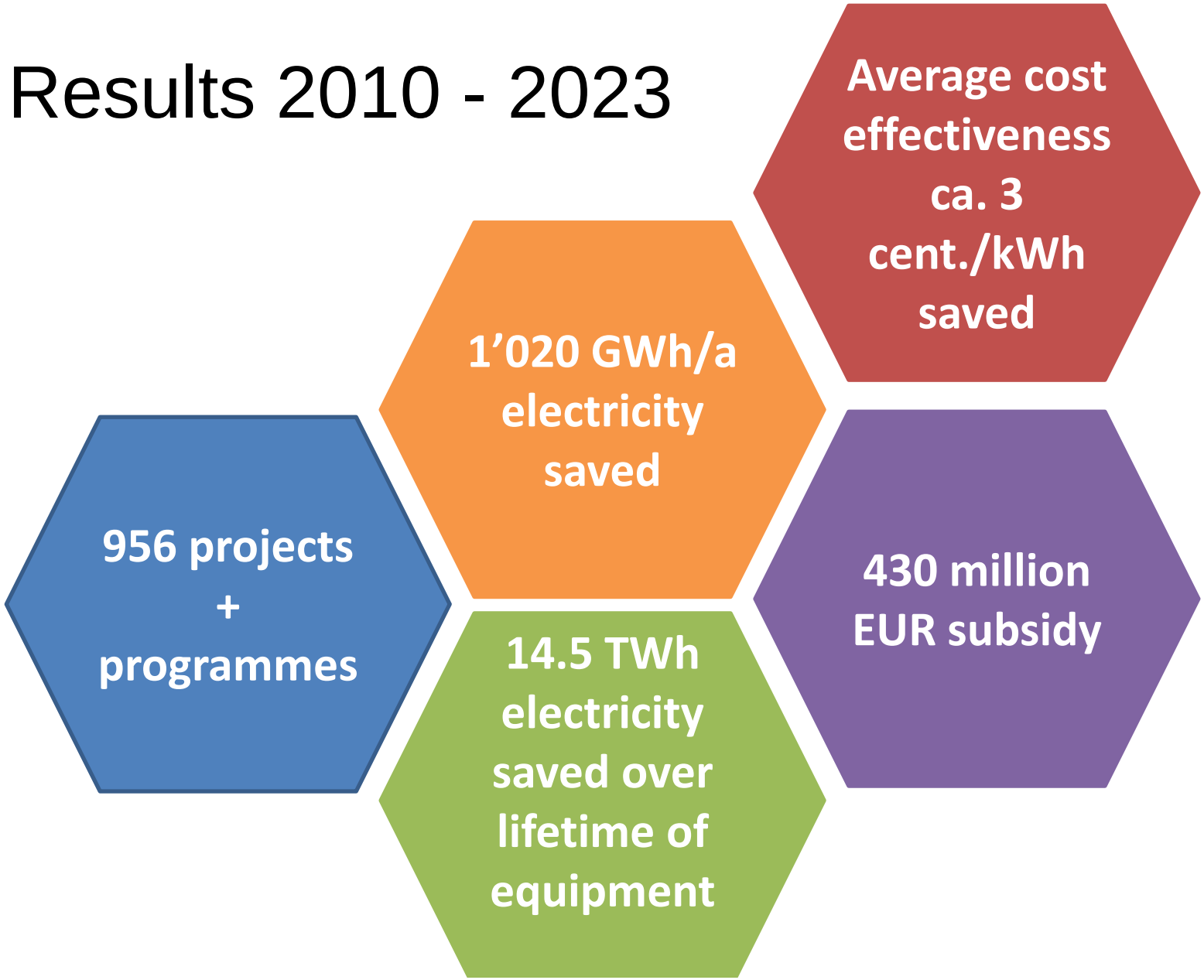
Competitive tenders

- **Period**: annually since 2010
- **Goal**: saving electric energy
- **Sectors**: household, industry, services
- **Budget**: ca. 50 Mio. EUR/year
- **Procedure**: tender for
  - projects (continuous): one project in own facility
  - programmes (1x per year): several projects combined, by third-parties
- **Criteria**: cost effectiveness

$$\frac{\text{amount of subsidy [CHF]}}{\text{amount of energy saved over lifetime of equipment [kWh]}}$$

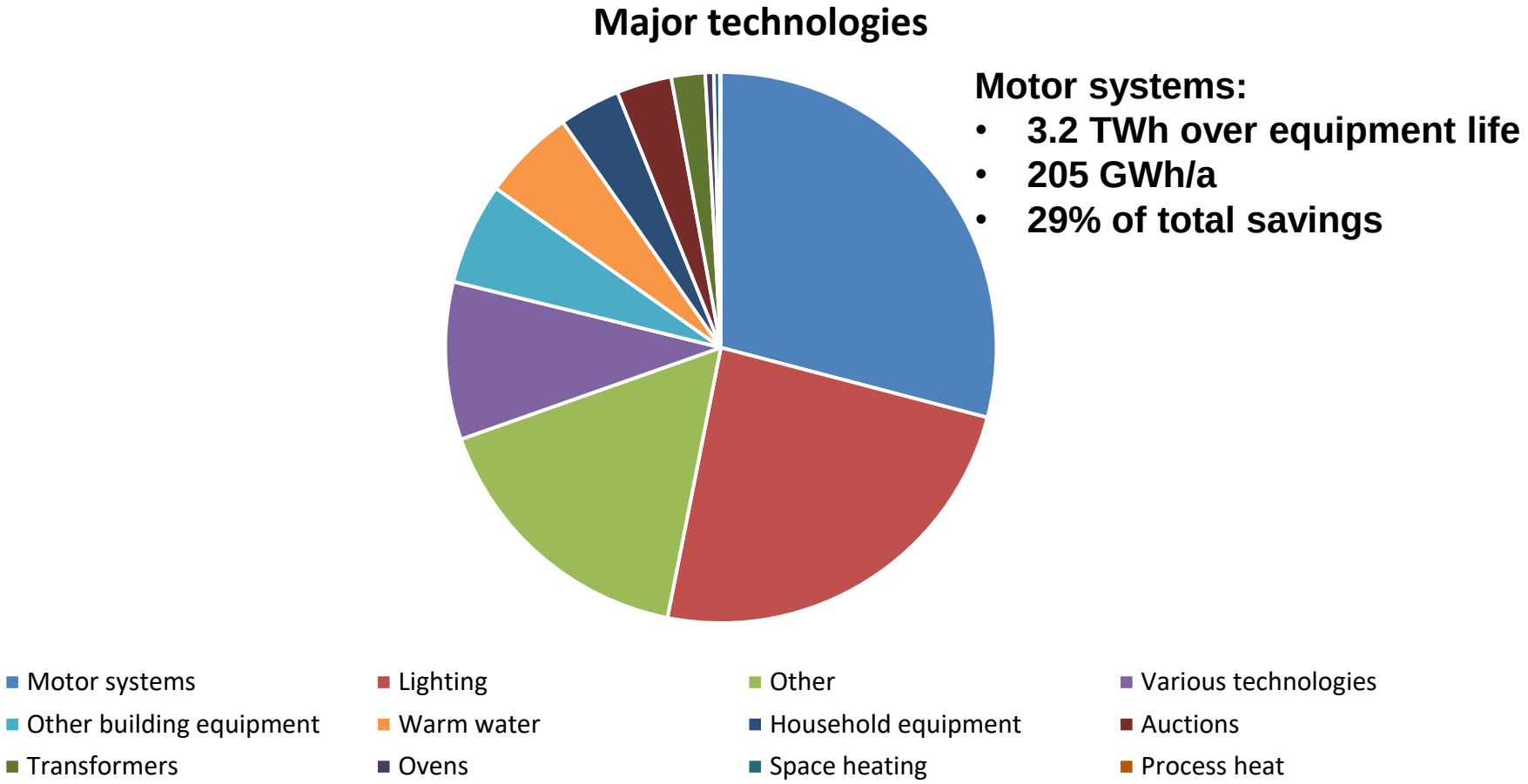
- **Subsidy**: max. 30% of investment costs
- **Payback**: min. 4 years
- **More info**: www.prokw.ch

Results 2010 - 2023



Source: https://www.bfe.admin.ch/bfe/de/home/foerderung/energieeffizienz/wettbewerbliche-ausschreibungen-prokilowatt.exturl.html/aHR0cHM6Ly9wdWJkYi5iZmUuYWRtaW4uY2gvZGUvcHVibGljYX/Rpb24vZG93bmxvYWQvODQyMA==.html

Savings per technology 2010 - 2021

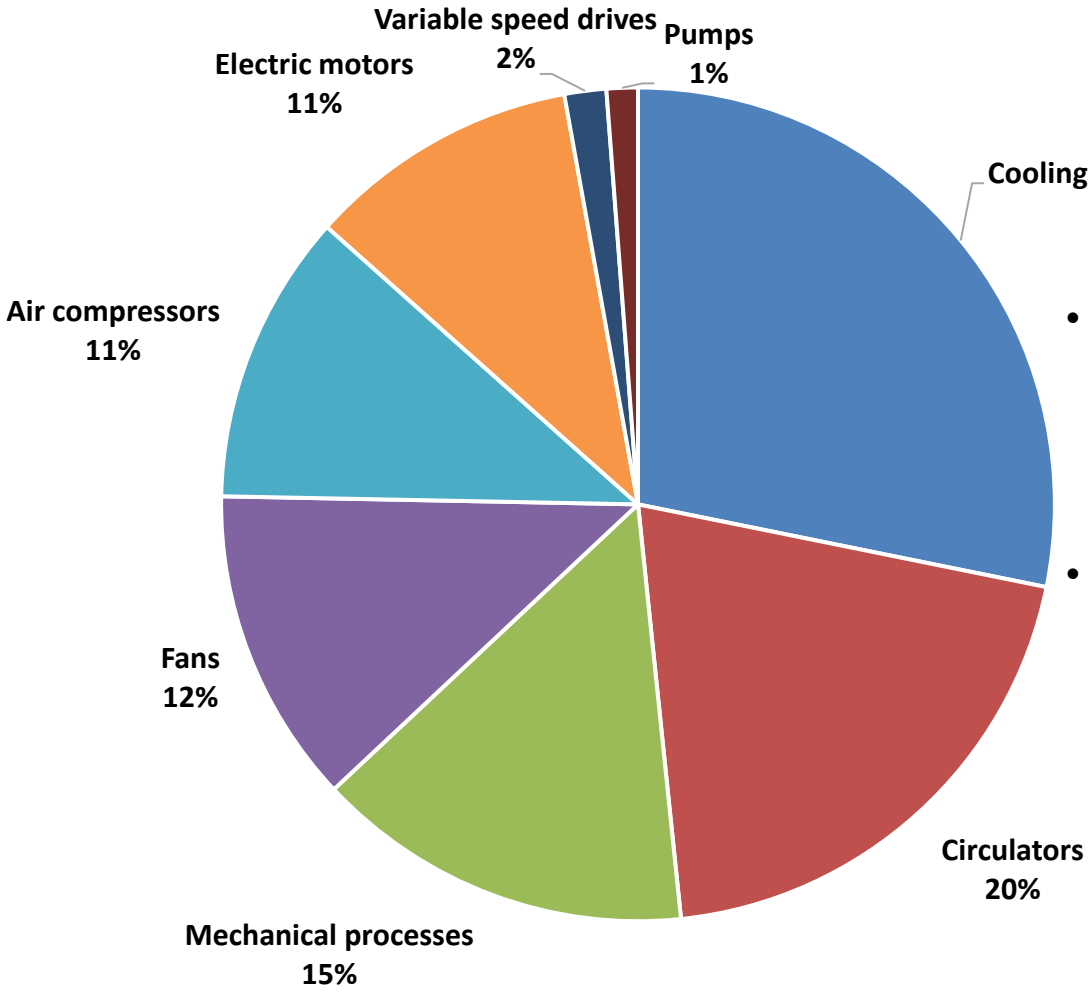


Source: https://pubdb.bfe.admin.ch/de/publication/download/11734

Poll #1: Which applications delivered the highest savings?

1. Fans
2. Pumps
3. Circulators
4. Air compressors
5. Cooling compressors
6. Motors
7. Variable speed drives
8. Mechanical processes

Savings in motor systems 2010 - 2021



- **Savings largely depend on type and success of programmes and projects**
- **Pumps hardly present – savings do not reflect technical savings potential**

Source: https://pubdb.bfe.admin.ch/de/publication/download/11734

Report

- Feasibility study for a financial incentive programme targeting electric motor systems in Switzerland
- Published in 2024
- In German
- Key findings in this webinar

Evaluation of Swiss competitive tenders:

- 14 programmes analysed
  - Expert interviews with programme managers
  - Data analysis


Schweizerische Eidgenossenschaft
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Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation UVEK

Bundesamt für Energie BFE
Sektion Geräte und Wettbewerbliche Ausschreibungen

Bericht vom 14. September 2023

Vorstudie Förderprogramm effizienter elektrischer Antriebssysteme in Unternehmen

Quelle: iStock / Hramovnick

Programme characteristics

Specific to	Focus	Examples/characteristics
Technology	Application	Circulators, fans, compressors
Technology	System optimization	Subsidizing analyses, measurements and concrete improvements
Target group	Select group	For participants of the voluntary target agreement scheme (open for technologies other than motor systems, e.g. lighting)
Target group	Sector	Gravel, hard stone, concrete and surfacing plants

Accompanying analyses vary:

- No support
- Some support (rough first analysis)
- Comprehensive support (two-step analysis with measurements)

Evaluation

Programme requirements

Limit programme effectiveness:

- Main funding criteria: cost effectiveness
- **Subsidy per end-user**: max. EUR 300’000
- **Duration**: max. 3 years
- **Budget**: max. EUR 3 million
- Budget share for **programme management**, training, communication, monitoring: max. 10%
- **Subsidy**: max. 30% of investment cost
- Support for **analyses**: max. 10% of subsidy

Result

- Keep each ‘budget position’ low
- Number of supported **analyses declining**
- **System optimisation** only in **few** programmes
- Means missing for **training** of consultants
- Limited programme **communication**
- Many different programmes – difficult to keep **overview**

Competitive tenders have come close to reaping the savings potential available within the framework of the programme, which were more the low hanging fruits.

Key success factors

Poll #2: Which are the most critical factors for programme success?

1. Programme focus (technology vs. target group)
2. Support for analyses (less vs. more)
3. Funding level (low vs. high)
4. Subsidy scheme (simple vs. complex)
5. Programme administration
6. Contact to potential programme participants
7. Programme awareness within target group
8. Qualification of external technical consultants
9. Additionality of measures (free-rider effect)

Success factors (1/2)

#1 Contact via established channels

- Continuous contact based on **trust**
- **Sufficient incentive for consultants** to engage and follow through
  - not only analyses but also efficiency measures

Channels	Limitations
'**Technical partners**' installers, manufacturers, vendors, service companies	build-up takes time
Existing **network of consultants** in the voluntary target agreement scheme	different know-how level
Existing **network of industrial clients**	limited expansion possible

#2 Programme awareness

- Programmes that are **increasingly known** (word to mouth) among the target groups are **in greater demand**

Success factors (2/2)

#3 Easy participation:

- **Simple programme design & implementation**
  - incl. application & monitoring
  - keep administrative barrier low
- **Simple & easy-to-understand subsidy scheme**
  - e.g. x% of investment cost
  - can be determined & communicated easily

#4 Sufficient financial incentive:

- **Subsidy should be 'tangible'**
  - e.g. 20% - 30% of investment cost
  - significantly improves ROI
  - facilitates willingness to accept the administrative burden of participation

#5 Qualification of involved consultants*:

- **Sufficient expertise of consultants, ability to carry out analyses**

*consultants are informing and advising end-users on efficient technologies and the financial incentive programme. They can be: installers, manufacturers, vendors, service companies, consultants of energy agencies, utilities, etc.

Programme design & building blocks

Programme design

Programme aspects	Standardised measures	Tailored measures
Energy savings	Lower (‘low hanging fruits’)	Higher (‘system optimisation’)
Cost per participant (investment & programme administration)	Lower	Higher
Technical complexity (required analyses & know-how)	Lower	Higher
Subsidy scheme	Simple	More complex

- Ideally: subsidy compensates for additional cost of energy efficient solution
- External evaluation of free rider effect*:
  - According to programme managers: 23%
  - According to programme participants: 47%
- Snowball effect: more measures implemented than planned

*Source: Eidgenössische Finanzkontrolle (EFK) 2019: Evaluation der Wettbewerblichen Ausschreibungen für Stromeffizienzmassnahmen, Bern

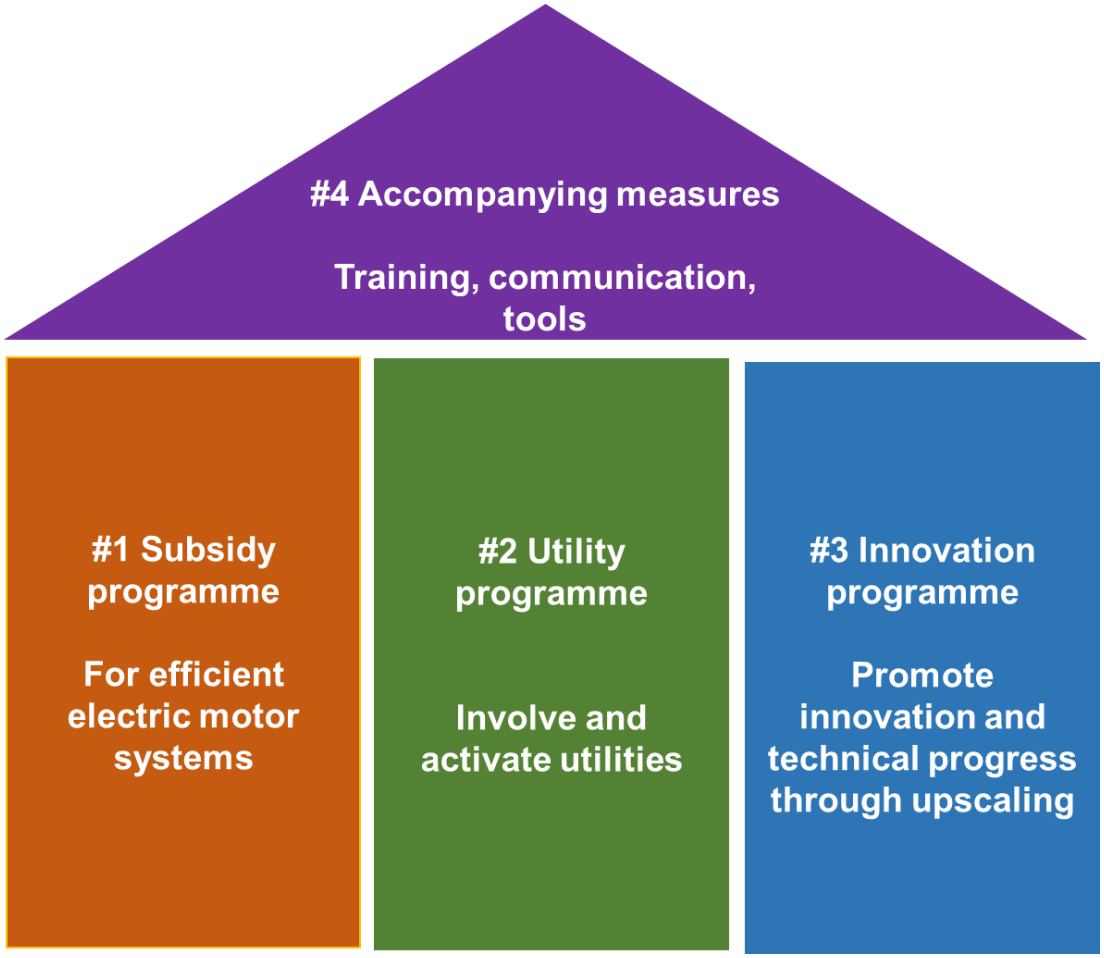
What is the ultimate goal?

1. Not only low hanging fruits
2. System optimisation (not only 1 component)
3. Focus on largest potential: old, big, oversized machines

Example:

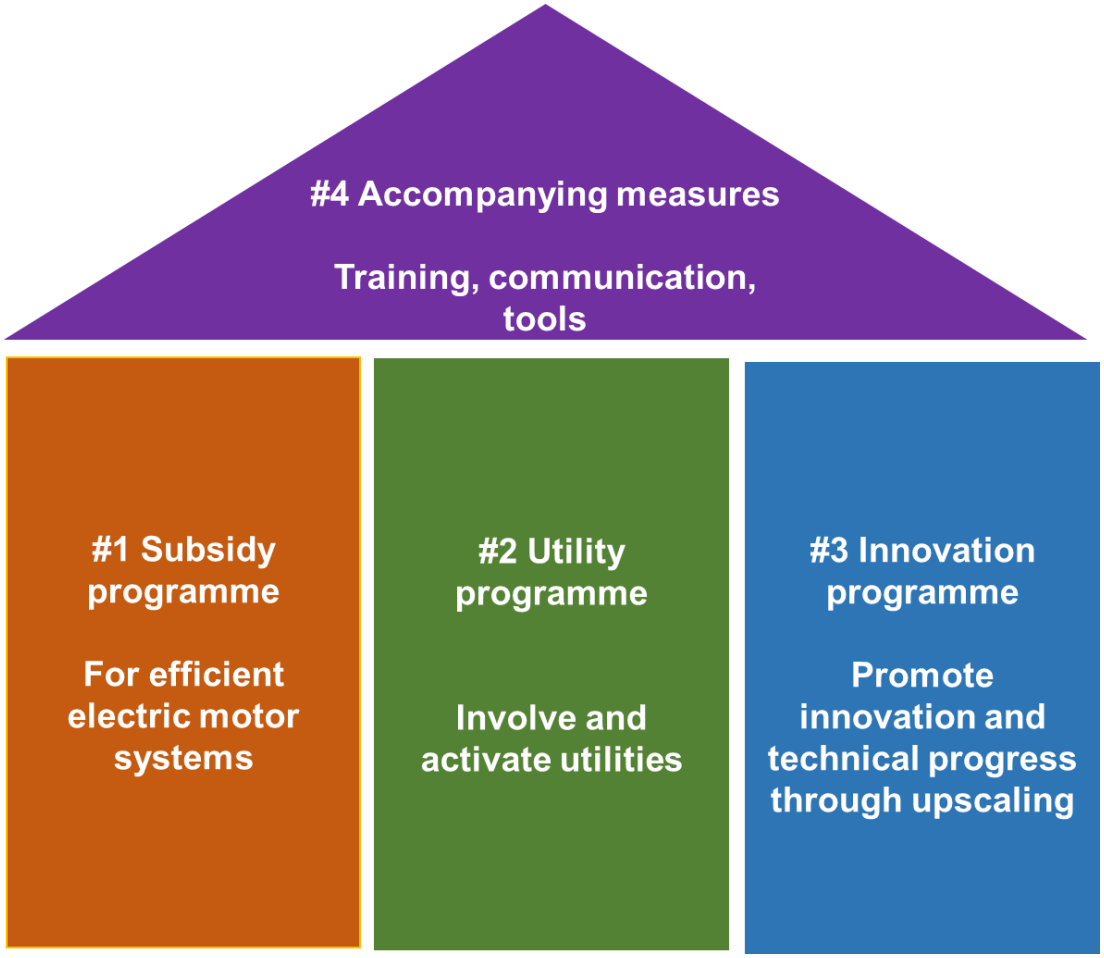
- 10% of electric energy consumption of enterprise
  x 10% savings = **1% total savings**
- 30% of electric energy consumption of enterprise
  x 30% savings = **9% total savings** -> 10 times more!

Building blocks



- The three programmes could be implemented individually or in combination

Building blocks



#1 Subsidy programme

- Installed & new systems
- End-users > 500 MWh/a
- Motor systems >15 yrs & 10 MWh/a
- Typical measures
  - Efficient components
  - Optimise to process
  - No standby
  - Variable Speed Drive

#1 Subsidy programme

Scope:

- **Installed** motor systems
- **New** motor systems
- Potentially include **other** users (lighting, ICT, thermal processes)

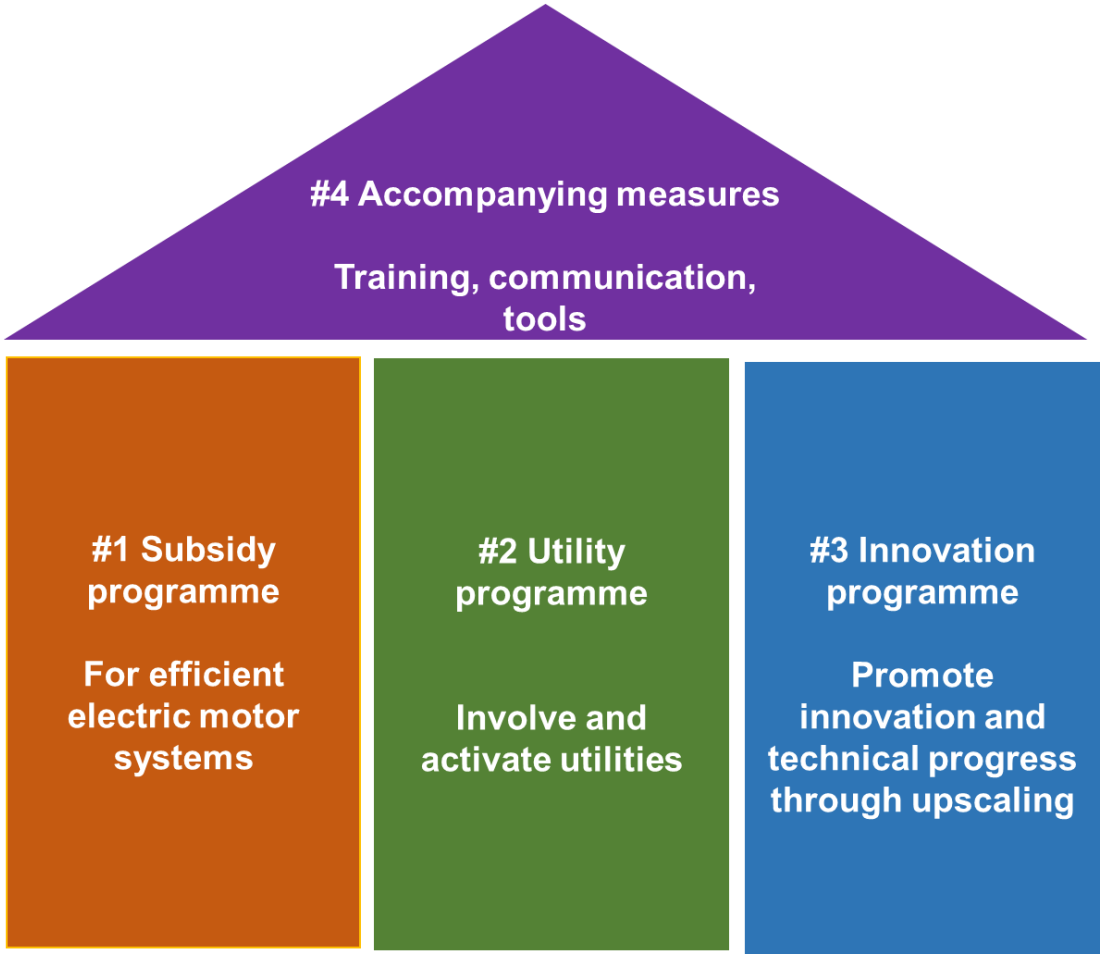
Sectors:

- Industry, services
- Agriculture, infrastructure plants, large buildings

Focus on:

- **End-users > 500 MWh/a** electricity consumption
- Old motor systems **(>15 years**)
- **Min. consumption 10 MWh/a** (e.g. 2 kW * 5’000 h/a)
- **Typical measures** with high savings potential:
  - Eliminate **standby**
  - **Efficient components** (above minimum requirements)
  - **Optimise** system **to process requirements** (pressure, temperature, volume flow)
  - **No transmission**
  - Use of **Variable Speed Drive**

Building blocks



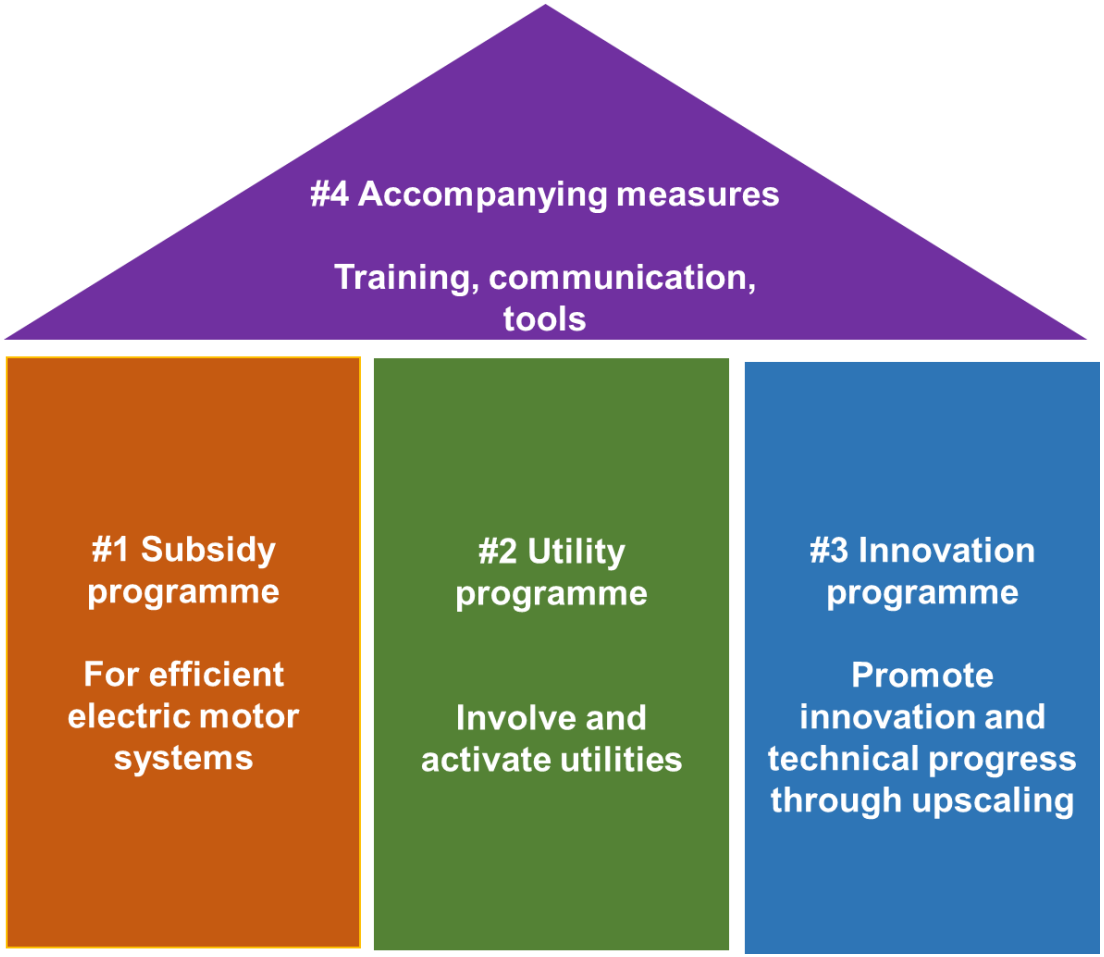
#2 Utility programme

- Utility offers subsidies for motor systems optimisation
- Progressive tariff reduction
- Free monitoring instruments
- Builds up technical competence

#2 Utility programme

- Goal: activate important stakeholder group with **direct access to end-users**
- Inspiration: European Energy Efficiency Directive & USA
- Idea: **utilities offer subsidies for motor system optimisation**
- Elements:
  1. **Subsidy for investments** (including analyses)
  2. **Progressive tariff reduction**: 10% lower tariff for 10% savings, 20% lower tariff for 20% savings, etc.
  3. **Free** installation of **monitoring instruments** (incl. remote sensors, etc.)
  4. "**Efficiency fund**" for efficiency measures, client+utility contribute 50%-50%
- Utilities to build up **technical competence** to advise their customers

Building blocks



#3 Innovation programme

- Public procurement programme for equipment manufacturers
- Decrease cost through economies of scale
- Innovative pump, fan and compressor systems
- Public authority launches design, tendering & large scale production

#3 Innovation programme

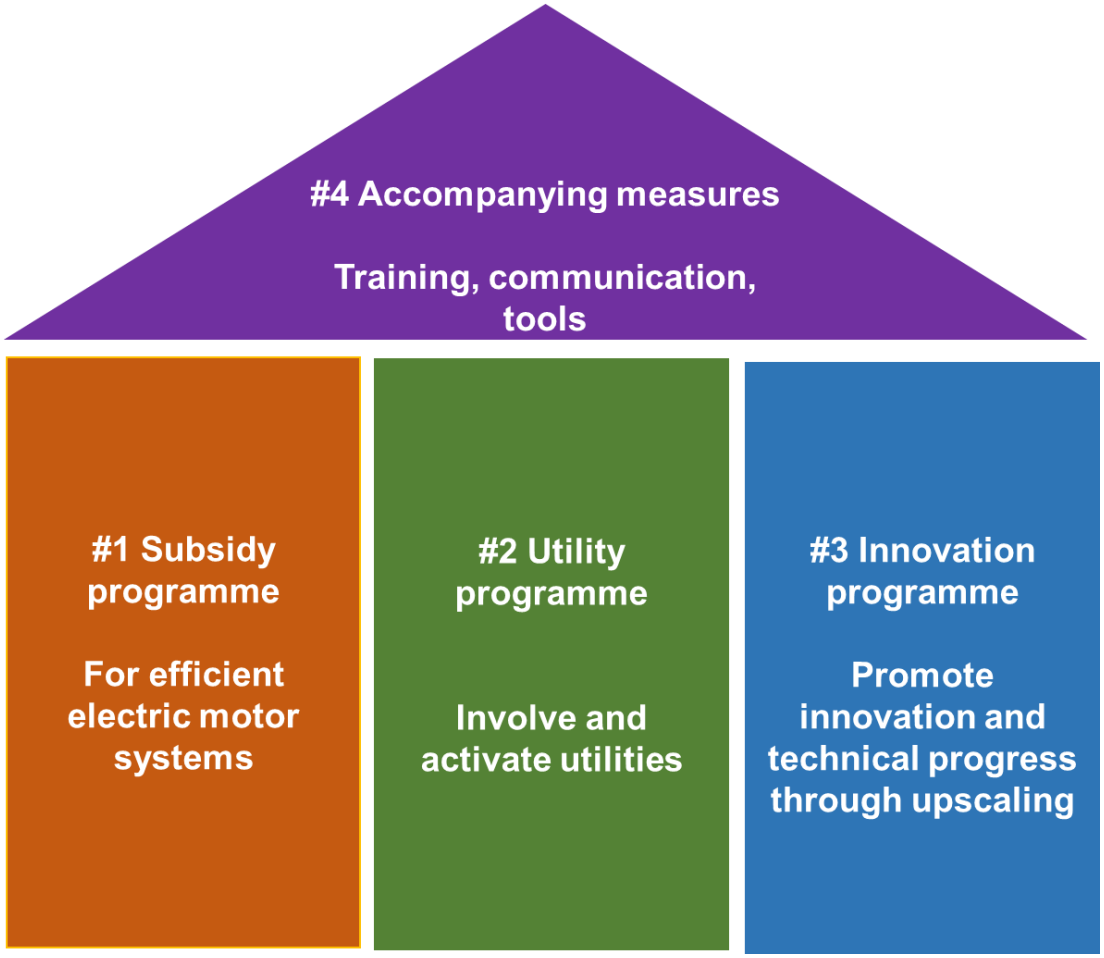
Goal:

1. **Decrease cost through economies of scale** via a procurement programme for equipment manufacturers
2. **Innovation boost** for suppliers, consultants and users.

Idea:

- Public authority launches the design, tendering and production of **innovative pump, fan and compressor systems** of various types in the most commonly used sizes (2 to 15 kW).
- Public call for tenders: manufacturers compete with **innovative standard systems**, specified in advance by technical experts.
- Volume: **1’000 systems** for installation **over** the **next three years**.
- More **favorable prices** for innovative systems **through mass production**. Volume discounts replace subsidies for manufacturers.

Building blocks



#4 Accompanying measures

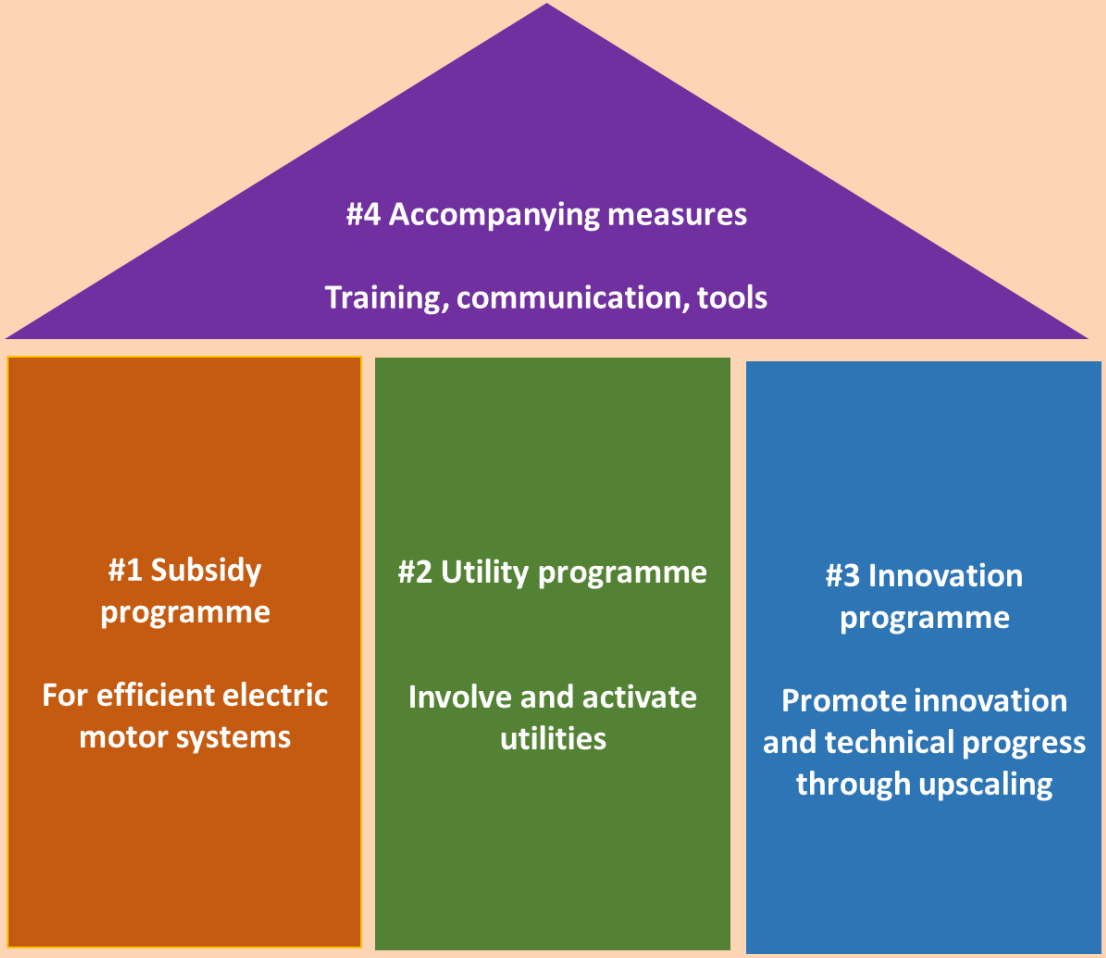
- Technical & administrative training + accreditation
- Central points of contact
- Information campaign
- Tools for preliminary and detailed analysis & programme administration

#4 Accompanying measures

- Goal: several measures to secure overall programme success

1. **Training & accreditation:**
    1. Technical training: how to optimize motor systems
    2. Administrative training: programme participation
2. **Communication**
    1. Central points of contact (website, chat, mail, telephone hotline)
    2. Information campaign with partners
3. **Online tools & tutorials**
    1. Technical tools for preliminary and detailed analysis of motor systems
    2. For setting up an order of priority: which systems to optimize first
    3. For programme administration and participation

Poll#3: Which building blocks would you choose for a programme?



- All
- None
- One, namely:…
- A combination, namely:…

Modalities for subsidies

Subsidy scheme

- 5 different modalities
  - A: fixed subsidy rate
  - B1 – B4: varying subsidy rate
- Subsidy cannot be >40% of total investment cost
- Soft measures (e.g. analyses) included in total investment cost (not only hardware)

Overview of possible modalities

#	Concept	Subsidy rate
A	Flat rate	max. 40% of total investment or max. 80% of additional investment
B1	Subsidy based on investment amount	20 – 40% for investment or 70% - 90% for additional investment, depending on investment amount: EUR 10’000 - 100’000 EUR 100’000 - 300’000 EUR 300'000 – 1’000’000
B2	Motor replacement (only)	Calculated based on the nominal power of the new motor
B3	System optimisation	+1% for savings < 30% +0.5% for savings > 30% 40% for savings >50%
B4	Subsidy on company level	20% - 30%, depending on share of savings by motor systems within the company

#A fixed subsidy rate

Total cost	Share of additional cost		Subsidy for total investment 30%	Subsidy for additional investment 80%	
[EUR]	[EUR]	[%]	[EUR]	[EUR]	[%]
100’000	20’000	20%	30’000	16’000	16%
500’000	100’000	20%	150’000	80’000	16%
1’000’000	200’000	20%	300’000	160’000	16%
100’000	40’000	40%	30’000	32’000	32%
500’000	200’000	40%	150’000	160’000	32%
1’000’000	400’000	40%	300’000	320’000	32%

*additional investment for choosing a more energy efficient solution

- If the additional cost is 20%: 30% subsidy for total investment is higher than subsidy for additional investment (16%)
- If the additional cost is 40%: 30% subsidy for total investment is lower than subsidy for additional investment (32%)

#B1 Subsidy based on investment amount

Investment cost (per measure)	Subsidy rate for investment	Subsidy rate for additional* investment
EUR 10’000 – 100’000	20%	70%
EUR 100’000 – 300’000	30%	80%
EUR 300’000 – 1’000’000	40%	90%

*additional investment for choosing a more energy efficient solution

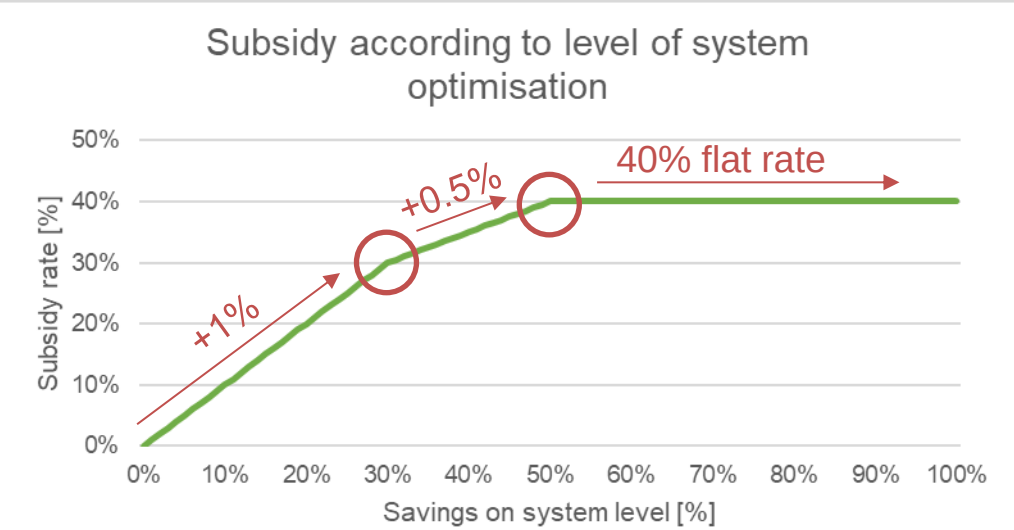
#B2 Motor replacement (only)

- Concept: incentivize resizing
- Standard subsidy coefficient: 0.75
- Standard subsidy rate: 20%
- If the nominal power of the new motor exceeds that of the old motor, there is no subsidy.
  - Exception: a sufficiently documented reasonable cause. In this case the standard subsidy with the standard subsidy coefficient applies:
    0.75 * 20% = 15%.

Motor before [kW]	Motor after [kW]	Extent of resizing	Subsidy coefficient (standard: 0.75)	Subsidy rate (standard: 20%)
100	100	100%	0.75	15%
	75	75%	1.00	20%
	50	50%	1.50	30%

#B3 System optimisation

- Idea: subsidy rate correlates with savings
- Savings < 30%:
  - Subsidy rate equals savings
- Savings > 30%:
  - a positive increment of 0.5% in the subsidy rate per % higher savings
- Savings >50%:
  - Subsidy rate of 40%



Savings	Increment	Subsidy rate
10%	1%	10%
20%	1%	20%
30%	1%	30%
40%	0.5%	35%
50%	0.5%	40%

#B4 Subsidy on company level

- This approach considers savings for a bundle of measures, on the level of an entire company.

Share of savings by motor systems within the company*	Subsidy rate
<5%	20%
5% - 20%	25%
>20%	30%

*compared to total electricity consumption of the company

Poll #4: Which funding modalities would you pick for a subsidy programme?

#	Concept	Subsidy rate
A	Flat rate	max. 40% of total investment or max. 80% of additional investment
B1	Subsidy based on investment amount	20 – 40% for investment or 70% - 90% for additional investment, depending on investment amount: EUR 10’000 - 100’000 EUR 100’000 - 300’000 EUR 300'000 – 1’000’000
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- All
- None
- One, namely:…
- A combination, namely:…

Considerations

- Funding on the level of one **measure**:

i. B2 motor replacement (only) and/or in combination with B3 system optimisation OR

ii. B1 Subsidy based on investment amount

- Funding on the level of a **company**:

i. B4 Subsidy on company level OR

ii. B1 Subsidy based on investment amount

- Funding at different **complexity** (both can be offered):

i. A flat rate OR

ii. B3 system optimisation

Energy Efficiency Obligations for electricity suppliers

Energy Efficiency Obligations for electricity suppliers (EEOS)

- New instrument*
- **Aim**: contributing to the reduction of the electricity consumption by 2 TWh by 2035
- **From**: 1 January 2025
- **Who**: Electricity suppliers with a minimum sales volume (e.g.: 10 GWh/a)
- **What**: Implement efficiency measures for which savings are calculated (consumptionn of replaced technology – consumption of best available technology, for the full duration of the impact)
- **How much**: 2% of the annual electricity sales volume
- **How**: No certification or trading platform planned

*based on Federal law on a secure electricity supply with renewable energies adopted by the Swiss Parliament the 29th of September 2023.

EEOS – energy efficiency measures

Energy efficiency measures **must** :

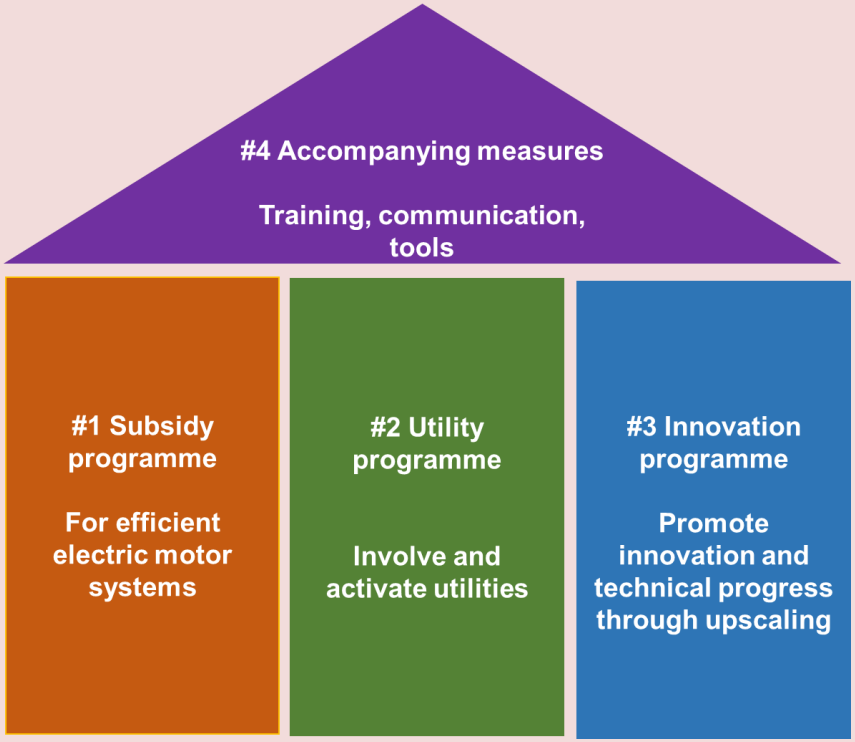
- be rolled out to **end consumers in Switzerland** (all, not just the *own* ones)
- **implemented by suppliers themselves** or **acquired from third parties**
- be based on the **best available technologies**
- and generate **measurable and quantifiable** electricity savings in a plausible and comprehensible manner.
  - Standardised measures
  - Non-standardised measures

Energy efficiency measures **may not be taken** into account, if:

- their implementation is **required by law**
- they are eligible for **financial assistance**
- they are **not** of a **sustainable nature**

Conclusions

- **Key factors of a successful programme:**
  - Contact to programme participants
  - Awareness within target group
  - Easy participation
  - Tangible subsidy
  - Qualification of involved consultants
- **Programme design depends on the objectives**
- Switzerland goes ahead with energy efficiency obligations for electricity suppliers



Questions?

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