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Energy efficient electric motor systems

Webinar: Learning from Indonesia

19th May 2016

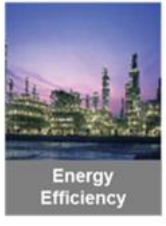
www.ecn.nl

Interaction

- We invite you to introduce yourself
  - Select and type into the “chat” pane on your screen
- To ask a question (Q&A after presentation)
  - Select the “questions” pane on your screen and type in your questions
- The presentations and recording will be made available after the webinar

Who we are – ECN

- Energy research Centre of the Netherlands



Experience working in: Argentina, Bangladesh, Brazil, Columbia, Ghana, Indonesia, Kenya, Kuwait, Mexico, Morocco, Mozambique, Pakistan, South Africa, Thailand and others

International Sustainable Energy

- Climate and energy strategies
- Developing country partners

1. Scoping & Prioritizing
2. Policy and Planning
3. Renewable Energy Deployment
4. Increased Policy Effectiveness

Who we are – Presenters

Lachlan Cameron is an advisor and technical analyst at ECN specialising in domestic sustainable energy policy and international climate policy concepts such as nationally appropriate mitigation actions (NAMAs) and nationally determined contributions (NDCs).

Jeffrey Sipma is a scientific researcher at ECN. His work focuses on energy efficiency in the built environment, where he is responsible for modeling energy consumption in the services sector. He holds a BSc in Chemical Engineering and an MSc in Environmental Science.

Maarten van Werkhoven is an advisor in energy, sustainability and business consulting. He works on energy efficiency, climate and motor related programs and projects together with governments, trade associations and industry.

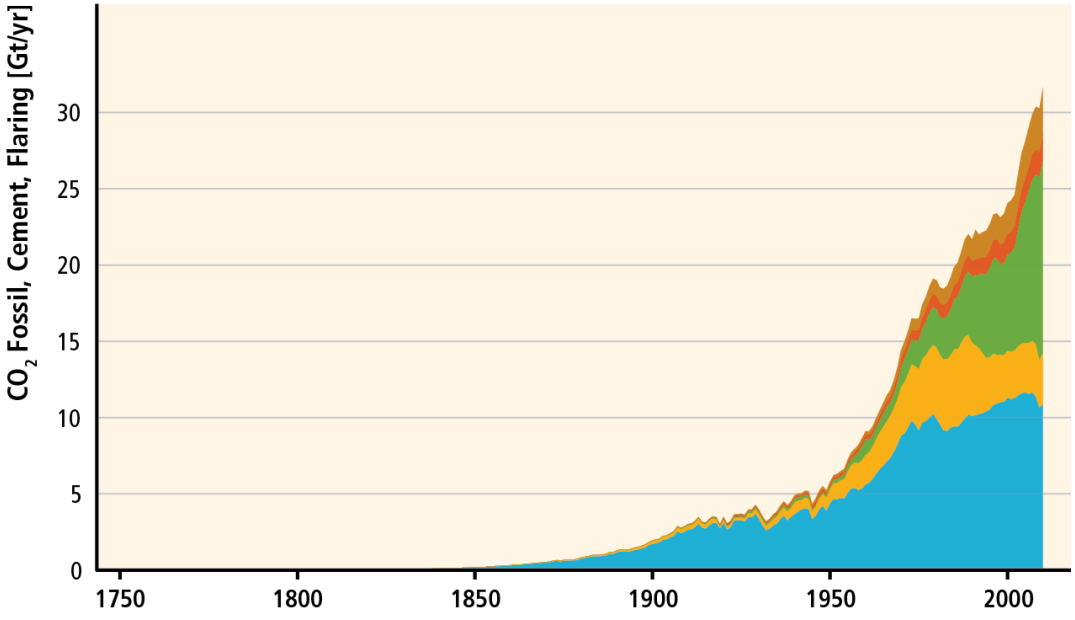
Objective of this webinar

- Introduction to the characteristics of Energy Efficient Electric Motor Systems (EE-EMS); their design and the savings that are possible from improved systems
- Describe the barriers that prevent more efficient systems being adopted
- Present the range of policies that are available to governments to encourage EE-EMS, and how these apply to a country context such as Indonesia

Why energy efficiency?

Climate change mitigation

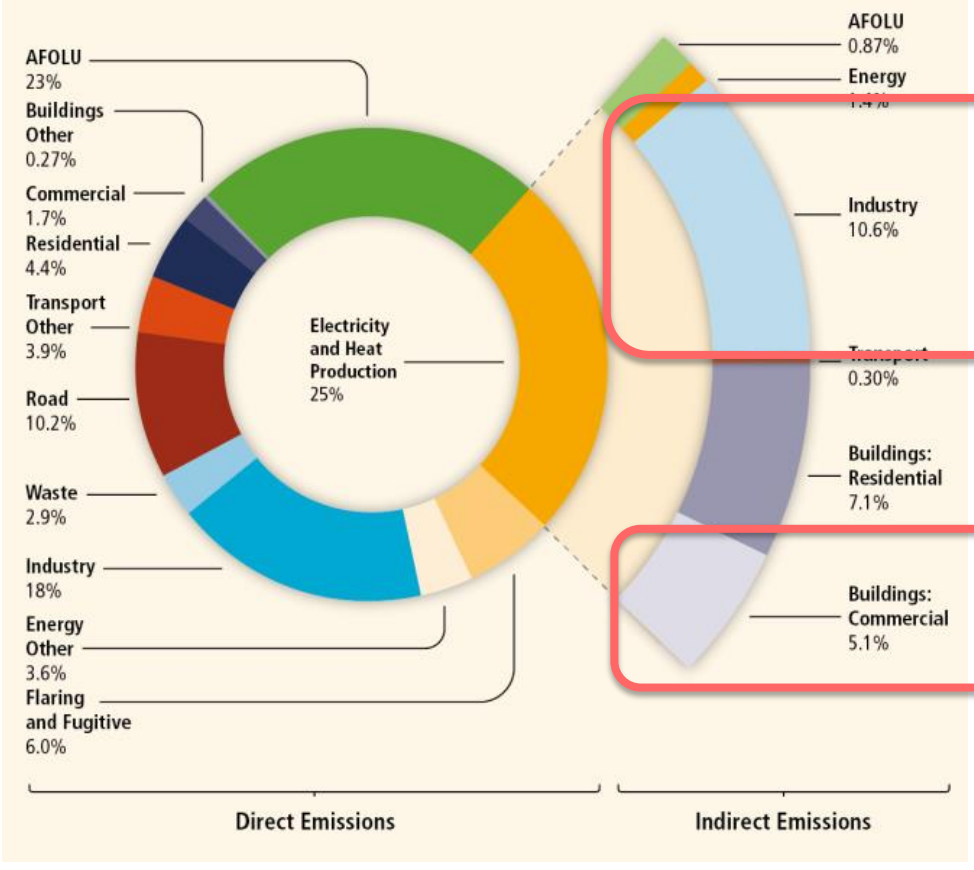
- Energy related GHG emissions, including electricity, are growing rapidly



source: IPCC (2014) AR5

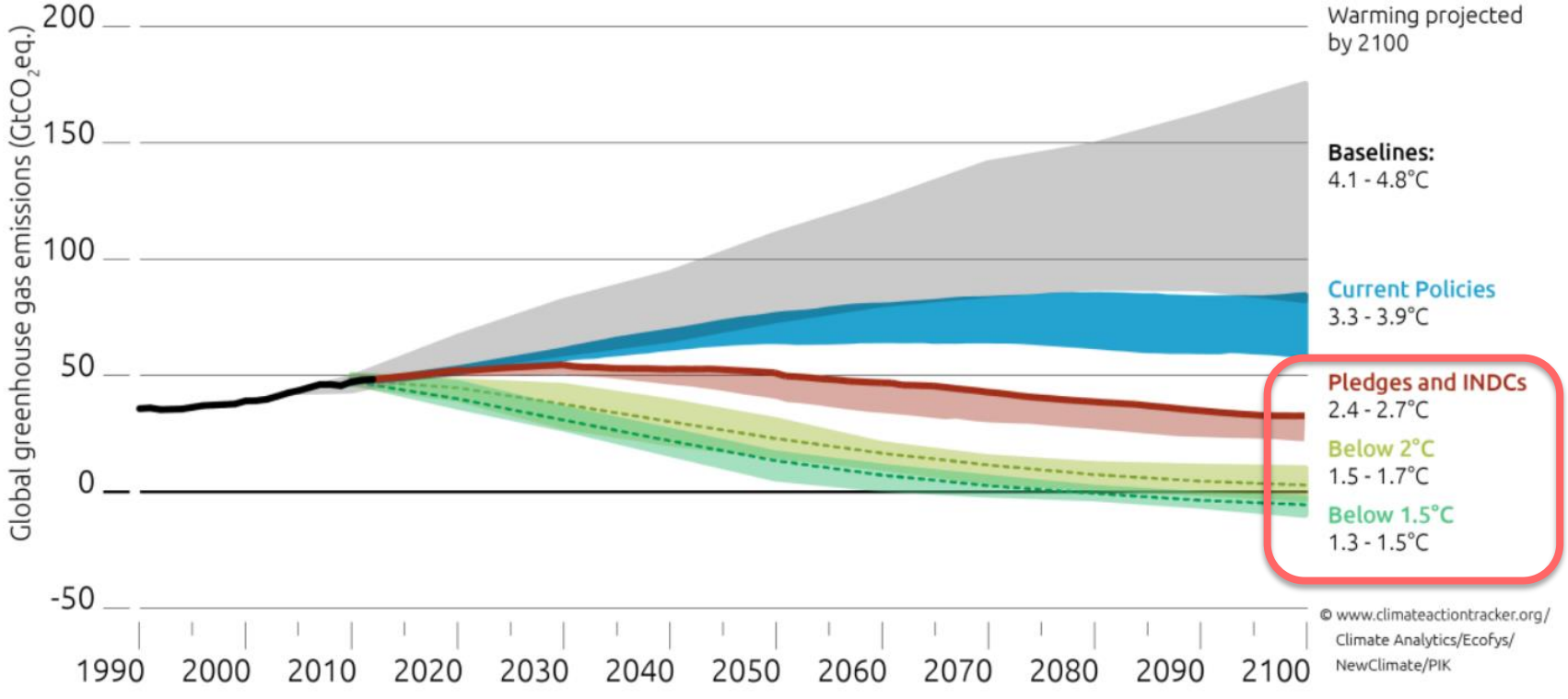
Climate change mitigation

- Energy related GHG emissions, including electricity, are growing rapidly
- Industry and commercial sectors account for a large share of emissions



source: IPCC (2014) AR5

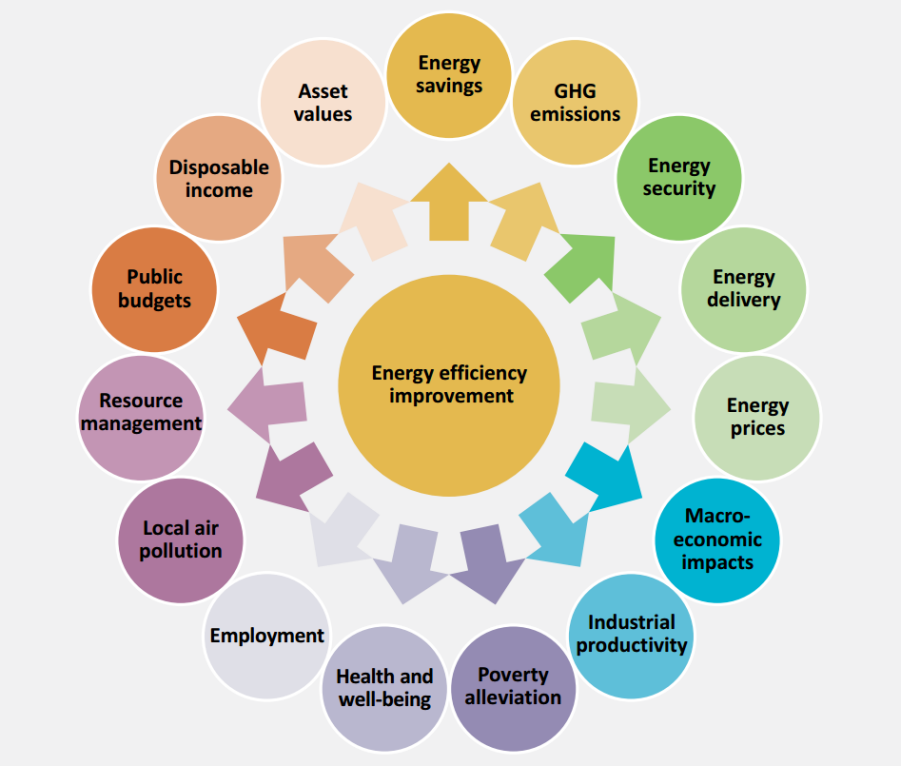
More action will be needed



source: www.climateactiontracker.org as of Dec 2015

Domestic benefits

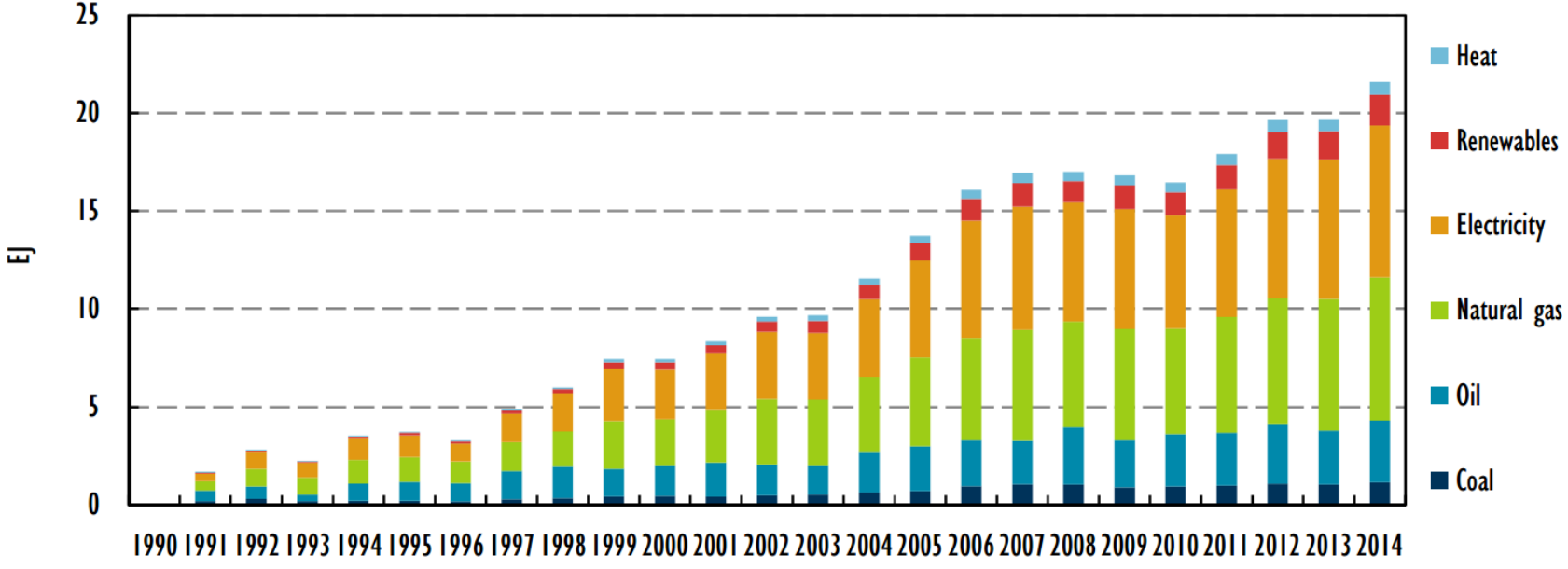
- Multiple benefits of energy efficiency improvements
- Opportunity to grow economies, provide jobs and increase the number of people with access to energy as well as a range of other benefits



source: IEA (2014) Capturing the Multiple Benefits of Energy Efficiency, OECD/IEA, Paris

Avoided total final consumption

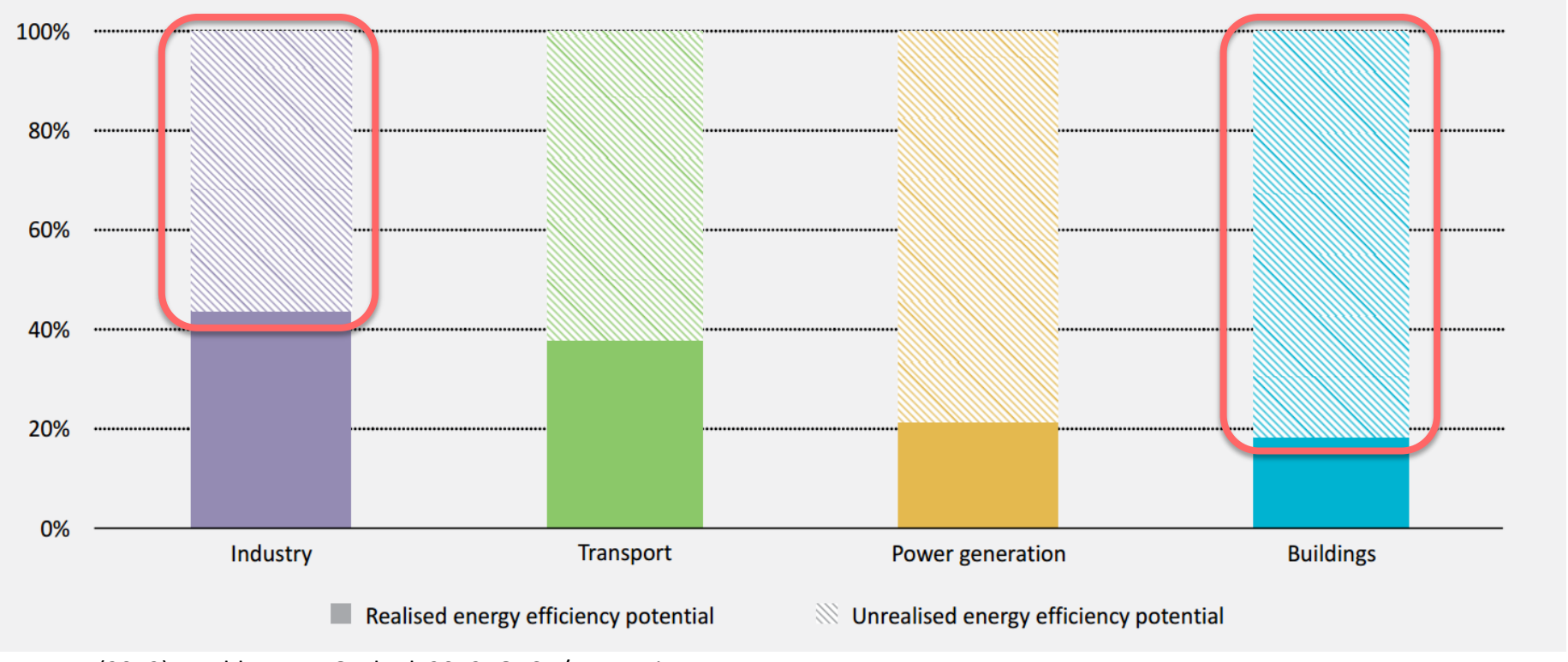
- Avoided TFC in IEA countries from energy efficiency investments made since 1990
- Now larger than the annual TFC of Japan and Korea combined



source: IEA (2015) Energy Efficiency Market Report 2015, OECD/IEA, Paris

There is huge potential

- Long-term energy efficiency economic potential by sector



source: IEA (2012) World Energy Outlook 2012, OECD/IEA, Paris

Background for this webinar

- Project supported by CDKN with the collaboration of
  - Energy research Centre of the Netherlands (ECN)
  - Ministry of Energy and Mineral Resources (ESDM) in Indonesia
  - Ministry of Industry
  - Ministry of Planning
  - Other stakeholders from the private sector and related government agencies

- Objective: to propose government activities that could help make the shift to efficient motor systems, building on existing efforts

- More information can be found at:

  www.ecn.nl/projects/ee-motors-indonesia

Thank you

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Energy efficient electric motor systems

Their importance and opportunities

Jeffrey Sipma
Amsterdam 19/05/16

Content

1. General overview electric motors and their driven systems
2. Quantifying the Indonesian project
3. Barriers: literature and interviews
4. Policy instruments to reduce barriers; next presentation by Maarten van Werkhoven

1. General overview electric motors and their driven systems

Global and Indonesian electricity demand 2006

Globally (195 countries) electricity demand TWh	15,700
Average each country electricity demand TWh	81
Indonesia electricity demand TWh	113
Indonesia as % from world demand	0.7%

→ 60% consumed by 8 countries: US, China, Japan, Russia, Canada, India, Korea, Brazil

Where this electricity consumption goes to?

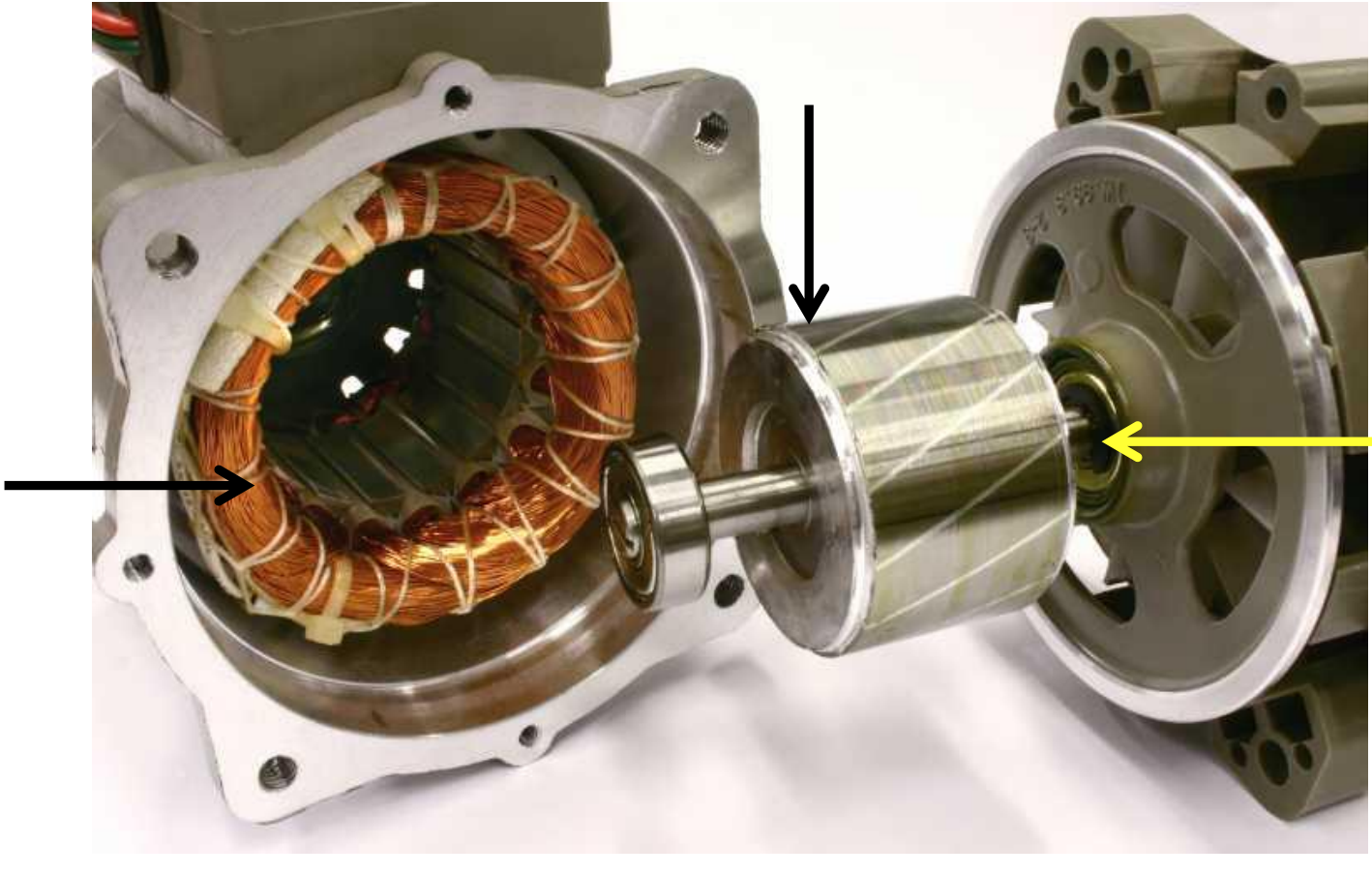
19 % is used to light our world

46% flows to electric motor-driven systems (EMDS)!

- **2,5 times more electricity consumption compared to lighting**

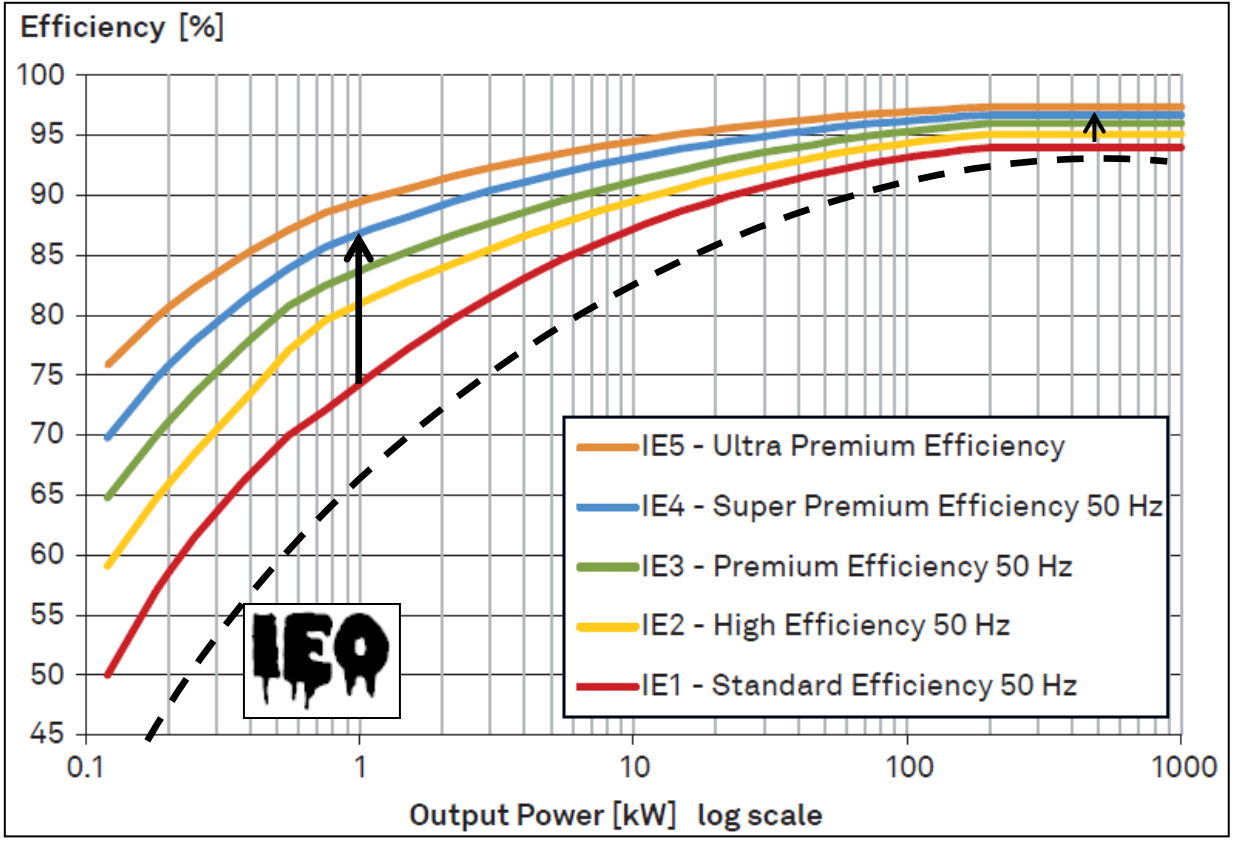
- **To keep things turning**
- **To keep things moving**

Making the electric motor more efficient



1. Thicker electric windings
2. Better insulation
3. Less space between stator and rotor
4. Better alignment of moving parts as ball-bearings

Energy efficient electric motors: IE-classes



- **5 international classes IE1-IE5**
- **IE0 'unbranded, cheap and low quality Chinese motors'**
- **1 kW motors: 10% efficiency improvement IE1-IE4**
- **400 kW: 3% efficiency improvement IE1-IE4**

Mandatory MEPS programmes: Minimum Energy Performance Standard

China_IE0

1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015

Korea

Canada

EU

Australia

New Zealand

New Zealand

Australia

Israel

Brazil

EU

China

USA

Efficiency

~IE1

~IE2

IE3

IND_IE1

China_IE3

Small motors, up to 0,75 kW

- **Residential sector, electrical appliances**
- **Often integrated in a ‘packaged machine’**
- **Refrigerators, mixers, DVD-players, PC hard disks**

Medium size motors, between 0.75 kW and 375 kW

- **Commercial and industrial sector**
- **Ordered from catalogues: stand alone or ‘specific device’**
- **Pumps, compressors, fans, conveyers, industrial handling and processing applications**

Large size motors, above 375 kW, until 100.000 kW

- **Industrial sector and infrastructure**
- **Custom designed for a special application, assembled on site, often integrated with other functions (cooling, heating, etc)**
- **Examples: waste water treatment plant, oil industry**

1. General overview electric motors and their driven systems:

   Prioritising a policy programma aimed at electric motors

Priority for size of electric motor

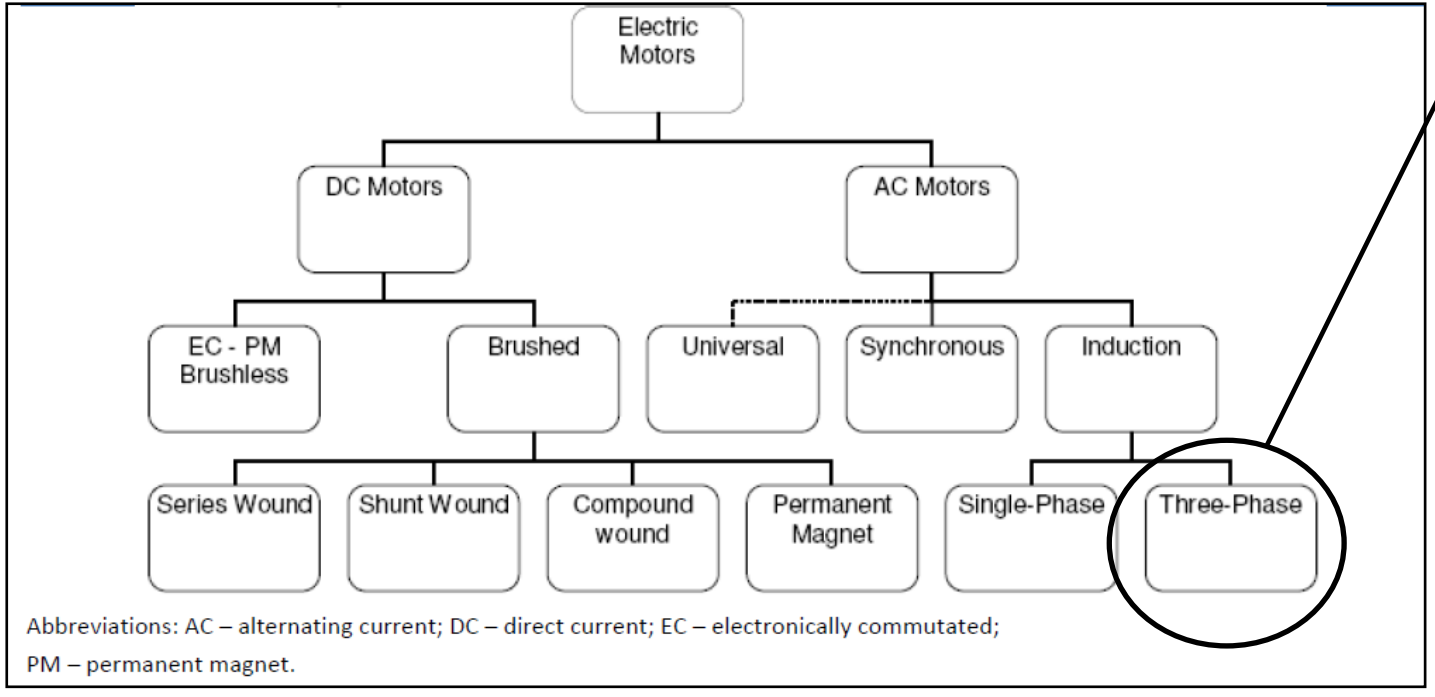
Size electric motor	small	medium	large
% total stock in use	90%	10%	0,03%
% of electricity used	9%	68%	23%

Packed machine	yes		
Specific device		yes	
Stand alone		yes	yes
Special application			yes

Residential sector	yes		
Commercial sector		yes	
Industrial sector		yes	yes

Priority	different approach	YES 1	YES 2

Priority for type of electric motor



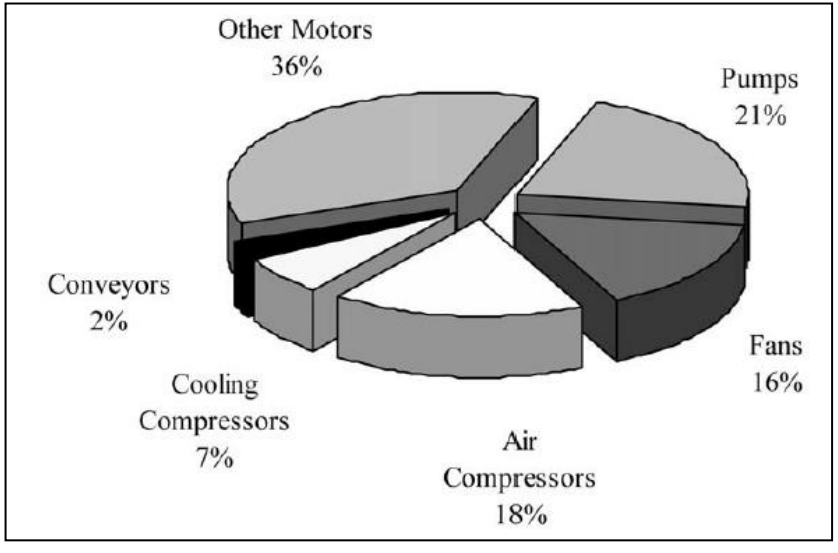
Abbreviations: AC – alternating current; DC – direct current; EC – electronically commutated; PM – permanent magnet.

- **80% of global stock!**
- **Clear international testing standard**

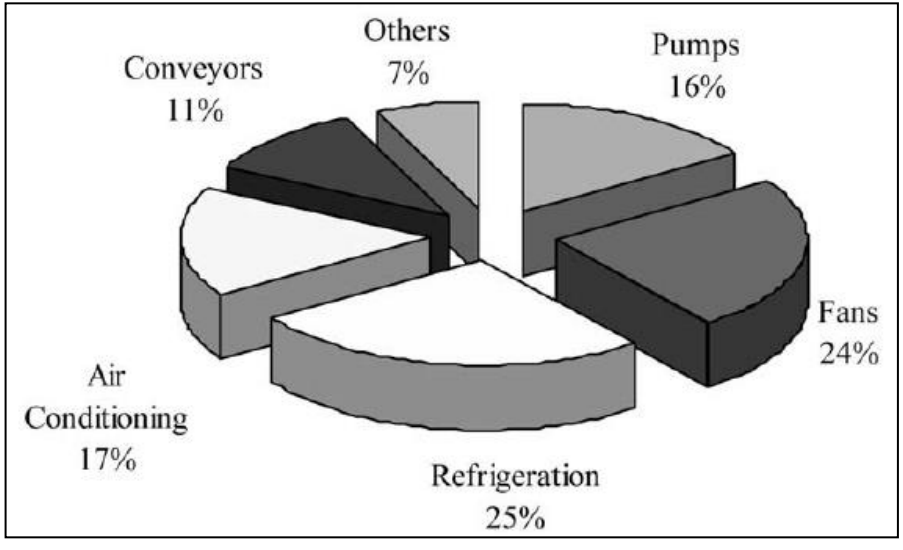
How a single phase AC motor works
Youtube

Priority for sector and 'motor driven systems' (applications)

Motors industrial sector: 70%



Motors commercial sector: 35%



Pumps + Fans + Compressors: 62%

Pumps + Fans + Compressors: 82%

Priority for an electric motor energy efficiency programme; conclusions

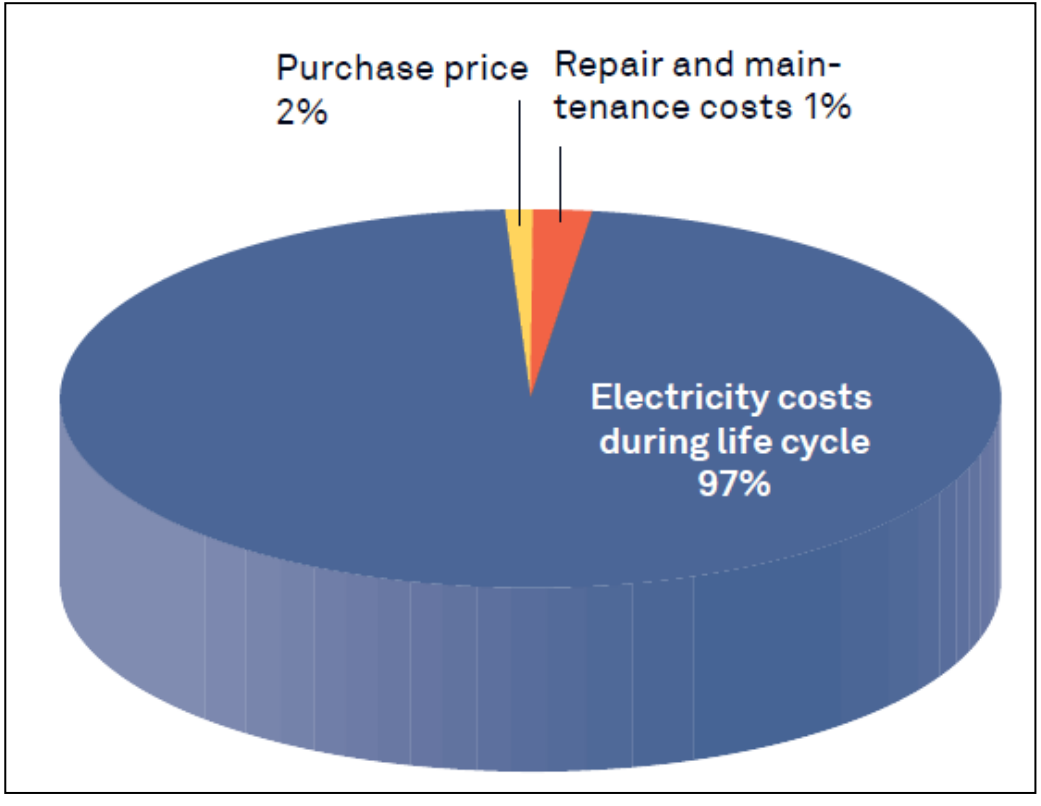
1. **First focus on the medium size electric motors**
2. **Start with the 3-phase induction motor**
3. **These are to be found mainly in the Industrial and Commercial sector**
4. **Often combined with pumps, fans and compressors**

1. General overview electric motors and their driven systems:

   Financial aspects

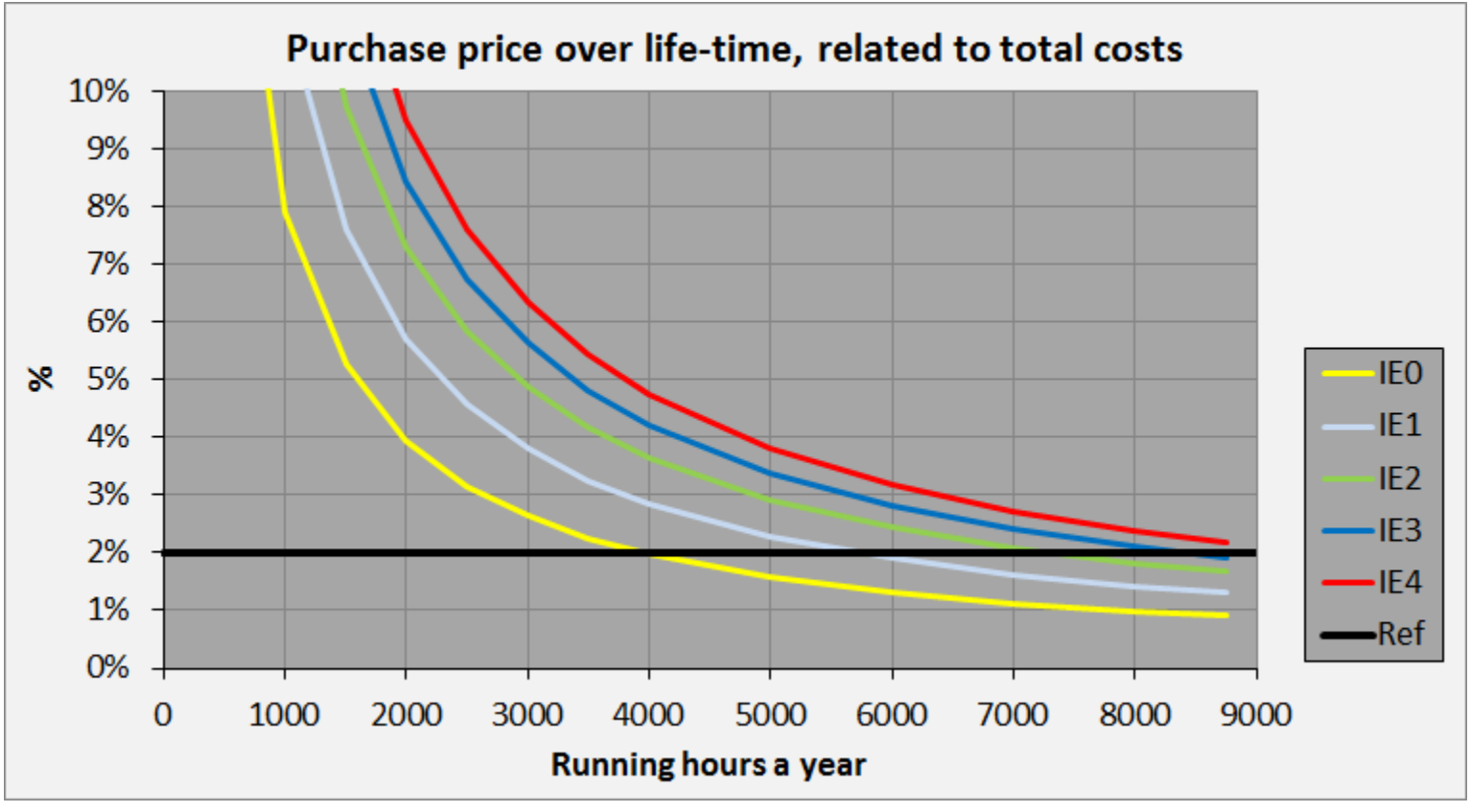
Purchase price over lifetime, literature

4000 operating hours per year, technical lifetime 20 years

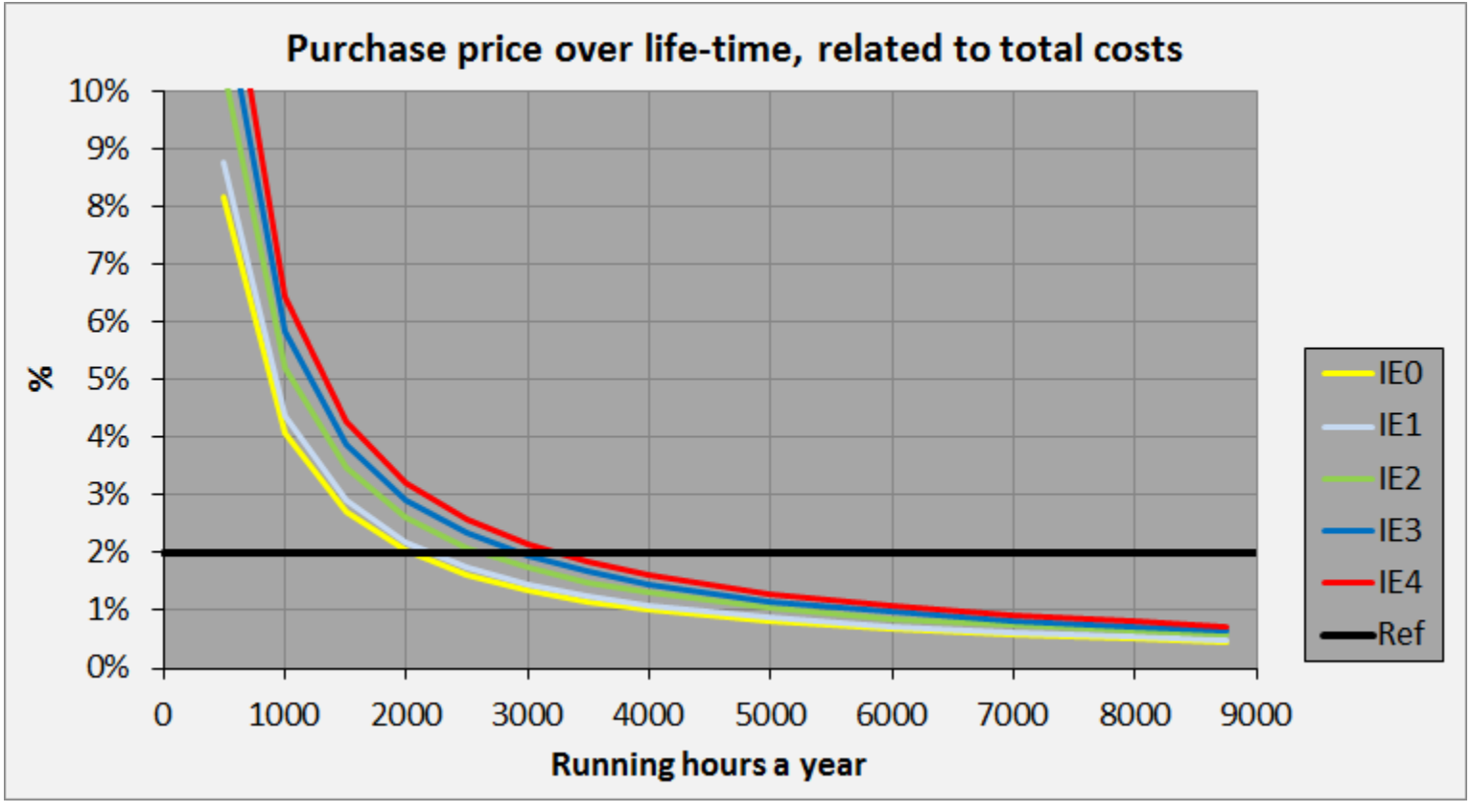


- **97 % of total cost is electricity usage**
- **Higher efficiency motor more expensive, but short pay-back time**
- **What about Indonesia situation? E.g. effect subsidized electricity prices?**
- **Test case industry: average 796 Rp/kWh (=0,06 USD/kWh)**

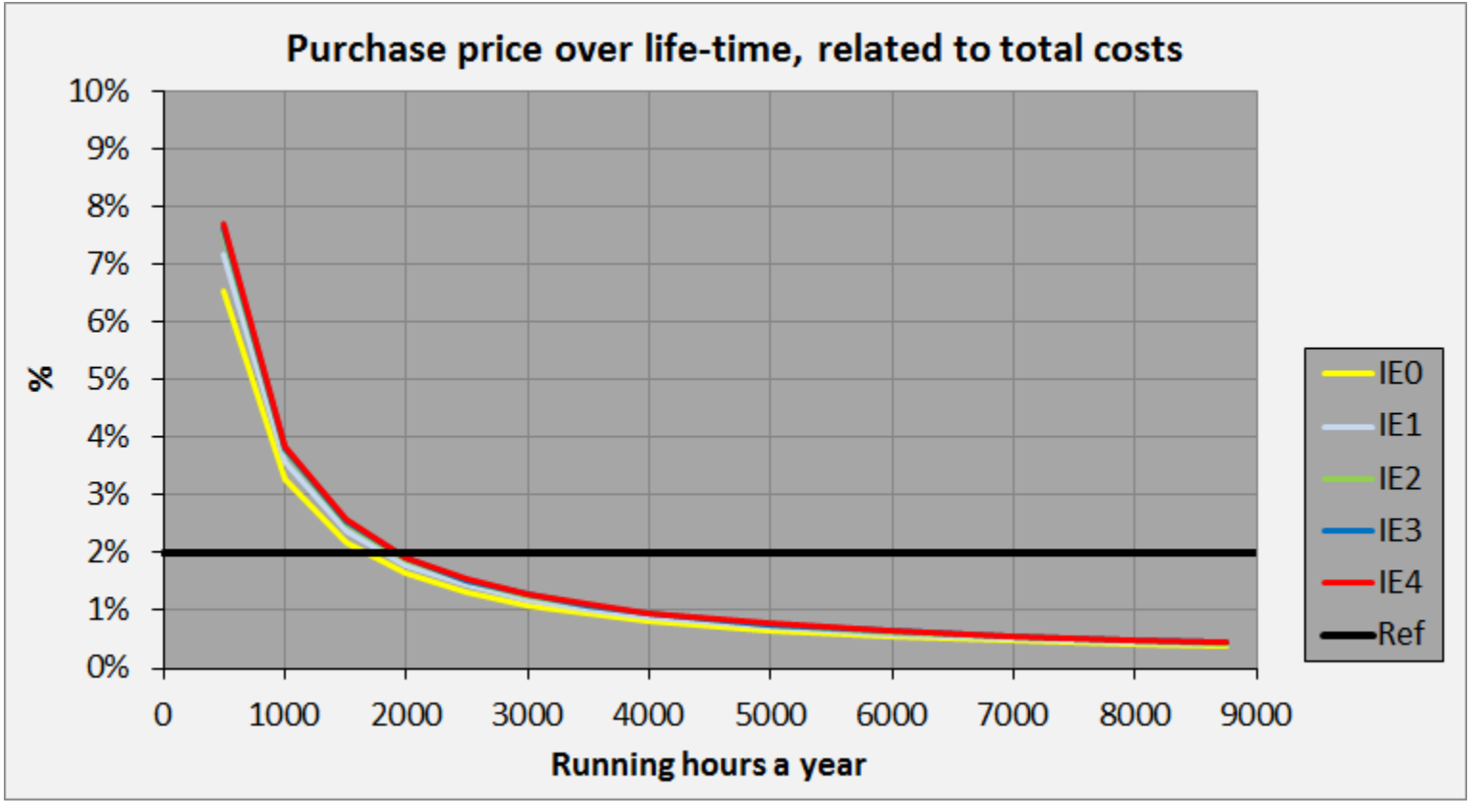
Purchase price over lifetime, Industry 1.1 kW electric motor



Purchase price over lifetime, Industry 22 kW electric motor



Purchase price over lifetime, Industry 110 kW electric motor

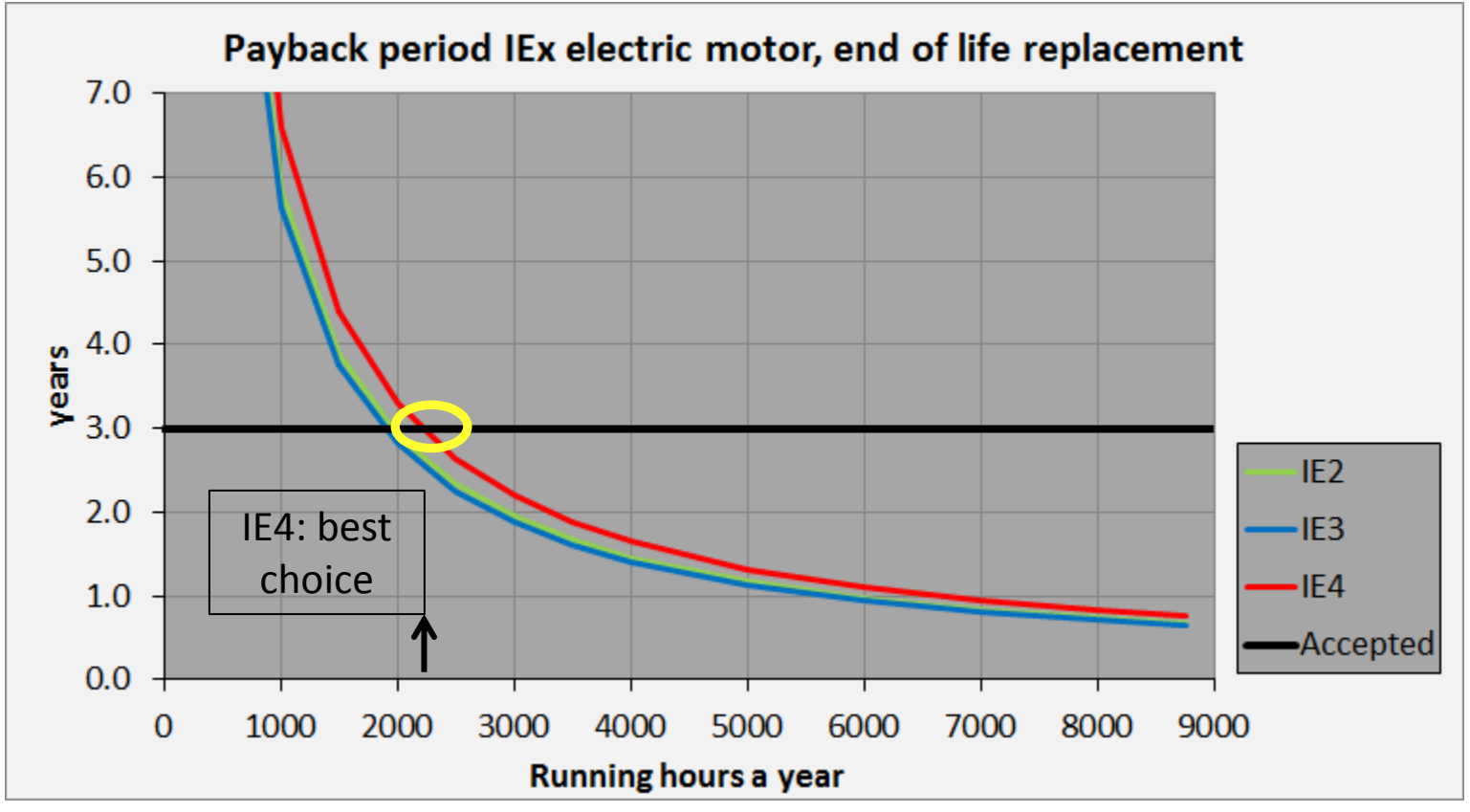


Purchase price over lifetime, Conclusion for industry

- **Due to high number of running hours, purchase price over life time for bigger size electric motors often <1%!**
- **Even with present level of subsidized tariffs**

➢ **Next slide: what about the payback time?**

Simple payback time: end of life replacement of IE1, 22 kW



Replacement of IE1, payback 3 year

kW - run	500	1000	1500	2000	2500	3000	3500	4000	5000	6000	7000	8000	8760
0.37	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
0.55	IE1	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
0.75	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
1.1	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
1.5	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
2.2	IE1	IE1	IE2	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
3.0	IE1	IE1	IE2	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
3.7	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
4.0	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
5.5	IE1	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
7.5	IE1	IE1	IE2	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
9.0	IE1	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
11.0	IE1	IE1	IE1	IE2	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
15.0	IE1	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
18.5	IE1	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
22	IE1	IE1	IE1	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
30	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
37	IE1	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
45	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
55	IE1	IE1	IE1	IE2	IE3	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
75	IE1	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
90	IE1	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
110	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
132	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
160	IE1	IE2	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
200	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
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450	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
500	IE1	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
560	IE2	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
930	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4
5000	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4	IE4

22 kW →

← 22 kW

Simple payback time: replacement of IE1, conclusions

- **Due to high number of running hours a year within the Industry, simple payback time in most cases < 1 year!**
- **When 3 years is an acceptable payback time, IE4 is often the best choice.**
- **Not shown: as well 'mid-life replacements', before the old motor breaks down, can have payback times < 3 years**

- **Note: in the Netherlands, IE3 is mandatory. When IE4 is chosen, tax-deduction is possible**
- **Try other situations with our free Excel file (Bahasa as well): www.ecn.nl/projects/ee-motors-indonesia/**

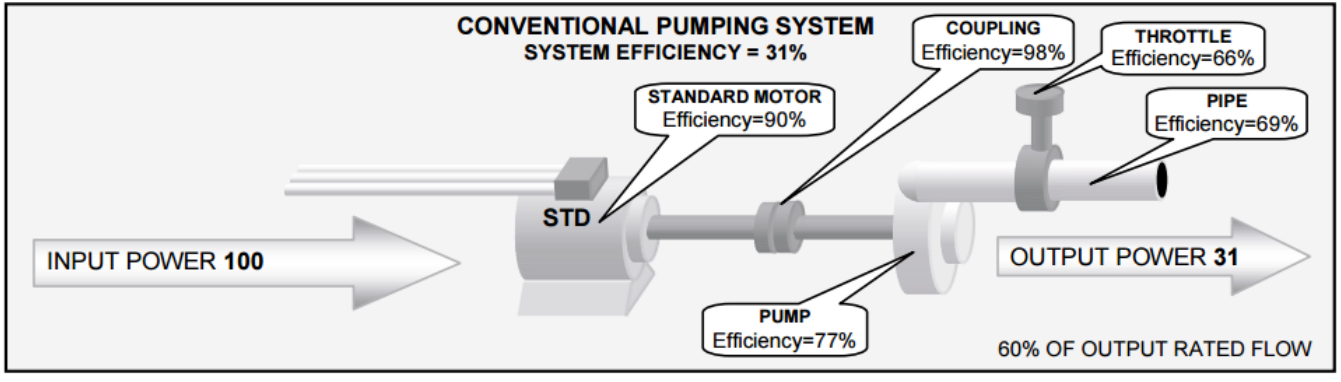
1. General overview electric motors and their driven systems:

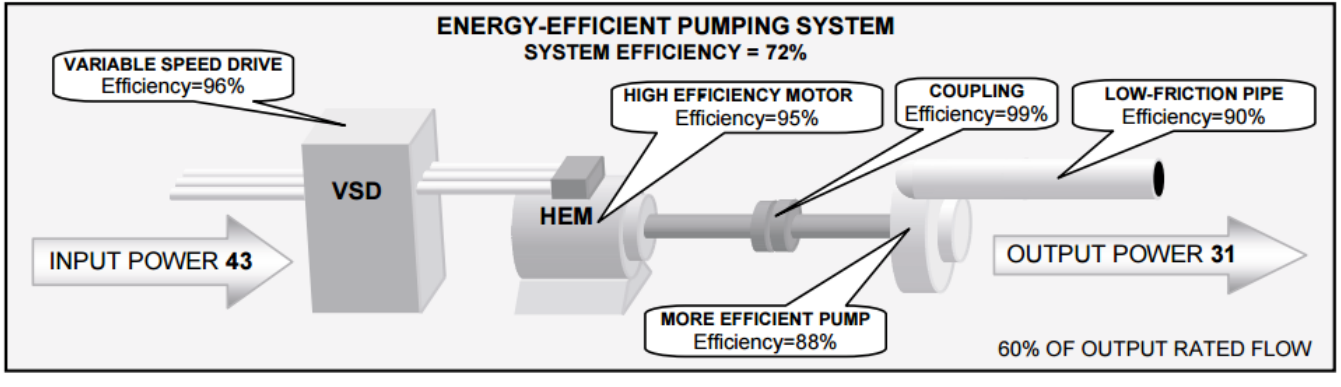
   Electric motor driven systems

It is about Energy Efficient Electric Motor driven **Systems** (EE-EMDS's) where the big savings are!

How a VSD works
Youtube

Example: pumping system





It is about Electric Motor-Driven **Systems (EMDS)**

	Motor efficiency	Coupling efficiency	Connected pump efficiency	Throttle versus VSD	Distrubution system efficiency	Total efficiency
Conventional:	90%	98%	77%	66%	69%	31%
Energy-efficient:	95%	99%	88%	96%	90%	72%
Savings:	5%	1%	11%	30%	21%	41% ←
Approach:	MEPS; labeling	Additonal approaches				

MEPS = Minimum Energy Performance Standard

Maka bukan sebaiknya tidak hanya fokus pada motor, tetapi sistem secara keseluruhan

Many success stories

Project	Country	Energy efficiency improvement	Cost-effectiveness
Optimization of the cooling water system in a pharmaceutical company by installing two new pumps, applying variable speed control and minimizing friction losses in the ductwork system.	China	Reduction of electricity demand of cooling water system by 49 percent	Payback about 1.8 years (investment of USD 145,000 and annual savings of USD 80,000)
Installation of 34 variable speed drives in a petrochemical company.	China	28% electricity demand reduction per tonne of crude oil refined	0.48 years static payback time
Installation of **15 variable speed drives** in a ventilation system in a textile plant	USA	59% reduction of ventilation system's electricity demand	1.3 years static payback time and USD 130,000 investment

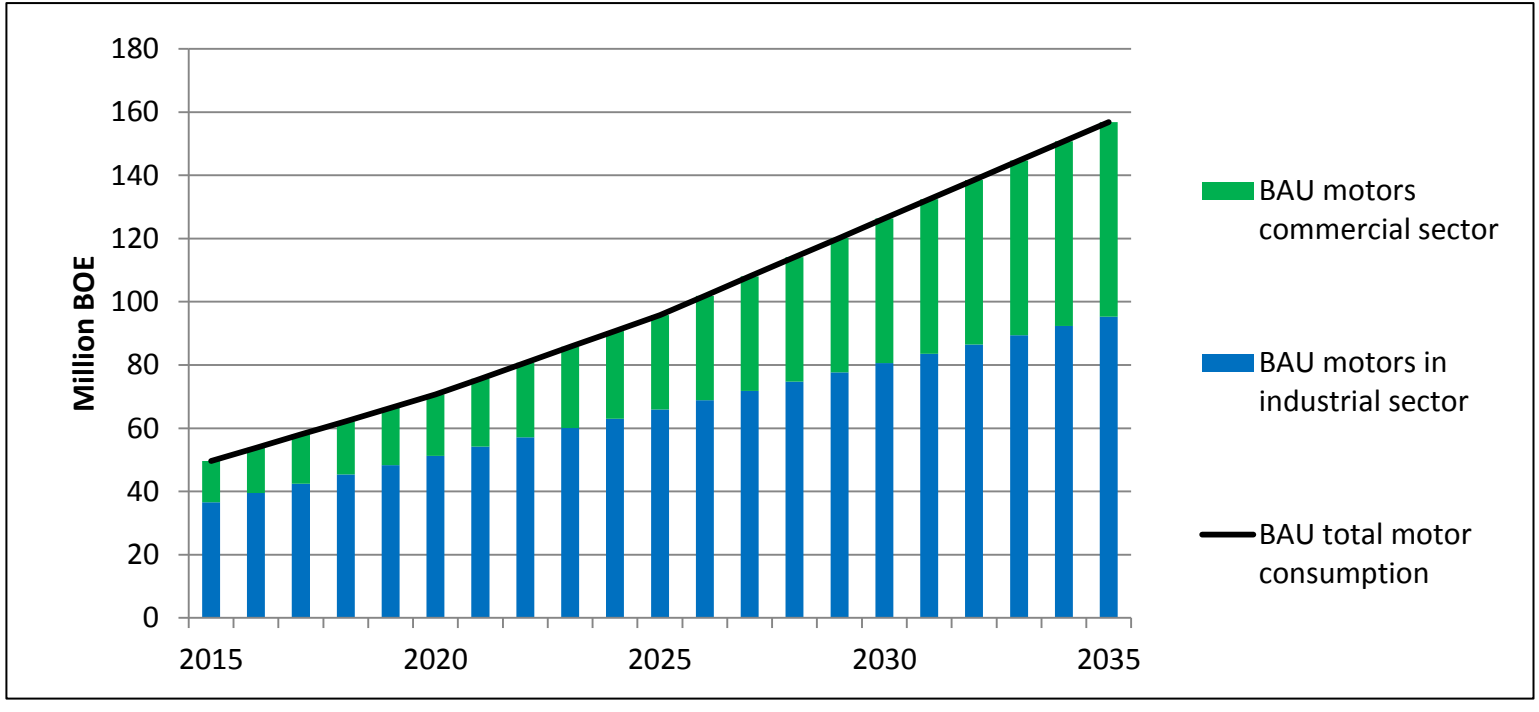
2. Quantifying the Indonesian project

- **Electricity consumption**
- **Electricity savings**
- **Financial savings sector and government**
- **Other benefits**

Consumption electric motor systems 2014: Bottom-up versus Top-down

Industrial plus commercial sector	million BOE usage 2014	TWh usage 2014	Total electric motor stock; medium and large size (pieces)	Average efficiency
Bottom-up approach (2014): import data	47	77	3.053.324	88,1%
Top-down approach (2014): Indonesian statistics	46	75		
Compare with world (2006): according to IEA (2011)	3.624	5.900	230.600.000	87%-93%
Indonesia as % from world	1,3%	1,3%	1,3%	

Consumption electric motor systems: BAU projection towards 2035



BAU: Present market share IE-classes Indonesia

IE class	% share production (< 0.75 kW)	% share production (0.75 kW - 45 kW)	% share production (> 45 kW)	% share production (all units)
IE4	0%	0,4%	0,8%	0,3%
IE3	0%	2%	5%	2%
IE2	0%	5%	10%	3%
IE1	50%	59%	68%	56%
IE0	50%	34%	17%	39%
Total	100%	100%	100%	100%

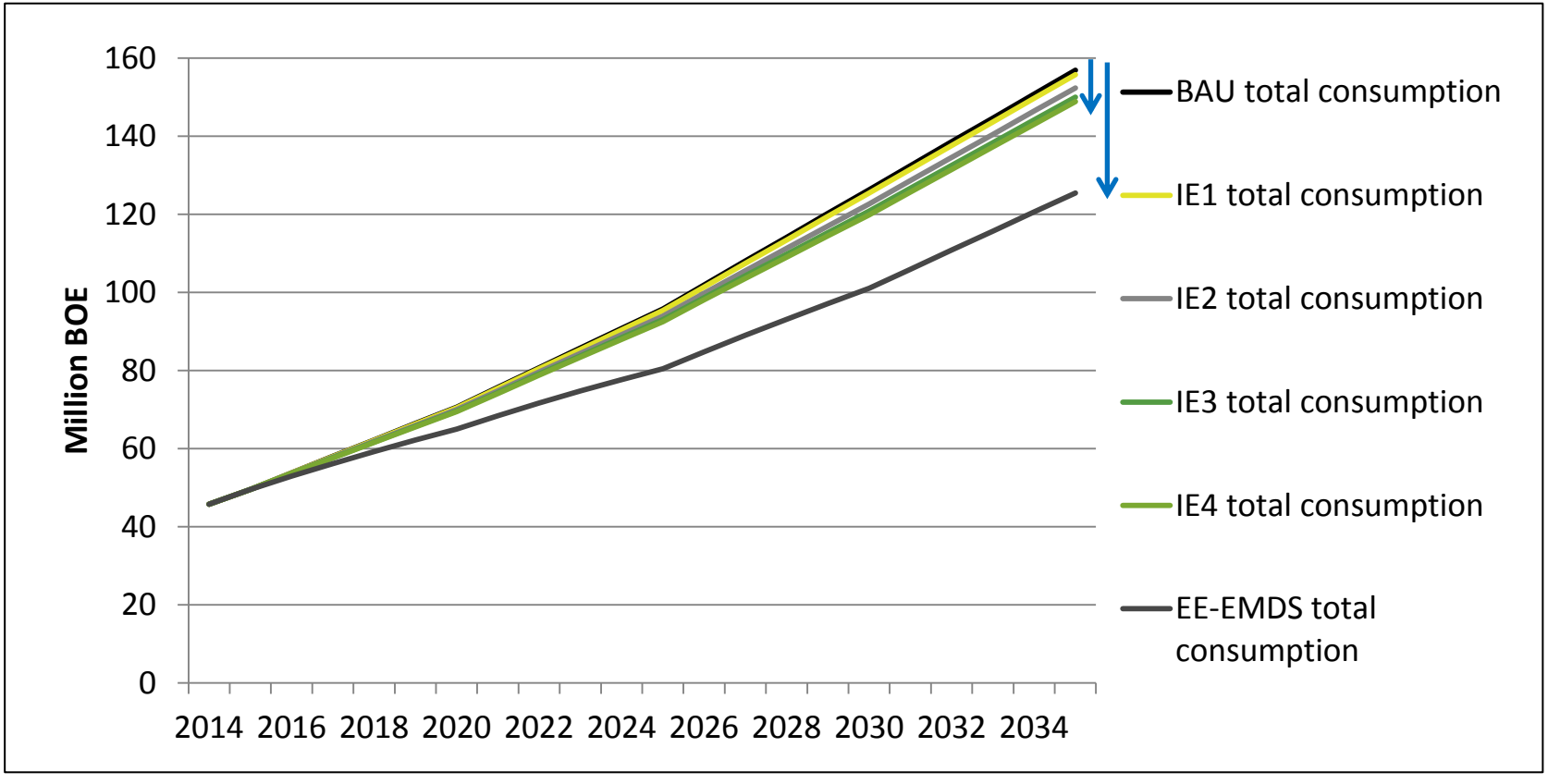
Savings: by IE-class and for optimizing electric-motor driven systems (EMDS)

		Market share and savings for chosen MEPS IE-class					
Motor efficiency class	**International coding**	**Present share**	**MEPS on IE1**	**MEPS on IE2**	**MEPS on IE3**	**MEPS on IE4**	**MEPS on IE4 and EE-EMDS**
Super premium	IE4	0,3%	0,3%	0,3%	0,3%	100%	100%
Premium	IE3	2%	2%	2%	100%	0%	0%
High	IE2	3%	3%	98%	0%	0%	0%
Standard	IE1	56%	95%	0%	0%	0%	0%
Below Standard	IE0	39%	0%	0%	0%	0%	0%
Total share:		100%	100%	100%	100%	100%	100%
% sector savings MEPS IE-target		0%	0,7%	2,9%	4,4%	5,1%	20%

Present MEPS

Systems approach

Electricity savings: effect MEPS versus system approach



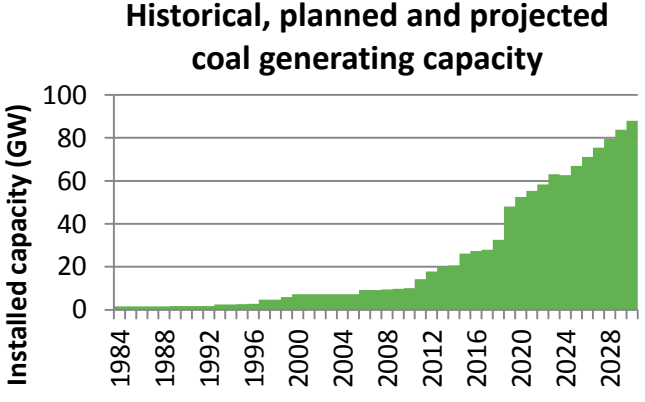
Electricity savings: effect MEPS versus system approach

Cumulative results 2015-2035 (20 years)					
	MEPS on IE1	MEPS on IE2	MEPS on IE3	MEPS on IE4	MEPS and EE-EMDS
Cumulative savings sector 2035 (TWh)	17	71	108	126	523
Cumulative avoided CO2 emissions sector 2035 (Mton)	15	62	93	110	454
Cumulative savings sector 2035 electricity mln USD	1.198	4.995	7.554	8.870	36.706
Cumulative savings governmental subsidies 2035 mln USD	713	2.973	4.496	5.279	21.847
Average results a year 2015-2035					
Average yearly savings sector (TWh)	0,9	3,6	5,4	6,3	26,2
Average yearly avoided CO2 emissions sector (Mton)	0,7	3,1	4,7	5,5	22,7
Average yearly savings sector 2035 electricity mln USD	60	250	378	443	1.835
Average yearly savings governmental subsidies mln USD	36	149	225	264	1.092

Electricity savings: effect MEPS versus system approach

Additional effect of system approach compared to MEPS for IE4	Multiplier at accepted pay-back time of 3 years
Industry and commercial sector: - electricity savings - financial savings (incl. government), - related GHG emission reduction	4 times more
Economy: direct investment equipment USD	9 times more
Employment: installation workforce in man-year	18 times more

Additional savings due to avoided power plant capacity



- This programme avoids 7,1 GW of needed power plant capacity
- This equals half of the 15 coal-fired power plants under construction at the moment
- This equals a saving of 11 *billion* USD investment

Plans for coal-fired power in Asia are 'disaster for planet' warns World Bank

But is doesn't go by itself….

3. Barriers: literature and interviews

Barriers at the level of manufactures and wholesale

- ***Customers demand for low investment cost, not life-cycle cost***
- Manufacturers tendency to discourage energy-efficient EDMS
- Inability to effectively explain the economy of energy-efficient EDMS and customer loyalty
- Inadequate assessment of actual use for EDMS
- Fear of EDMS failure that will disrupt production
- Lack of incentive to innovate

Barriers at the level of planning and engineering

- Limited types of motors and components to minimise capital costs
- ***Outdated engineering skills***

Barriers at the level of investors and energy managers

- Complexity of EDSM
- Sales generally not the end-user
- ***Large stock of old inefficient replacement motors***
- Purchasing decisions typically based on lowest investment cost
- Limited knowledge of energy-efficient options
- Inadequate understanding of how to avoid energy losses

Some additional barriers found in Indonesia

- Cheap (unbranded) import of bad quality Chinese electric motors, can this really be stopped? And should it actually be stopped for all situations (e.g. only little running hours a year)?
- Changing name plates to make the performance of a motor look better
- Brochures and catalogue with electric motor specifications can not always be trusted
- Low electricity costs due to subsidizing program → although we have seen that even then a payback period of three years can often be achieved
- Own electricity production with own generators
- ***Rewinding industry, including low quality rewinding (but fast)***
- Large stock old 'bad' motors, often rewinded and oversized
- Employees working with motors and pumps, are not trained to operate the system in an efficient way (e.g. keeping it running at night).

Luckily there are is a lot of information available to face these challenges!

4. Policy instruments to reduce barriers: next presentation by Maarten van Werkhoven

Webinar Energy Efficient Motor Systems, learning from Indonesia

Part 2: *Policy tools for improving motor systems in the Indonesian context*

19 May 2016

Maarten van Werkhoven, TPA advisors, Netherlands

Rita Werle, Impact Energy, Switzerland

Introduction

Maarten van Werkhoven, TPA advisors, Netherlands
Rita Werle, Impact Energy, Switzerland

Projects, programs and policies for energy efficiency in industry and buildings:

- International
  - IEA 4E Electric Motor Systems Annex www.motorsystems.org, Operating Agent and Coordinator
  - Motor Summit conference www.motorsummit.ch
- Netherlands
  - Green Deal Program on efficient motor systems
  - Knowledge Network
- Switzerland
  - Topmotors awareness raising & training program www.topmotors.ch
  - EASY Efficiency for Motor Systems audit program with financial incentives

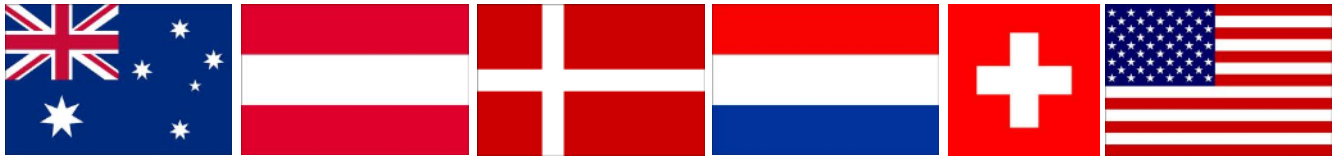
EMSA Electric Motor Systems Annex

International Energy Agency

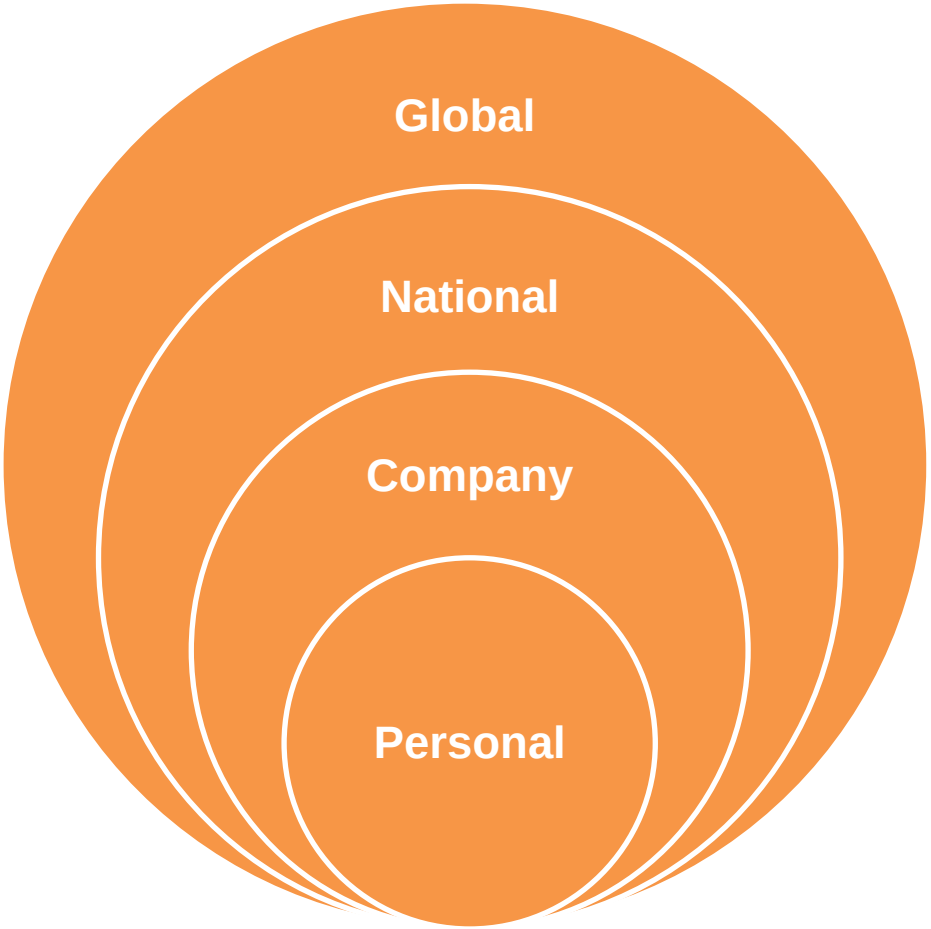
- 6 countries
- 2009 – 2017, 3rd phase 2014 - 2017
- EMSA: www.motorsystems.org

4E Energy Efficient End-use Equipment International Energy Agency

4E Electric Motor Systems EMSA



EMSA for market transformation



…harmonized global standards

…successful policies

…energy management & audits

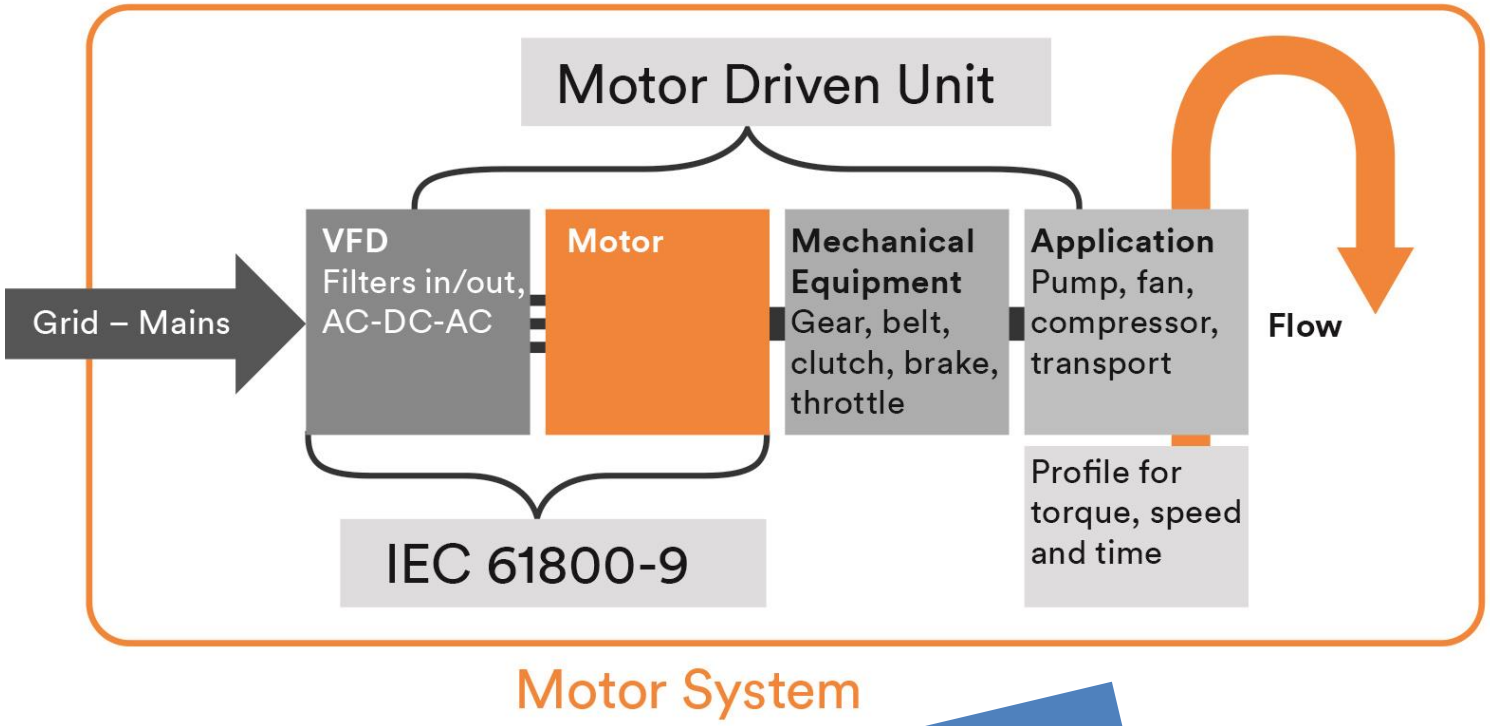
…tools & information

Contents

1. Policy Guidelines for motor systems
2. Indonesia - Proposed Market Development program
3. Resume

1. Policy Guidelines for motor systems

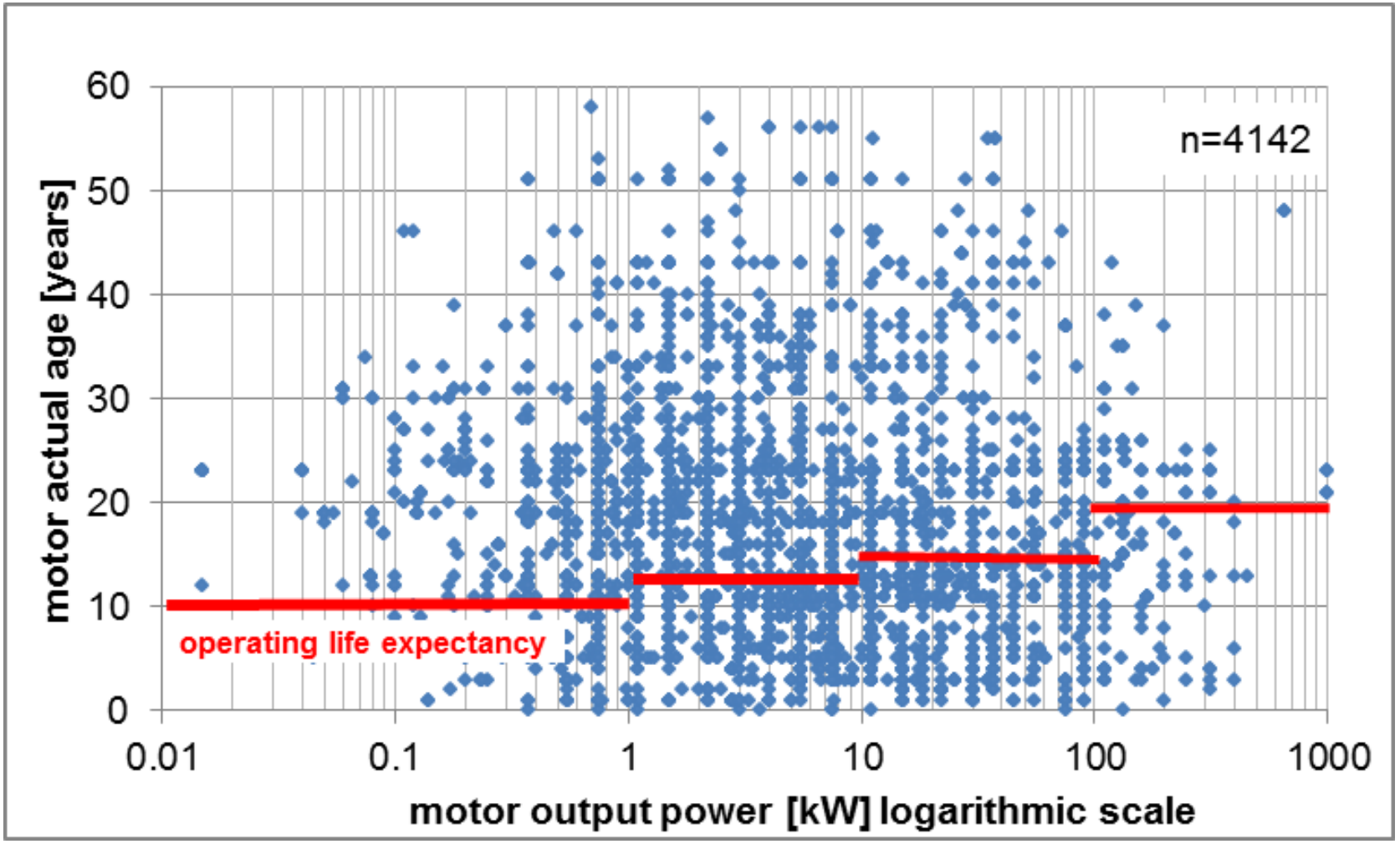
Electric Motor Systems



- Motor systems drive pumps, fans, transportation systems, processes.
- They can be in new and existing industrial applications, in infrastructure and building systems.

20% - 30% savings

Never touch a running system



56% of motors are older than their operating life expectancy; these older motors are 99% too old.

Successful policy implementation

EMSA publications

Upcoming

- Policy Guidelines for Motor Driven Units (2016/17)

Download:
www.motorsystems.org
www.iea-4e.org

Back ground

Policy guidelines for electric motor systems

- There is no single instrument to facilitate energy savings
- Different elements influence the decision making in industry
- Cost efficiency is no guarantee for implementation
- Different barriers exist in procurement, installing and using energy efficient motor systems

I. Therefore a mix of policy instruments is needed to overcome the barriers for energy efficiency

II. Policy has to be defined broader than just Minimum Energy Performance Standards (MEPS)

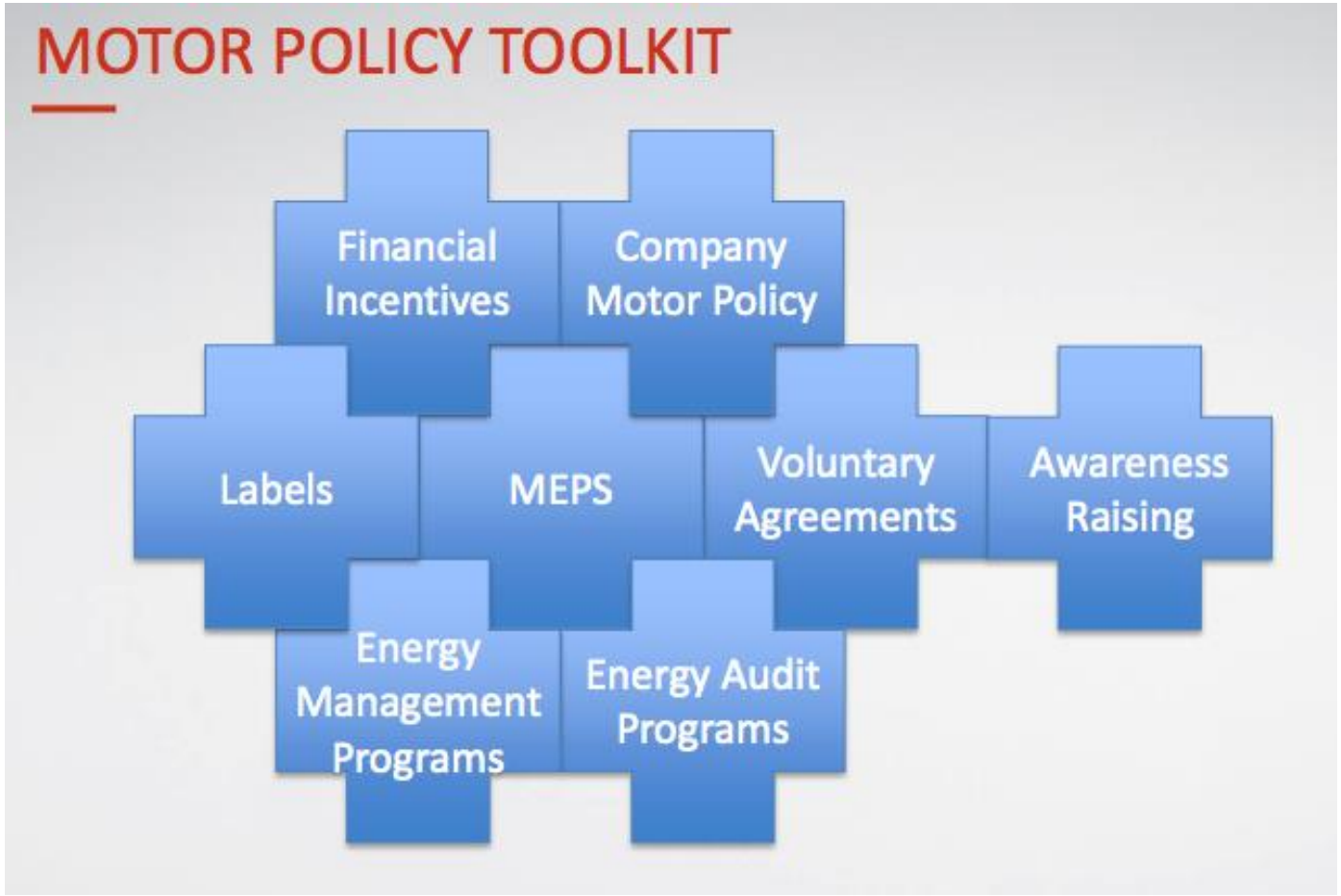
Source: P. Lackner et al, EEMODS 2015; EMSA

Policy Guidelines as a “cook book”

- Framework for policy makers to consider how to plan and implement a comprehensive energy efficiency strategy for electric motor systems
- Thorough guide to the range of policies most commonly used to stimulate motor efficiency and the key attributes of each type of policy
- The guideline shows policy makers
  - what needs to be taken into account when implementing such policy instruments
  - successful examples considered worthwhile to follow
  - recommendations for implementation

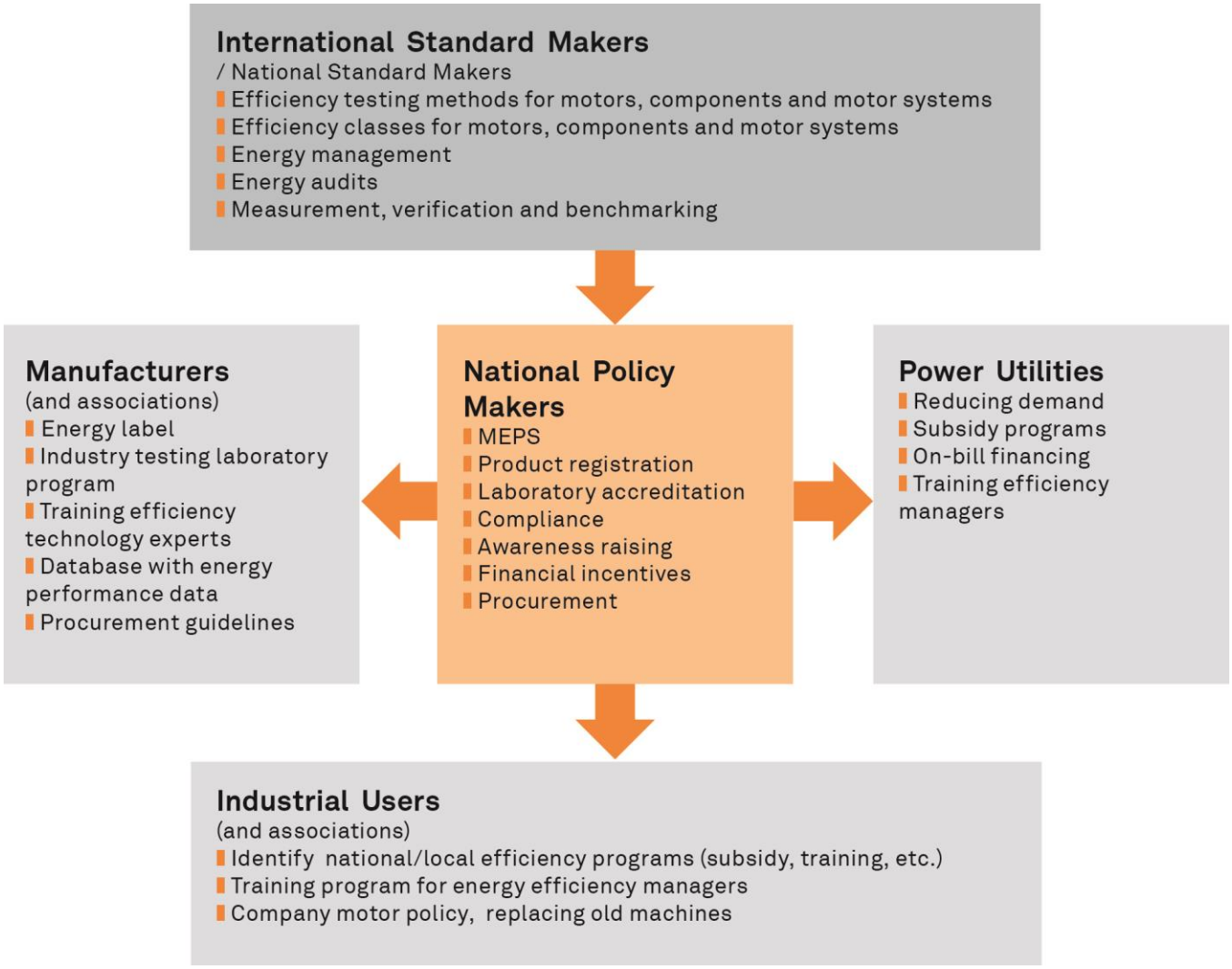
Source: P. Lackner et al, EEMODS 2015; EMSA

Motor Policy Toolkit



Key Stakeholders

Most effective policies stimulate action



2. Indonesia – Proposed market development program

Policy instruments

Applying the Policy Guidelines (1)

Instrument	Status in Indonesia	Recommendations for Indonesia
Minimum Standards	IE1 is in draft status as the minimum performance standard for motors. No plans for pumps, fans, compressors	Get MEPS IE1 into force, and start planning increase the level stepwise to IE2 and IE3. Develop international coordinated market surveillance: including international test-labs, registration system
Labelling	For motors IE1-IE4 is used similar to labels	Support of international labelling initiatives
Energy Management	According to the energy efficiency law (70/2009) big companies have to implement elements of an energy management system and conduct energy audits	Improve enforcement of law; expand regulation to larger number of companies affected

Applying the Policy Guidelines (2)

Instrument	Status in Indonesia	Recommendations for Indonesia
Energy Audits	According to the energy efficiency law big companies have to conduct energy audits and develop a conservation program. And report to government	Check if reported energy saving measures for motors are implemented; supply further training and support for energy auditors in this field
Company Motor Policy	No examples known	Integration of motor systems policy in energy management systems; trainings for stakeholders
Voluntary Agreements	Voluntary agreements are not used yet	Start a pilot with industry, including saving targets, monitoring and benefits. Motor systems as important topic for energy audits and part of energy management system

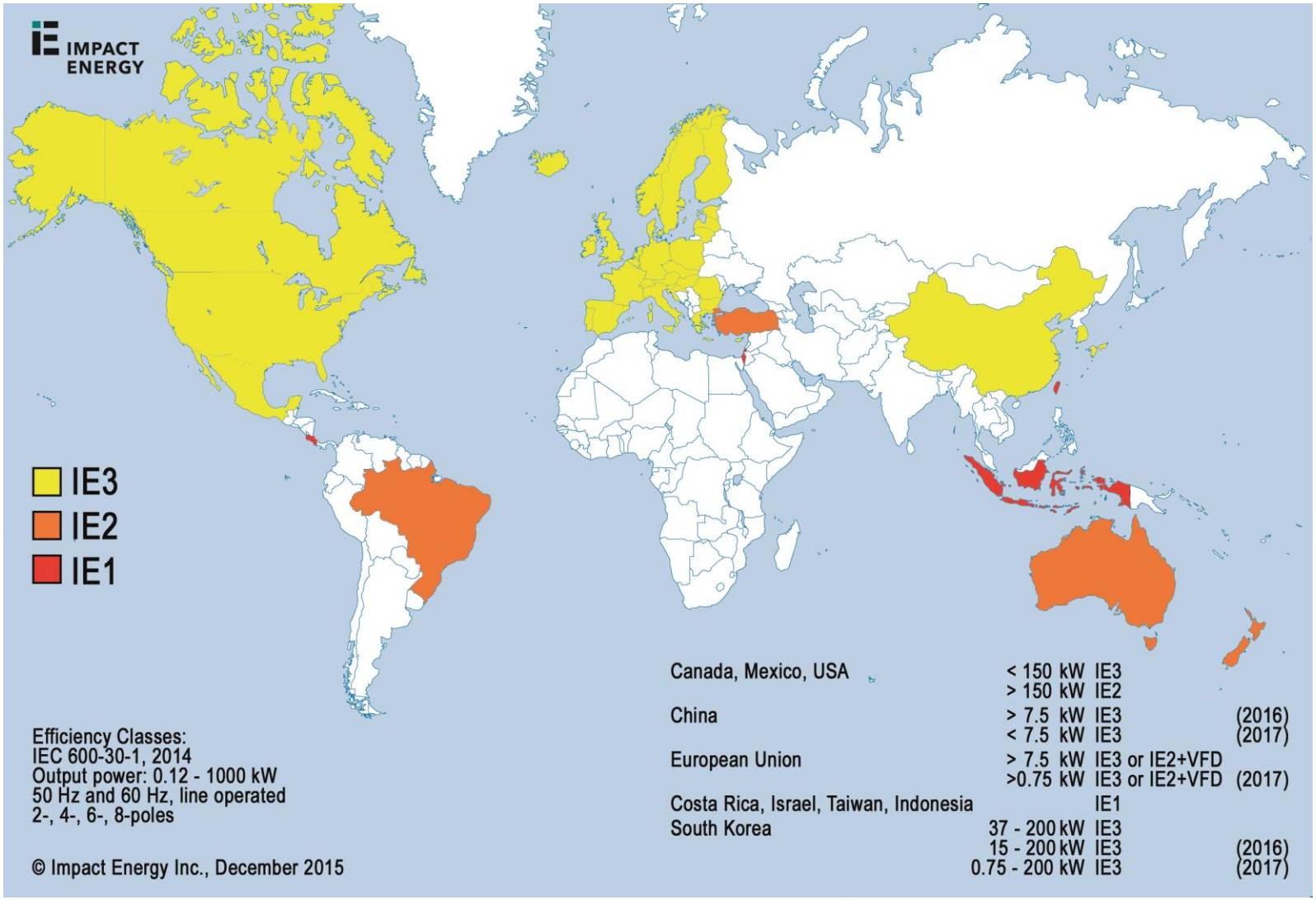
Applying the Policy Guidelines (3)

Instrument	Status in Indonesia	Recommendations for Indonesia
Financial Instruments	Electricity prices are partly subsidized, depending on region and company size; No further tools	Implement financial incentives to support the implementation of energy efficiency measures, with • grants schemes & tax incentives; • loan and guarantee instrument; • companies that join VA : access to lower energy tariffs
Raising Awareness and Information	Some programs on: training energy audits & motor systems	Set up an information and awareness campaign in cooperation with associations; stakeholder platform with government and associations; development of market for audits and energy management training

Market development program for Indonesia

1. Join the global level of higher Minimum Energy Performance Standards (MEPS)
2. Harvest benefits of regulation on Energy Management
   - Improve enforcement
   - Expand regulation
3. Add Voluntary Agreements
4. Add Supporting activities
   - Financial incentives
   - Training factory staff and external specialists
   - Stakeholder platform on policies & regulation

Global MEPS overview - motors



1. Minimum Energy Performance Standards (MEPS) – *join the global level*

1. Higher efficiency level (no waste basket for low quality products in Asia):
   - IE2 (2 years)
   - IE3 (5 years)
2. Include further motor systems and components:
   - Pumps, fans (3 years)
   - Compressors, variable frequency drives (5 years)
3. Set up registration
4. Establish compliance regime
   - Regular check-testing
   - Build laboratory capacities: install & calibrate equipment, train qualified staff
5. Define punishment for non-compliance:
   - Publish non-compliant product and manufacturer (most effective)
   - Financial fines
   - Other

MEPS on pumps, fans, compressors
motor driven units

- US:
  - pumps (& motors) in place,
  - fans & compressors: in preparation
- EU:
  - pumps & fans in review (& motors),
  - compressors in preparation
- Australia:
  - pumps (& motors) in place,
  - fans under consideration
- China:
  - pumps, fans, compressors (& motors) in place

2. Harvest benefits of existing regulation

Regulation Energy Management

Core elements (through energy management)

- Mandatory
- Large energy consumers 6000 TOE/year *)
- Energy management:
  - appoint energy manager
  - formulate energy conservation program
  - periodic energy audits
  - recommend result of audit
  - report implementation yearly to government
- Results of 800 audits so far

Improvements possible on

- Quality of audits, quality of conservation program
- Monitoring
- Commitment & Implementation by companies

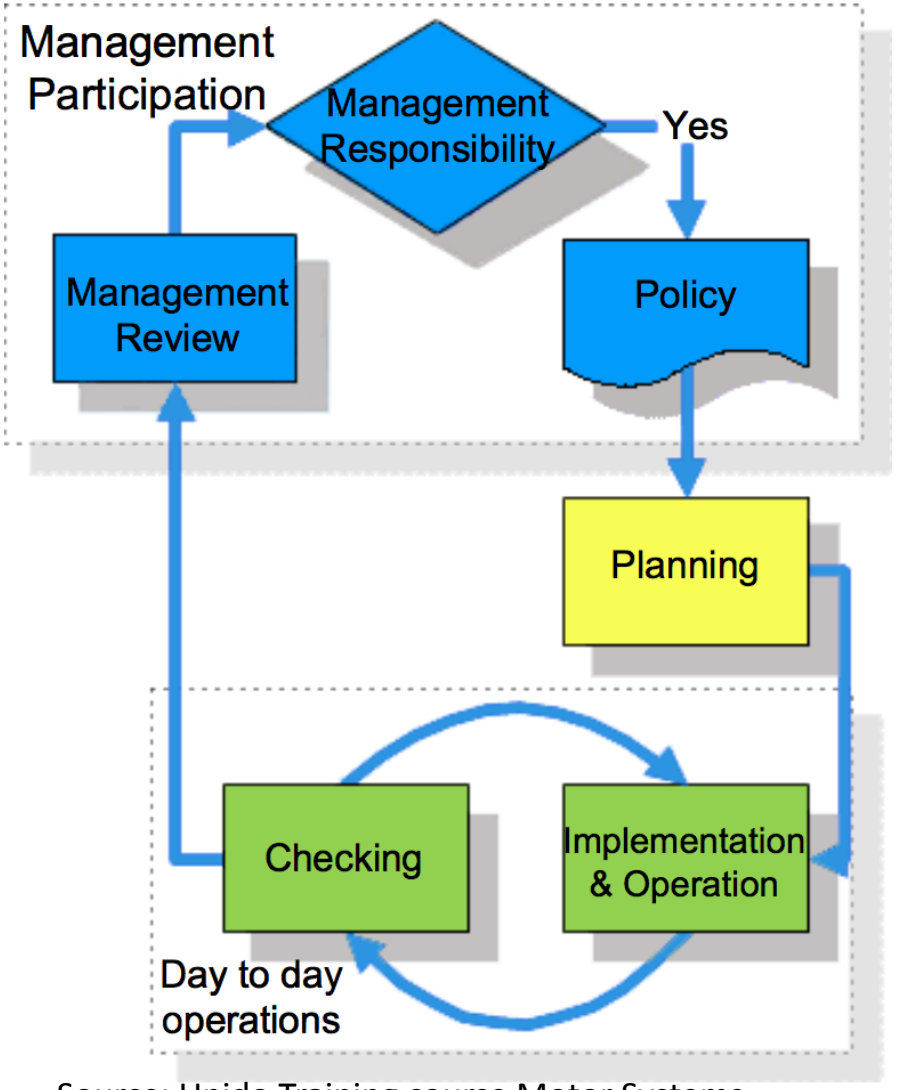
*) 260 companies TOE total energy; -> 310 is lowered to 4500 TOE total [note: indicative number, by J. Sipma]

What is Energy Management System

Management System by which organisations establish

- the systems and processes necessary to
- achieve operational control and continual improvement of energy performance.

It includes a set of defined practices and actions.



Source: Unido Training course Motor Systems

Improve Regulation on energy management
enforcement and expansion

GOVERNMENT

1. Identify affected companies
2. Increase motivation for participation
3. Enforcement
4. Monitoring
5. Multiply results

COMPANIES

1. Set savings target
2. Appoint energy manager
3. Do audits by certified** auditors
4. Define action plan
5. Implement measures
6. Define purchasing criteria
7. Report progress to government
8. Attend user groups

**) internal or external

Expansion of regulation on energy management

Goal

- Achieve larger savings
- Enlarge use & effectiveness of existing regulation

How

- Lowering threshold of 6,000 TOE/year
  - Need for further analysis of specific energy use (per company) and numbers of companies affected, and
  - Implications for monitoring and compliance

3. Introduce Voluntary Agreements

core elements

Government (Ministries, agencies)

Industrial sectors, Commercial sectors (trade organizations)

Individual companies

Defining structures for binding agreement

- Benefits when participating and actions at non compliance

Commitments (trade org.)

- Agree on quantitative targets sector
- Report on EE improvements

Commitments

- Supply of incentives
- Support in developing EE-plans
- Cooperative actions on enforcement
- Monitor EE improvements on sector level

Commitments (companies)

- To implement EnMS
- EE-audit every 4 yrs
- Implement measures [xx]
- Monitor EE improvements (on company level)

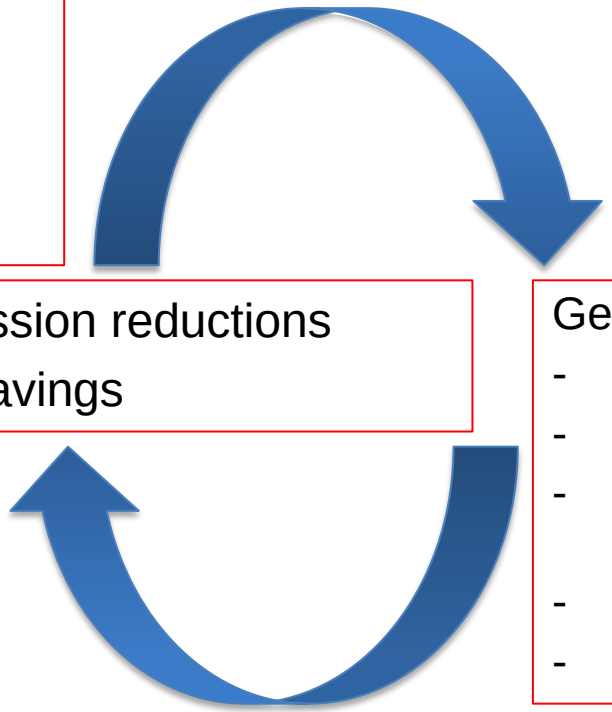
Benefits VA for involved parties

Government (Ministries, agencies)

Industrial sectors, Commercial sectors (trade organizations)

Individual companies

Get
- ‘Entrance’ to companies
- Cooperative enforcement
- Improvement of effectiveness regulation



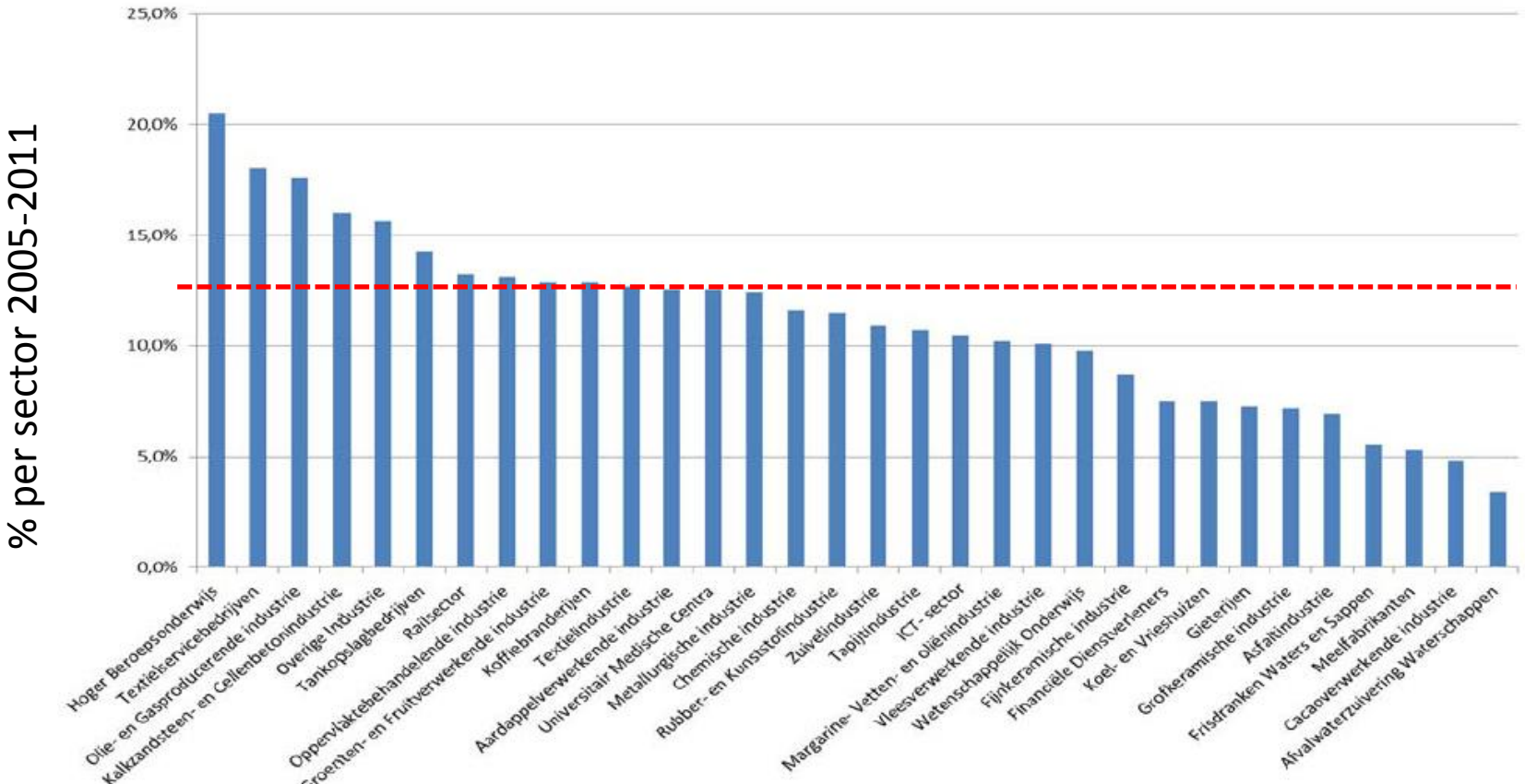
CO_2 emission reductions

Energy savings

Get
- Training, capacity building
- (some) funding
- Mutual understanding of enforcement
- Benefits of Energy Efficiency
- Recognition

Example: performance of VAs in The Netherlands 2005-2011

- Efficiency improvement: 26 PJ, =13%; eq. 2,1% per year
- 33 sectors, 1100 companies, energy use 3-70% of costs



Next possible steps for assessing potential for VA

- Involve potential partners, trade associations
- Select the core elements of an Indonesian VA scheme
- Detail the scheme, including time path, funding, potential participation and cost/benefit

Some criteria for selection

- Number of companies, cumulative energy use, energy intensities
- Entry to trade associations and their members
- Identification of matching interest in incentives and benefits

4. Supporting activities (1)
Financial incentives

Increase the level of investment and participation in EE

- Smaller companies short term: grants schemes
- Larger companies: short term tax incentives
- All companies longer term: loan and guarantee instrument
- Generally: decreasing energy subsidies
- Companies that join VA's: access to lower energy tariffs
  - Potential strong incentive for getting companies to participate
  - And fining those who do not comply

4. Supporting activities (2)

Information and awareness - Training program

Key topics

- Energy management
  - principle
  - steps
  - tasks and responsibilities
  - experience
  - successful communication, selling your project
- Motor systems
  - practical methodology for optimization
  - efficiency of motors, pumps, fans, compressors, converters
  - system improvement
  - measurements on site
  - cost/benefit analysis
  - practical tools and examples

Training setup

INTRODUCTION

Energy policy

MANAGEMENT

- ISO 50001
- Communication
- Negotiation

TECHNOLOGY

- Motor systems
- Pumps, fans, compressors
- Converters
- Motor-Systems-Check

- Self-study
  - pilot project in factory
  - excursion to external factory
- Two levels:
  - internal factory staff: overview
  - external specialists: in-depth

4. Supporting activities (3)

Information and awareness - other tools

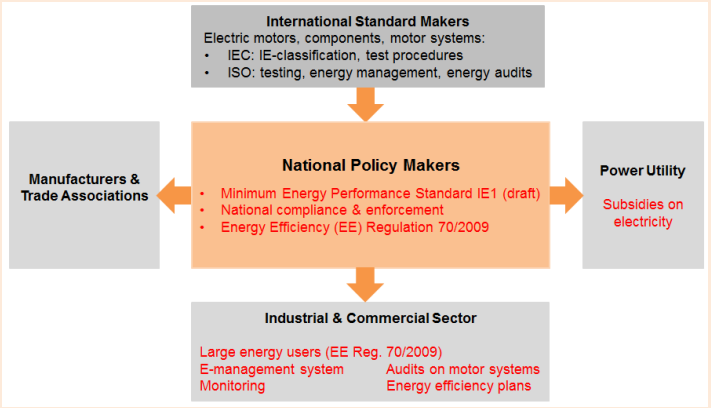
- Training programs
- User groups
- Best practices
- Measure lists (specified per sector)
- Information (other)
- Financial support
- Support in audits and programming of energy efficiency plans
- Purchasing criteria

Motor Systems Tool
free download on:
www.motorsystems.org

4. Supporting activities (4)

Stakeholders' energy efficiency platform in Indonesia

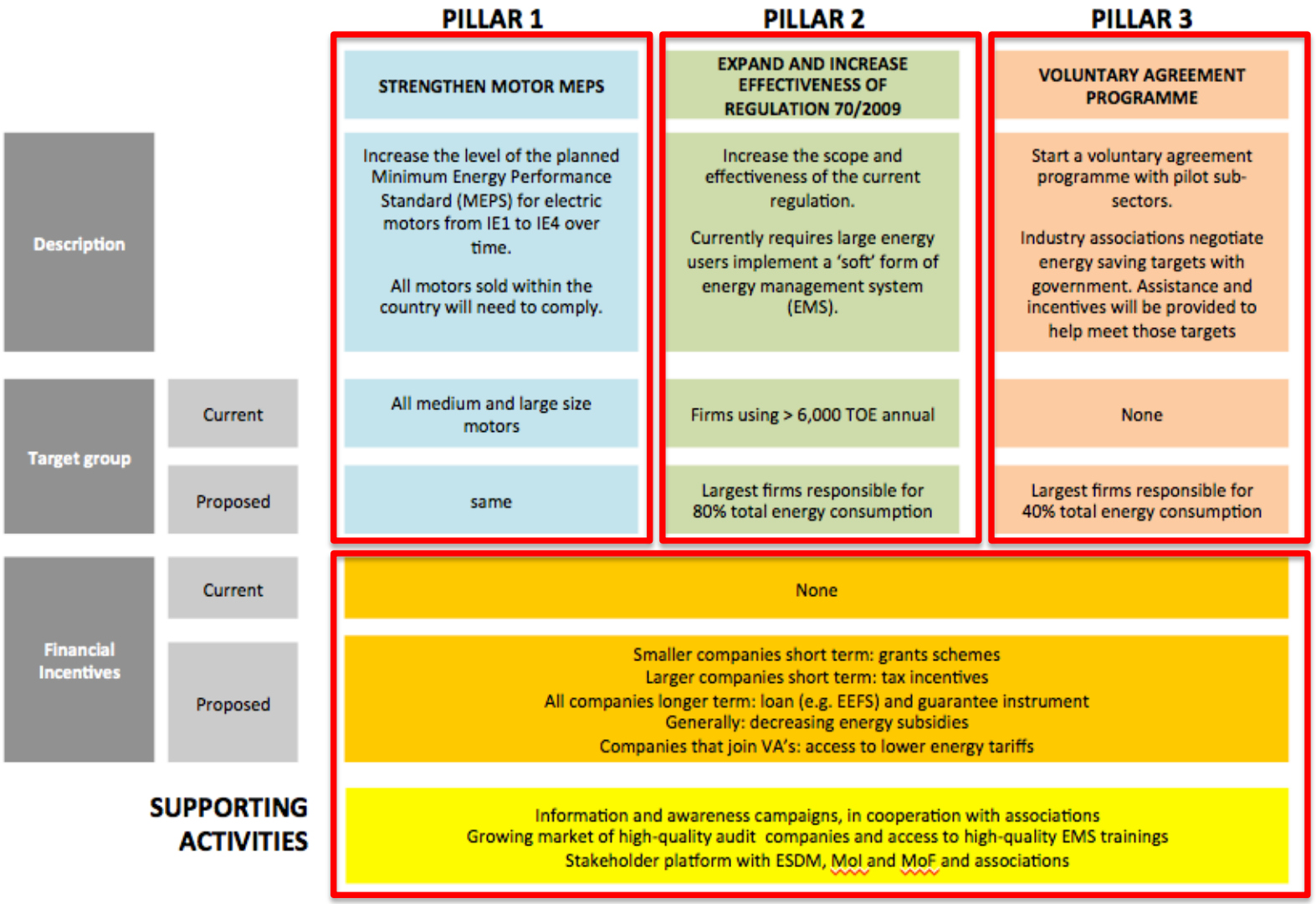
- Government
  - Ministry of Energy & Mineral Resource (ESDM), Ministry of Industry, Ministry of Finance
- Power utility Perusahaan Listrik Negara (PLN)
- Industry
  - Trade associations: cement, iron& steel, pulp & paper, textile, etc.
  - Manufacturers: Tatung, Teco, ABB, etc.
- International organizations & programs
  - UNIDO United Nations Industrial Development Organization
  - GIZ Deutsche Gesellschaft für Internationale Zusammenarbeit
  - ADB Asian Development Bank
  - BRESL Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling
  - UNDP United Nations Development Programme
  - ICA International Copper Association
- Multipliers
  - WWF World Wide Fund
  - Others?



3. Resume

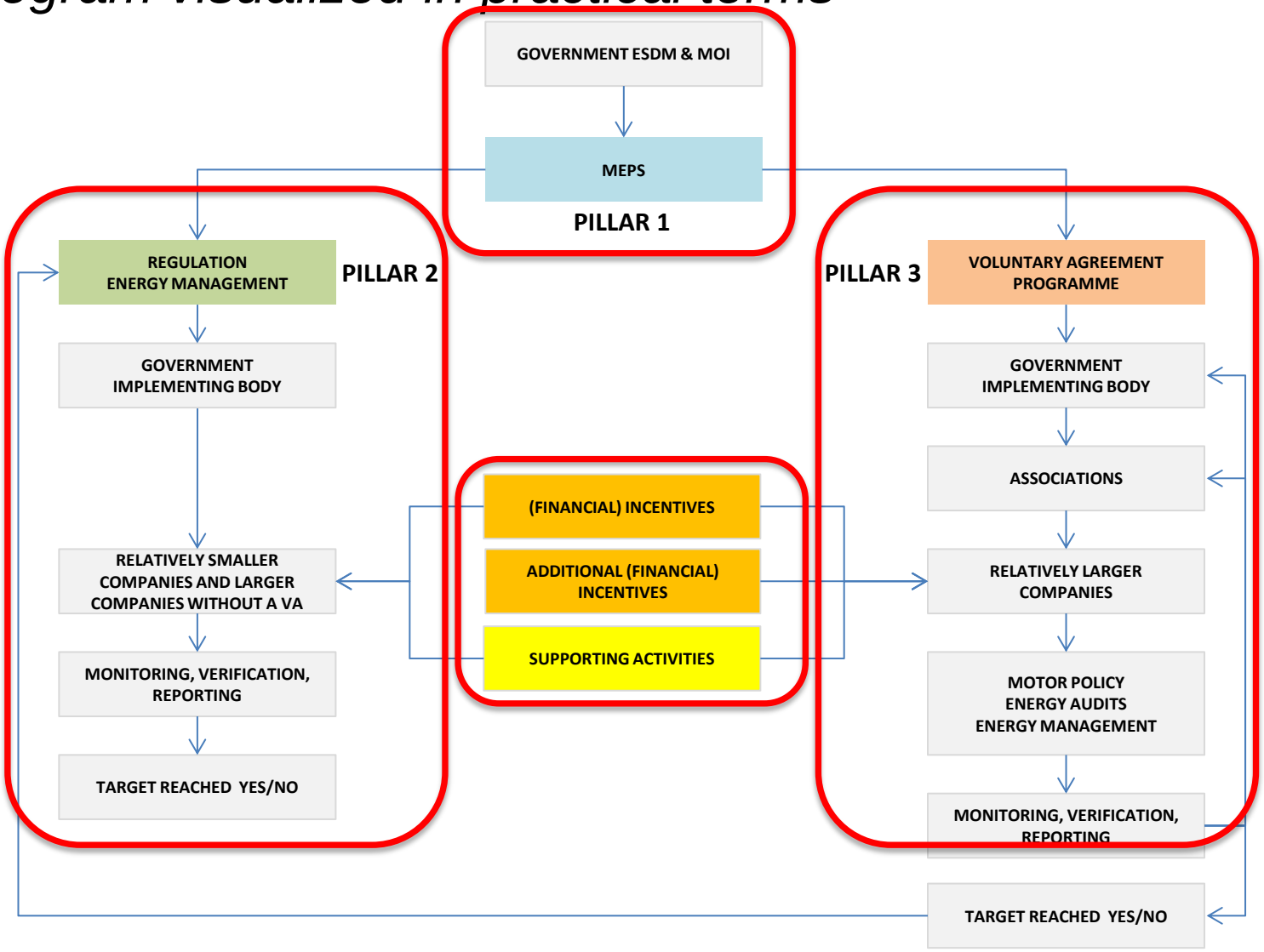
Resume

Program pillars + supporting activities



Resume

Program visualized in practical terms



Thank you – contact details

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