Decision Tree - How to realise Energy Efficiency projects, through an ESCO partnership or other Routes

Authors
Maarten van Werkhoven - TPA advisors
Stijn Santen - CO2-net

Reviewers
Victor Donselaar – ADVEN Group
Roman Stelmaszczyk, Jack Noot – GETEC Efficiency GmbH
Ruud Swarts – OCI Nitrogen
Hendrik van Gils – Tata Steel Europe
Yorick Kramer – Rabobank

May 2021

Table of Contents

Annexes

1. In short

This paper introduces a 'Decision Tree' as a tool to assist industrial companies to consider and initiate an ESCO partnership (Energy Services Company) for implementing energy efficiency projects. The Tree is complementary to the P6-25 White paper "Realising Energy Efficiency projects through ESCO partnerships" [1]; the White paper introduces the ESCO concept as a method to accelerate the realisation of energy efficiency projects within industry.

The CO_2 reduction goals have become more stringent with the EU raising it's ambition recently setting the goal at 55% reduction till 2030 (compared to the 1990 level). For the Dutch industry this amounts up to 16.0 million ton CO_2 reduction per year (14.3 million ton, 49%-goal, plus 1.7 million ton, extra 6%). Energy efficiency can deliver a very cost-effective contribution to these goals by at least 3 million ton CO_2 reduction per year as underpinned by the Project 6-25 publication of summer 2020[2].

A rough estimate of the required investment to reach this goal is approximately 10 billion Euro, of which an estimated 1 billion Euro is for energy efficiency.

Energy in industry involves a large portfolio of measures. Industrial energy efficiency measures can play a key role especially up to 2025, but beyond as well, in this challenge to realise greenhouse gas emissions. These measures are economical attractive with relative short pay back times and can be implemented on relative short term to contribute directly to emission reduction targets for 2025 and beyond.

The main challenges as identified by industrial companies in realising CO_2-reducing energy efficiency projects range from lack of availability of CAPEX and difficulties in meeting financial KPI's, lack of availability of skills and resources and complexities to implement. Establishing an ESCO partnership can resolve a number of these challenges.

This Decision tree elaborates a stepwise approach to assist industry in selecting and developing a set of Energy Efficiency projects through an ESCO partnership. The Tree contains a series of steps with a focus on the *preparatory* activities in developing industrial efficiency projects. These steps follow the general project phases when developing energy efficiency projects, starting with the Engage or Pre-Identify phase, see Figure 1.

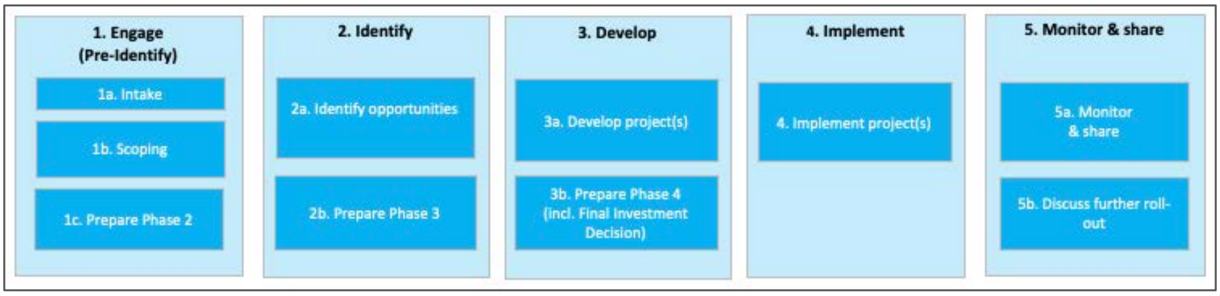


Figure 1 Process Phases for developing energy efficiency projects

The Decision Tree focusses on the steps in the pre-Identify phase. Considering an ESCO-partnership for the development of energy efficiency projects requires early preparatory steps by the industrial company. The detailing of an actual ESCO-partnership, including all technical, financial and organizational aspects, will be done during the execution of the Phase 2 (Identify) and Phase 3 (Develop). The final partnership agreement can and needs to be made before the start of Phase 4 (Implement).

[1] See www.6-25.nl/literature

[2] P6-25 Validation study, June 2020. See www.6-25.nl/literature

2. Introduction to Decision Tree

How to read this document: Chapter 2 gives a more detailed introduction to the Tree. Chapter 3 elaborates the Tree step by step and Chapter 4 briefly describes the next steps once an ESCO has been selected for a partnership for business case development. Chapter 5 concludes with some conclusions and recommendations for further acceleration of the energy efficiency activities in Dutch industry.

The main challenges in realising CO_2-reducing energy efficiency projects in industry, as identified by research[3, 4] concern CAPEX, skills, resources, complexities for implementation and compliance drivers:

- Lack of availability of CAPEX and difficulties in meeting financial KPI's
  The low or non-existent availability of CAPEX for energy efficiency projects is a regular encountered barrier for these projects. This can be due to overall CAPEX limitations within a company, but also due to a lower ranking of energy efficiency projects in the competition with other investment projects. This type of barriers is present in 41% of the cases.
- Lack of availability of skills and resources
  Energy efficiency projects demand for specific expertise, depending on technology, within a company and for some dedicated resources to enable the development and implementation of such projects. In 43% of the cases these challenges do hamper implementation.
- Complexities to implement
  The implementation of an energy efficiency project can have effects on an individual process unit, a process plant or an entire site, resulting in increasing complexity of the project development and related work. Alignment of the project's implementation with the regular operation can be demanding. In 12% of the cases these challenges are listed as important factor.
- Lack of direct compliance drivers
  The current regulations in the field of energy efficiency and CO_2-emission reduction do not generate concrete strong compliance drivers. The main driver for CO_2 is the ETS-regime which defines a cap and trade system for emission allowances (price ranges currently at 5-25-50 EUR/ton.year). Roughly 280 industrial companies in the Netherlands fall under this regime. Given the recent price-increase (from 28 EUR/ton CO_2 in November 2020 to 50 EUR/ton CO_2 in May 2021) the business case for energy efficiency projects reducing scope CO_2 emissions is growing.
  However, in case of energy efficiency, e.g. the Energy Efficiency Directive, has a more soft approach as it does not include obligations for the large industrial companies to implement the identified energy efficiency measures. As a result, savings on electricity ("scope 2") are not on a top priority in this field. Focus on the aspects of OPEX savings of energy efficiency, CO_2-levies and company sustainability goals can enable and enlarge the management focus on energy efficiency and CO_2-emission reduction.

The challenges outlined above can be partly solved through a partnership with an ESCO; partly, as projects with specific characteristics qualify best for an ESCO-partnership, as shown in the Figure 2.

[3] Research by University of Stuttgart.
[4] RVO Market Consultation Process Efficiency, July 2020

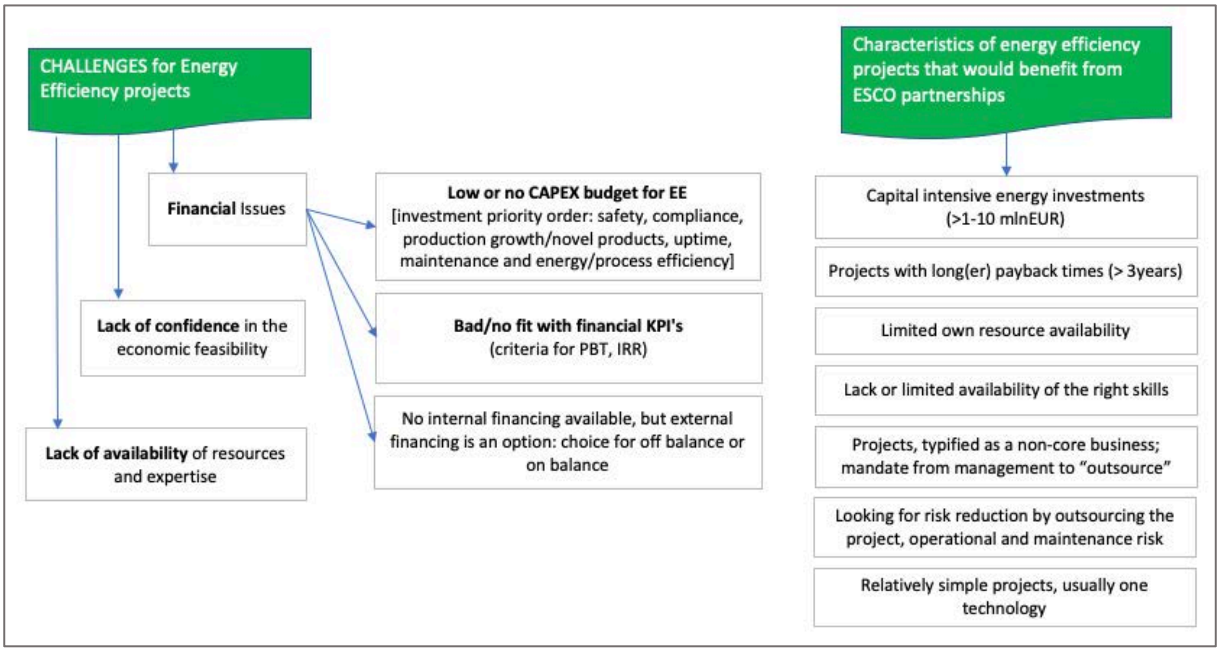


Figure 2 Challenges for Energy Efficiency projects & Characteristics of EE projects for ESCO partnership

3. Decision Tree – preparing energy efficiency projects and an ESCO partnership

For getting to a successful industry-ESCO partnership for energy efficiency projects three steps have been defined, as shown in Figure 3. This Figure shows in the orange part - Step I. Preparing a Long list of Projects; in the green part - Step II. Shift the Long list into Short lists A & B; and in yellow - Step III. Preparing the route towards Identifying the projects and partners for the preparation of the project development and implementation. The steps are described in short in the following paragraphs.

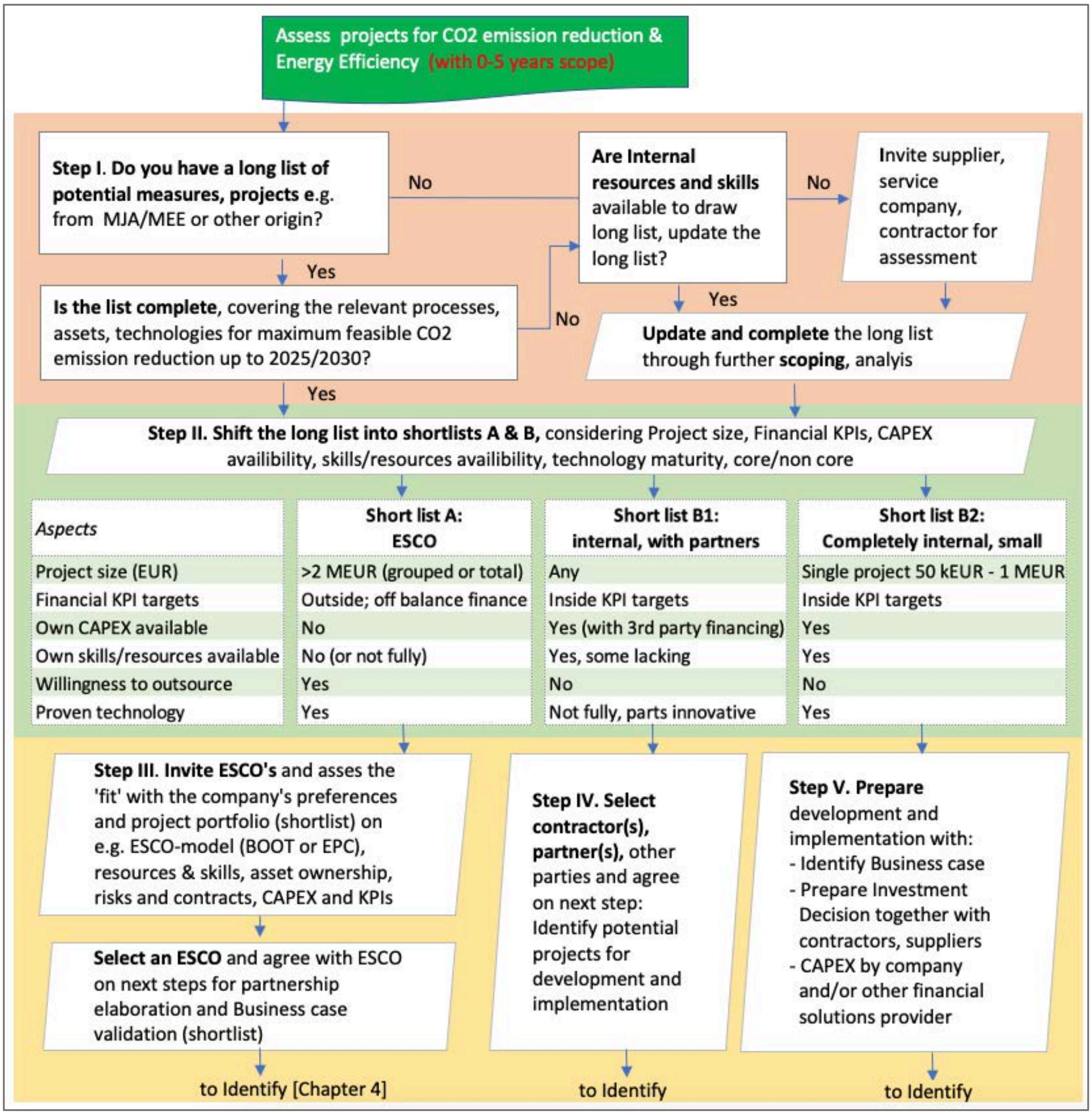


Figure 3 - Decision Tree, Step I. to Step V.

Step I. Prepare a Long list of potential Energy Efficiency projects

Starting point is a long list of potential projects (for CO_2/Energy Efficiency): either such a list is available, or this list has to be developed as a first scoping activity. The list can originate from an EED-report[5] (energy audit) but can be as well a list of existing energy efficiency projects waiting for funding, approval for further development. In general, the accuracy of such business cases is at level of ± 30-50% CAPEX.

It can be of great benefit to perform a renewed scoping and analyses of the energy efficiency and CO_2 reduction potential based on the current state of technology. Developments in the field of technology development and regulation (levies, taxes, subsidies) in topics like electrification, CO_2-emission levy and development of energy prices can demand such a further assessment as well.

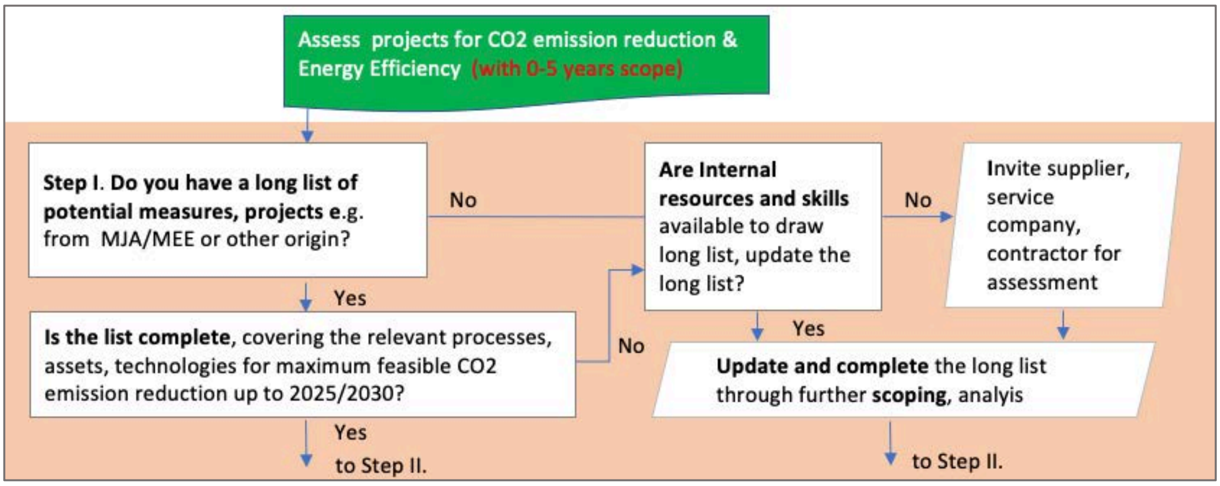


Figure 4 - Step I, Prepare an updated, complete list of potential projects

[5] EED = Energy Efficiency Directive (EC Directive 2012/27/EU and amending Directive 2018/2002)

Step II. Shirt the Long list into two Short lists A & B

The next step is to differentiate the projects from the long list into a section with projects potentially fit for an ESCO partnership, and other projects which are best fit for internal development, implementation and operation.

Step II. Shift the long list into shortlists A & B, considering Project size, Financial KPIs, CAPEX availibility, skills/resources availibility, technology maturity, core/non core

Aspects	**Short list A: ESCO**	**Short list B1: internal, with partners**	**Short list B2: Completely internal, small**
Project size (EUR)	>2 MEUR (grouped or total)	Any	Single project 50 kEUR - 1 MEUR
Financial KPI targets	Outside; off balance finance	Inside KPI targets	Inside KPI targets
Own CAPEX available	No	Yes (with 3rd party financing)	Yes
Own skills/resources available	No (or not fully)	Yes, some lacking	Yes
Willingness to outsource	Yes	No	No
Proven technology	Yes	Not fully, parts innovative	Yes
	to Step III.	to Step IV.	to Step V.

Figure 5 - Step II, Shift into Short list A & Short lists B1 and B2

Some key characteristics of energy efficiency projects define to a great extent the potential for an ESCO partnership, i.e. the maturity level of the technology involved, the complexity and financial aspects as CAPEX and KPI's like ROI and PBT (return on investment and payback time):

- The maturity level of the technology involved is a key aspect. Only well proven technologies qualify for implementation through an ESCO partnership. Technologies that are in demonstration phase might not be fully suitable, whilst a novel technology that has no references will most likely not be suitable for development through an ESCO partnership. An important added value for the industrial customer is into reducing the risks involved with the project. The ESCO in turn has a clear interest in reducing the project risks, e.g. operational, technical and financial risks, as much as possible through a sound assessment of the risks involved and thus working with mature technologies only.
- The second main technology aspect is the project's character: does the project relate to the core process(es) or does it involve non-core processes, like utilities. Projects related to non-core processes qualify best for an ESCO-partnership.
- Third aspect is the project's scale in terms of investment size (CAPEX in million EUR) and the calculated return on investment (ROI, simple payback time - PBT) in years.

Based on the above listed aspects the Long list can be shifted into two type of short lists:

Short list A, projects that have a potential fit for an ESCO partnership, with the following characteristics

- Non-core assets like utilities, non-process related
- Proven technology
- Investment size >2 million EUR (1 project, or as a group of smaller projects e.g. 100 kEUR per project).
- Financial KPI's are outside company target e.g. payback times go up to 6-7 years; interest into option of off balance sheet finance.
- No company CAPEX is available given the project size and KPI's
- The company's skills and or resources are not (fully) available

- The technology involved is proven, mature, and is in general related to utilities or an unit operation like for example mechanical vapour recompression.
- There is a willingness to outsource – the development, implementation, and operation.

With this shortlist A, the next step is to invite one or more ESCO's for acquaintance and assessment of potential fit, see Step III.

Short list B contains 'other projects' which have as main characteristic the internal focus and will, capability to take on the development and implementation. Alongside this the following characteristics are:

B1 Internal, with other partners:

Projects that are closer to core process(es), have a medium to large size, have a medium to high complexity (technology) and involve (partly) an innovative technology. The CAPEX – including third party financing – is available and the KPI's are within target. The company is not prepared to outsource the operation, whilst the projects are to be developed in house, in cooperation with technical suppliers, engineers, research and such.

B2 Completely internal, small:

Projects with a low complexity/proven technology, a fit with the internal KPI's (e.g., a PBT < 3 years), a small to medium project size (i.e., from 50 kEUR to 1 MEUR grouped), own CAPEX available, own resources and skills available; these projects qualify best for short term in-house development and implementation.

For the shortlist B1 and B2 the next steps towards development are described in Step IV. and Step V.

Step III. Invite ESCO's and assess potential fit (Short List A)

Industrial ESCO's apply different business models (see also the Whitepaper). In this step the industrial company assesses together with the ESCO's the potential 'fit' with the company's preferences and project portfolio (Short list A) on aspects like the ESCO model specifics; financial and contract specifics like investment size, on/off balance, KPIs and performance fee; available resources, contract duration, asset ownership; roles and responsibilities in the different contract stages; and finally, the ESCO track record and fit with the related technologies.

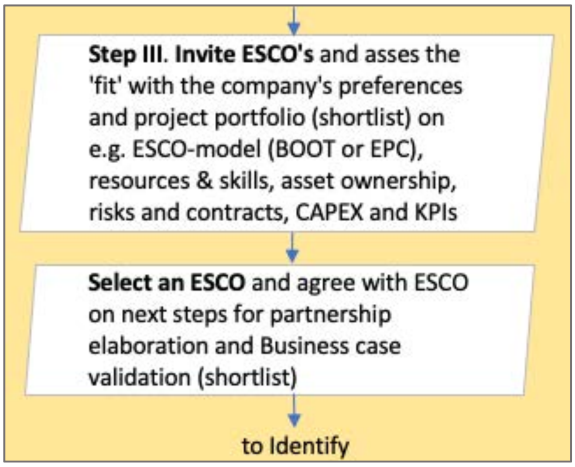


Figure 6 - Step III Invite ESCO's and assess potential fit

Depending on the type of project(s) the following two ESCO models are widely applied:

- **Build, Own, Operate, Transfer** (BOOT): this type of ESCO model is used for large energy efficiency projects
    - Investment size >2 million EUR per project
    - medium-high complexity
    - 10-20 years duration (contract)
    - Asset's ownership by ESCO during contract duration
- **Energy Performance Contract** (EPC): this type of contract is often used for smaller energy efficiency projects i.e., between 0.1 - 5 million EUR investment size per project. In most partnerships the minimum total project size will need to amount to 1 million EUR to get a sufficient minimum scale of operation. The individual projects are *grouped* into one larger project.
    - Investment size grouped >2 million EUR
    - Investment size per project >100 kEUR
    - low-medium complexity
    - 5-10 years duration (contract)
    - Asset's ownership by ESCO during contract duration
- Grouping of projects can be applied at the start i.e., for one group of projects at a specific site. Another way of grouping is by applying a framework agreement for the ESCO-partnership. The smaller projects are to be defined separately for instance per site, within this framework.

In both ESCO models financing can qualify as off-balance. The contracts for the partnership have a duration between 5 to 20 years and cover all technical, financial, and operational aspects for the different project phases, as development, implementation, operation, monitoring and transfer. Depending on the ESCO model the partnership will give the industrial company long term predictable cost with positive business case (BOOT) or long term guaranteed energy cost savings (EPC).

Select an ESCO and agree on next steps including validation of business cases
Step III is concluded by the customer selecting an ESCO for the next phase Identify, where the business cases will be validated (as listed on the Short list) and the partnership between customer and ESCO further elaborated.

An ESCO partnership is a long-term partnership, ranging from 5 to 15-20 years, with effects into a number of main company responsibilities, e.g. finance, production, operation, maintenance and compliance. These issues will be addressed and explored further in this stage. Usually, the business cases are detailed to a level of ± 20-40% CAPEX. This step is normally concluded with a 'go/no-go' and described into a Letter of Intent or Joint Project Agreement.

Step IV. Steps for development of 'Other projects' - Follow up on Short list B1

The projects from Short list B1 are less attractive or feasible for development in an ESCO-partnership due to some specific project aspects. Especially the aspects of proximity to core processes and/or the type of technology (complexity and maturity level) make other implementation routes the better option.

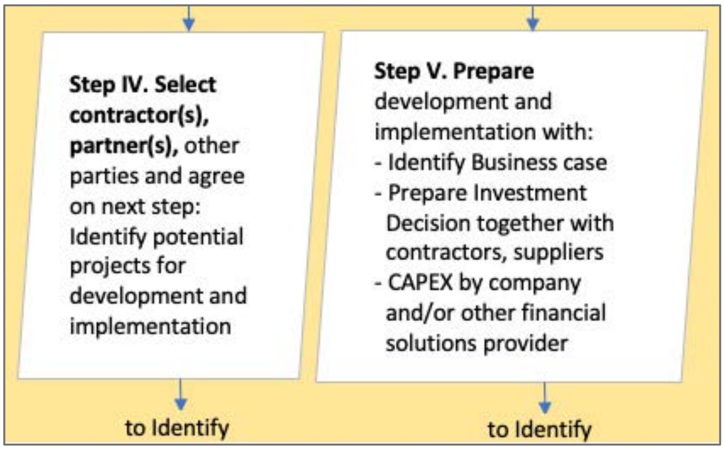


Figure 7 - Steps IV and V: towards In-house implementation of Shortlist B1 and Shortlist B2

Industrial companies can follow the normal project development routines as to prepare for implementation: i.e. identify the Business case, assess feasibility and prepare the investment decision, in cooperation with contractor(s), engineers, supplier(s) where needed.
For the financial project development, the company will need to assess its financial resources in cooperation with financing parties and assess the potential for subsidies and support schemes as well.

Step V. Steps for development of 'Small projects' - Follow up on Short list B2

The projects from Short list B2 'Other Small projects' are in principle fit for short term implementation with a good payback time (e.g. < 3 years), a low complexity and thus a relative (more) simple implementation. If the company has no CAPEX available for these projects some financial solutions are available, e.g. leasing or sale & lease back. These financial arrangements can be provided by technical supplier or system integrator and typically concern contract periods of 3-4 years. As these solutions can have a certain impact on the company's financial ratios the overall cost and benefits do need to be positive for both the industrial company and it's supplier. Depending on the type of financial arrangement the ownership is transferred back to the customer at the end of the contract term. Examples can be found in the rotating equipment and lighting installations.

4. Next step – Identify: develop business cases and define ESCO partnership

Now that an ESCO has been selected, the start of the next phase **Identify** is there. In this phase the ESCO will work with assistance from the industrial company on the validation of business cases and detailing the organizational part of the ESCO-partnership. This includes further involvement from management, finance and legal into the analyses and definition of the details for the ESCO model and ESCO partnership. The Identify phase concludes into a list of validated business cases and an agreement on the principles of the ESCO partnership, and selection of business cases to take up to the next phase: Develop.

Figure 8 gives an overview of the steps or tasks to be made in the consecutive Phases. Each of the first three Phases is concluded with a go/no go decision.

Phases	Item/Task	Document(s)
pre-Identify	Long list, e.g. from EED audit	(Non Disclosure Agreement)
	Re-assessed long list	
	Short list of potential measures	(± 30-50% CAPEX)
Identify	Agree on project team	Non Disclosure Agreement
(Feasibility)	Business Cases validation	
	Agree on time/cost coverage: feasibility, no cure no pay, extended payment	
	Analysis and (conceptual) design	
	List of validated Business Cases	Letter of Intent or
	Agree on ESCO model & partnership	Joint Project Agreement (± 20-40% CAPEX)
Develop	*Tailor made concept per business case*	
(Conceptual & Basic)	Conceptual engineering	eg PFD, Process Flow Diagrams
	Basic engineering	eg P&ID, Process&InstrumentsDiagrams
	Extra validation	
	Supplier selection	
	Contractual model	
	Operational model, Resources: in-house, ESCO	
	Final application for subsidy	
	Defining busines case's CAPEX & OPEX	Final Investment Decision (± 10% CAPEX)
Implement	Detailed engineering design	
	Construction time, cost	
(Detail, Purchasing,	Construction permits	
Commissioning)	Infra connection, site (soil)	
Operations	Safety and compliance environmental	
Maintenance	Insurance, operation	
	Maintenance	
	Monitoring, metering, inspections	
	Environmental measurements	
Future changes	Legislation, governmental measures	
	Force majeure	
Asset transfer	From ESCO to industry	If any, depending on actual ESCO-model,
(optional)	At agreed price and terms	on/off balance, and more

Figure 8 – Phases and steps in the development of business cases and ESCO partnership

The **Develop** Phase includes the conceptual and basic engineering. Before the actual conceptual and basic engineering can start several aspects need to be addressed ranging from available resources, CAPEX, finance options and risks. Depending on the outcomes the industrial company can decide to mandate the ESCO to lead the work and select if appropriate the engineering contractor and technology partner.

During this phase an extra validation of business cases can be done, i.e. supplier independent, technology independent. Followed by a supplier selection, i.e. best price vs. quality vs. risk (focus on long term performance). The contractual model will be agreed upon with the industrial customer, e.g. open book in case of higher risks vs. closed book in case of mature technology. The phase will deliver the CAPEX and OPEX with the required accuracy for FID (final investment decision, in general at ± 10% CAPEX). Around this point the **final subsidy application**, if any, needs to be covered.

The next phases **Implement** and **Operation** are not further elaborated in this paper. At the end of the ESCO's contract term, the asset transfer from ESCO to industry will happen, at agreed terms.

For the case of having the **Shortlists B1 and B2** on hands: although no ESCO will be involved in the project development, roughly the same set of project development phases apply. The actual tasks normally assigned to the ESCO will now be delegated to the industrial company itself – specific departments and officers – and involved partners, contractors.

Annex I shows details of the project team's tasks and composition for the ESCO, industrial company and other partners involved. Annex II shows the consecutive project phases for the development of energy efficiency projects through an ESCO partnership.

5. Concluding remarks

The Decision Tree shows a step-by-step approach to identify and develop energy efficiency projects. One important route for industrial companies to break down several barriers preventing the projects' realisation is into an ESCO partnership. An ESCO partnership can be instrumental e.g. in providing the capital needed (e.g. through off balance sheet financing), decreasing the risks involved for industry and providing the resources and skills for the project's development, implementation and operation.

However, a number of specific projects from the company's project portfolio do not qualify for an ESCO-partnership. This is the case for ESCO's that do not have the experience with certain mature technologies (TRL level) with low market penetration. Also, the maturity of technologies of certain technical solutions can be lower. Last but not least there could be a lack of willingness to outsource due to the potential impact the technology can have on the core process or the relationship with other processes. In case the company has sufficient CAPEX available and/or the project scores within the company's financial KPI's an ESCO-partnership is not the most obvious route for to industrial company.

To achieve the reduction goals as set by the EC and the Dutch government, industry will need to develop and execute a systematic route to increase energy efficiency and reduce CO_2 emissions. The current available technology portfolio can already deliver on short term, i.e. to 2025. For the midterm market ready "new" technologies need to be deployed at large scale. For implementation of these technologies new partnerships between technology suppliers, ESCO's and the industry will need to be developed, as to being able to address the set of defined climate goals in practice.

ANNEXES

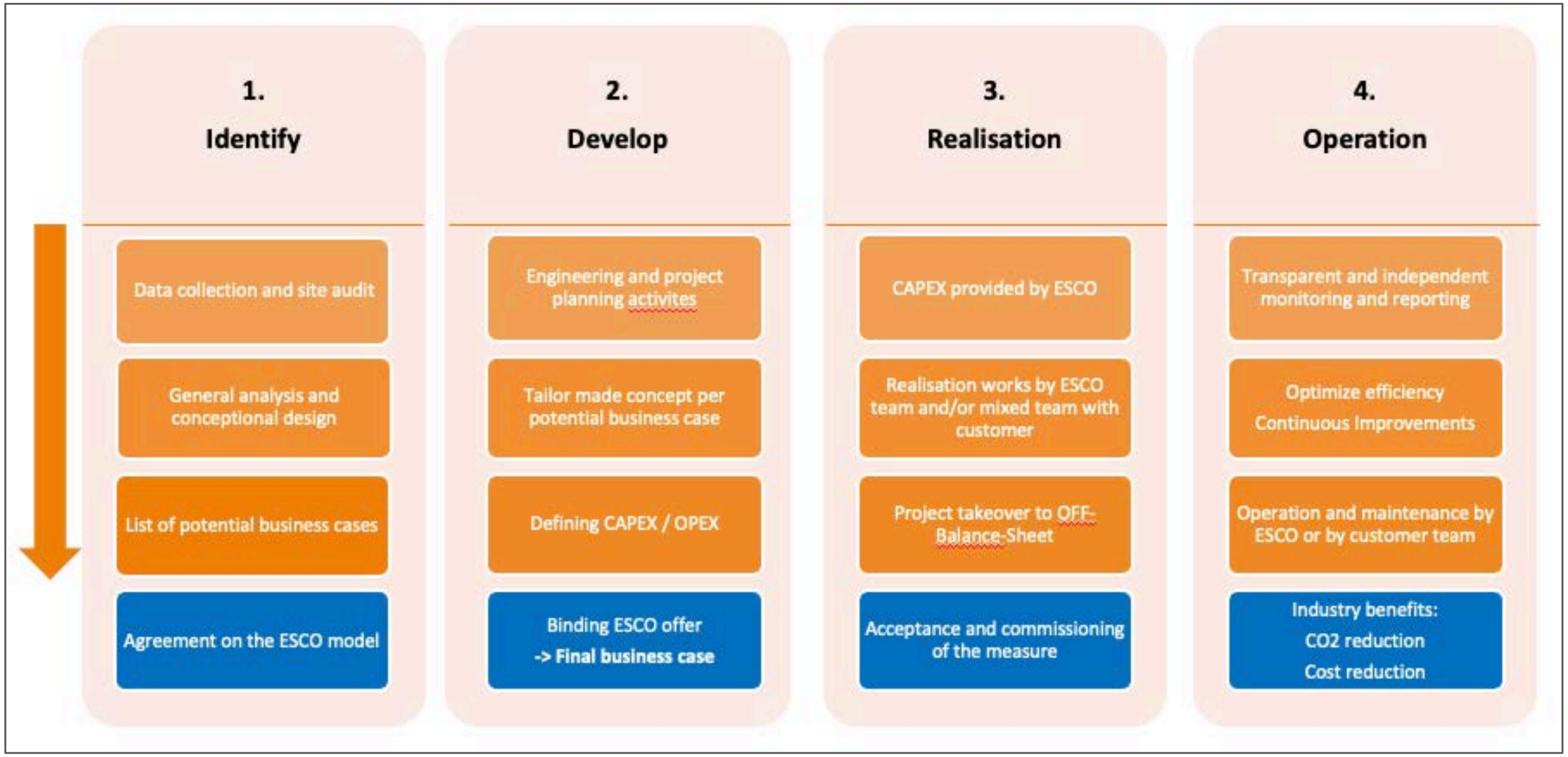
ANNEX I Detailed overview of Project Team composition per project phase

Phases	Item/Task	Document(s)	INDUSTRIAL CUSTOMER	ESCO -BOOT *)	ESCO -EPC *)	ENGINEERING CONTRACTOR	TECHNOLOGY SUPPLIER
pre-Identify	Long list, e.g. from EED audit	(Non Disclosure Agreement)	**IC**	-	-	-	-
	Re-assessed long list		**IC**	(EBT)	(ESC)	(EC)	-
	Short list of potential measures	(± 30-50% CAPEX)	**IC**	(EBT)	(ESC)	(EC)	-
Identify	Agree on project team	Non Disclosure Agreement	**IC**				
	Technology profile		*ESCO selection*				
	- Proven, existing; number of suppliers, public references, known BCs			**EBT**	**ESC**	-	(TS)
	- Innovative; few suppliers, few BCs			**(EBT)**	-	(EC)	**TS**
	- Invention; one supplier; proof of concept			-	-	**EC**	**TS**
	Scale (CAPEX) & ESCO-model			BOOT: 2-80 mln EUR	EPC: 0.1-5 mln EUR		
(Feasibility)	Business Cases validation		team	team		(team)	(team)
	Agree on time/cost coverage: feasibility, no cure no pay, extended payment						
	Analysis and (conceptual) design		Data delivery	Analysis		(EC)	(TS)
			Finance, technology	Meet finance, technology			
	List of validated Business Cases	Letter of Intent or					
	Agree on ESCO model & partnership	Joint Project Agreement (± 20-40% CAPEX)	**IC**	**EBT**	**ESC**	(EC)	(TS)
Develop	*Tailor made concept per business case*		(IC)	**EBT**	**ESC**	**EC**	(TS)
(Conceptual & Basic)	Conceptual engineering	eg PFD, Process Flow Diagrams		flow diagram		**EC**	(TS)
	Basic engineering	eg P&ID, Process&InstrumentsDiagrams		civil works		**EC**	(TS)
	Extra validation			Supplier independent, Technology independent		**EC**	(TS)
	Supplier selection			Best price vs. quality vs. risk (long term performance)			
	Contractual model		(IC)	Open book (in case of higher risks) vs.			
				closed book (mature technology)			
	Operational model, Resources: in-house, ESCO		**IC**	**EBT**	**ESC**		
	Final application for subsidy		**IC**	**EBT**	**ESC**		
	Defining busines case's CAPEX & OPEX	Final Investment Decision (± 10% CAPEX)		Engineering by ESCO and partner			
			IC	**EBT**	**ESC**		
Implement	Detailed engineering design			**EBT**	**ESC**		
	Construction time, cost						
(Detail, Purchasing,	Construction permits			**EBT**	**ESC**		
Commissioning)	Infra connection, site (soil)		**IC**				
Operations	Safety and compliance environmental		**IC**	**EBT**	**ESC**		
Maintenance	Insurance, operation						
	Maintenance			**EBT**	**ESC**		
	Monitoring, metering, inspections			**EBT**	**ESC**		
	Environmental measurements			**EBT**	**ESC**		
Future changes	Legislation, governmental measures		**IC**				
	Force majeure		**IC**	**EBT**	**ESC**		
Asset transfer	From ESCO to industry	If any, depending on actual ESCO-model,	IC	**EBT**	**ESC**		
(optional)	At agreed price and terms	on/off balance, and more					

Notes *) BOOT = Build, Own, Operate, Transfer; EPC = energy performance contract; IC = Industrial customer; EBT = ESCO-BOOT, ESC = ESCO EPC; EC = Engineering contractor; TS = Technology Supplier

ANNEX II Four phases to develop energy efficiency projects through an ESCO partnership

Getting to a successful energy efficiency project through an ESCO partnership demands the execution of four phases, starting with 'Identify' up to 'Operation'. Each phase ends with a decision moment, as conclusion of that phase and as means or moment to define the way forward to the next phase. These decision moments are represented by the blue boxes in figure below.



Source: P6-25 White paper "Realising Energy Efficiency projects through ESCO partnerships", see www.6-25.nl/literature