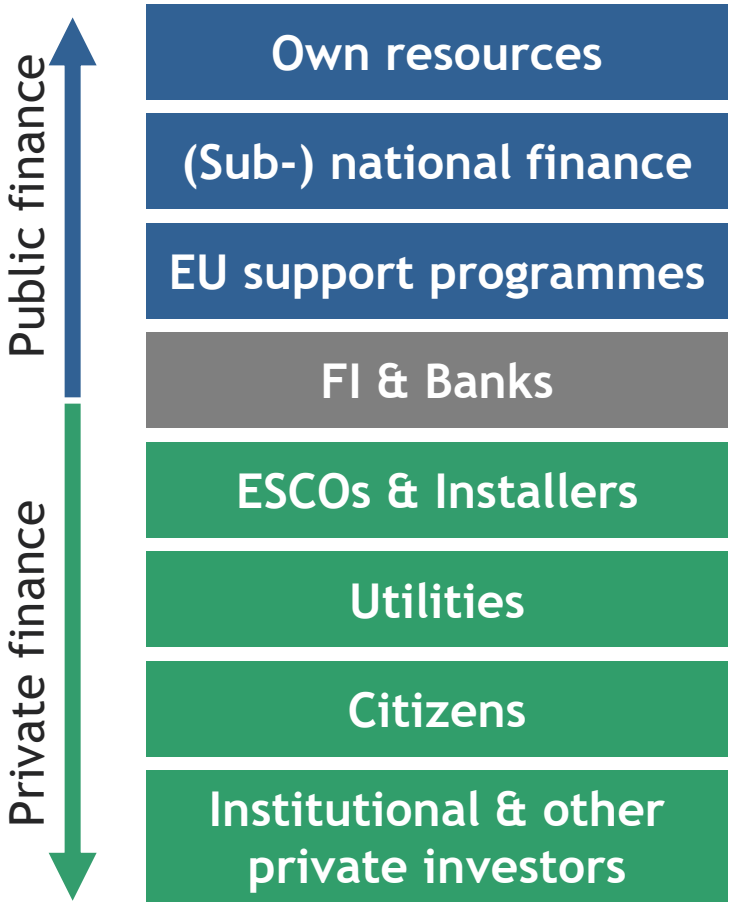
training

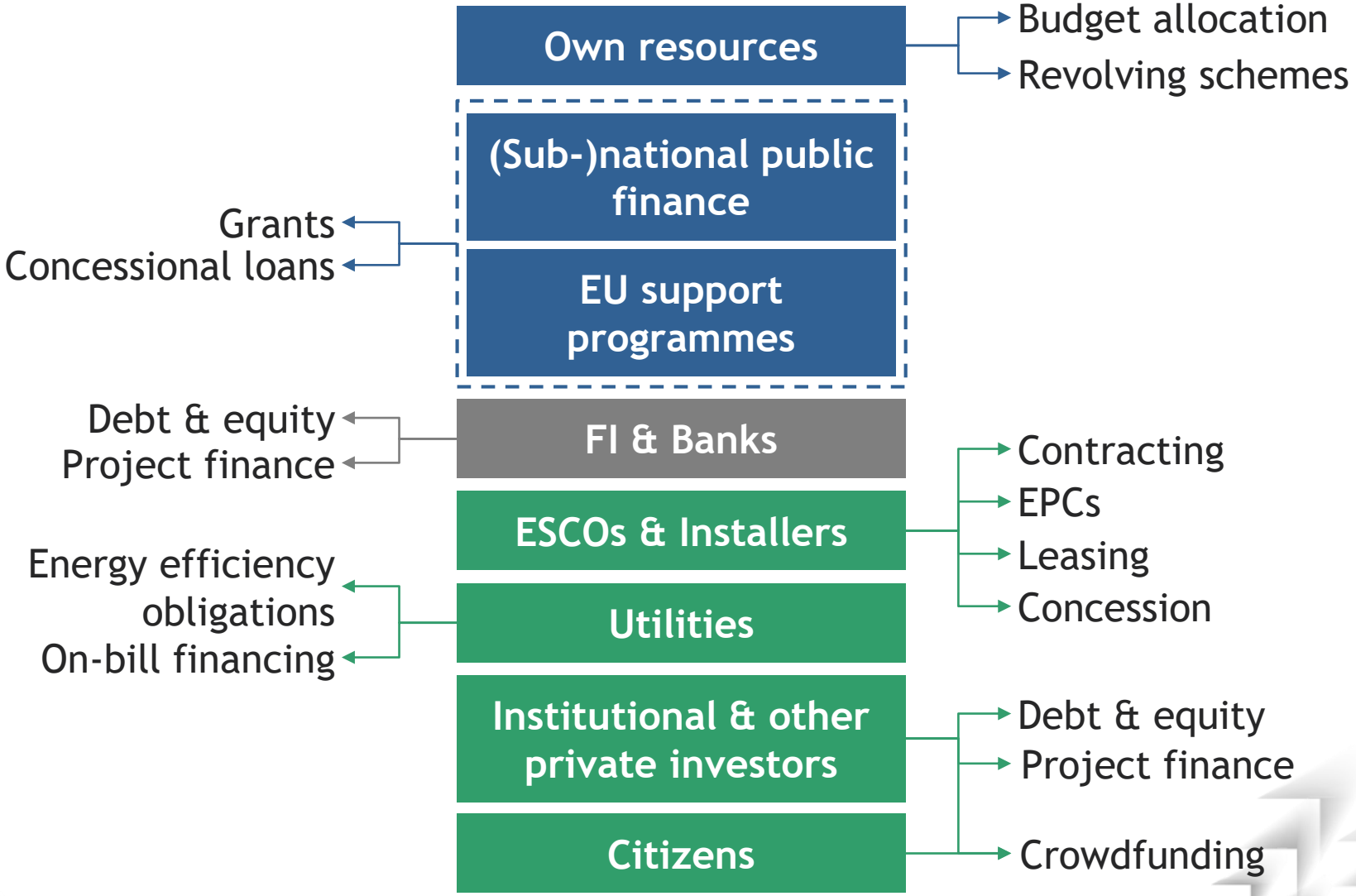
Financing models for energy-efficient urban street lighting

Matthias Hessling | Aleksandra Novikova | Kateryna Stelmakh | Julie Emmrich

Funding sources - recap



Matching sources and models

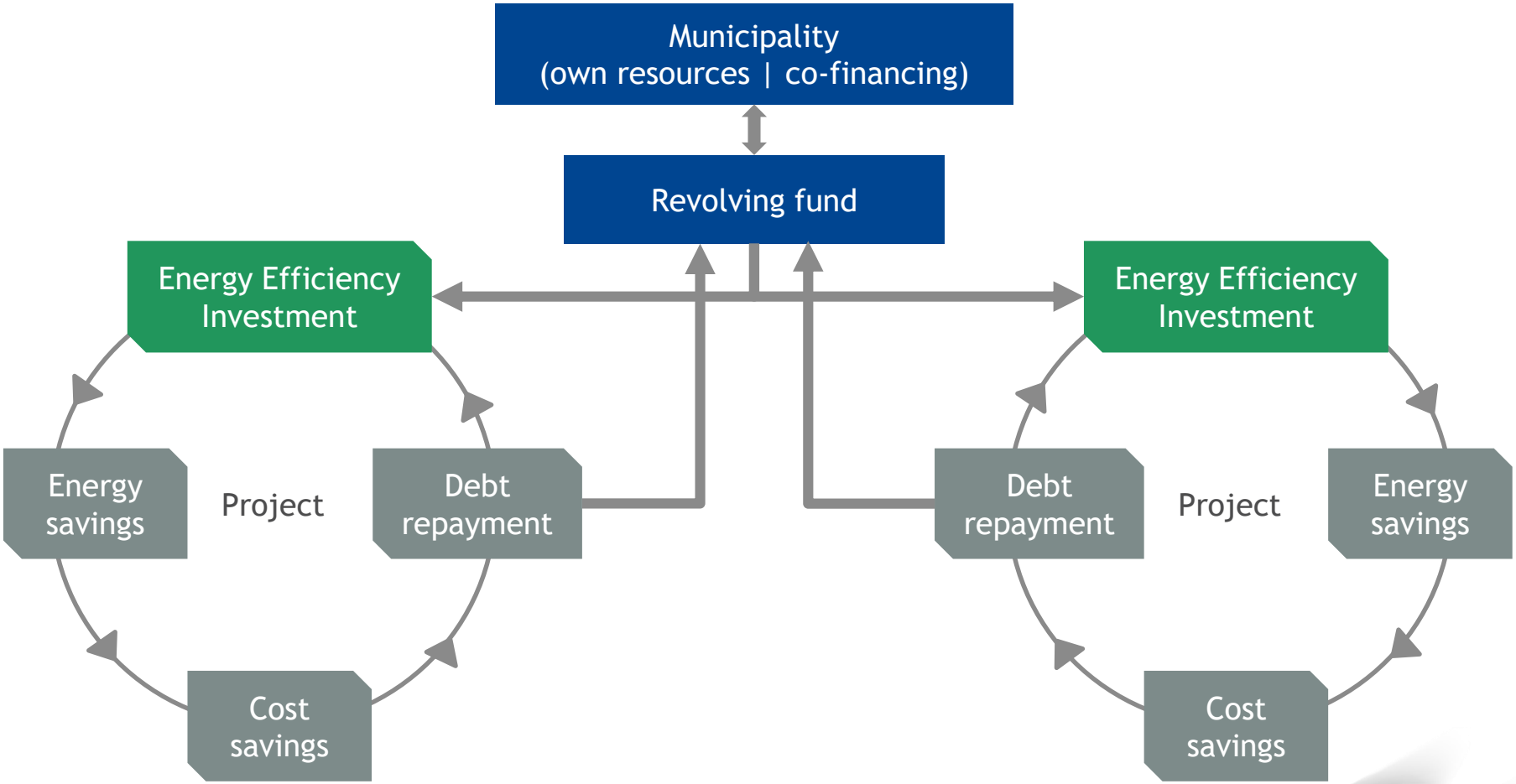


Self-financing

Self-financing

1) Municipal budget
2) Revolving schemes

Self-financing | Revolving schemes

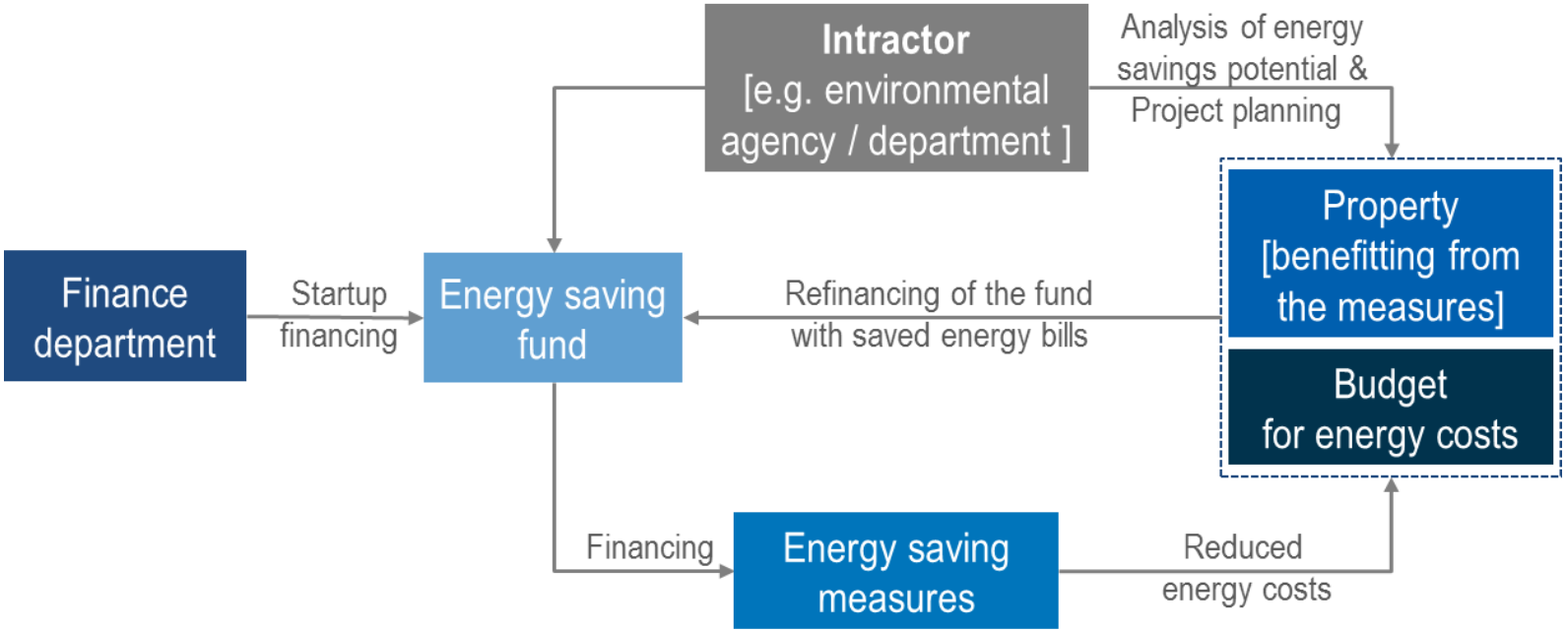


Source: ESMAP (2014) in Novikova et al. (2018)

Self-financing | Revolving schemes

- Intracting (internal performance contracting)
- Internal revolving fund with outsourced services
- External revolving funds with multiple financiers

Self-financing | Intracting (internal performance contracting)



Advantages for municipalities:

- do not need external capital
- pay no interests on capital and can reuse capital
- cooperate within their units

Disadvantages for municipalities:

- carry full up-front cost and all project risks
- may achieve lower project efficiency vs when the upgrade is delivered by private actors

Projects financed by this model: municipal infrastructure projects

Jurisdictions that applied this model: started in Germany, now France, Italy, Croatia etc.

Source: Junghan and Dorsch (2015)

Self-financing | Internal revolving fund

Architecture

- Municipality(s) initiate a revolving fund, provide capital and manage the fund
- Small municipalities share management costs and initial funding in a merger
- Fund provides financial instruments to external service providers
- Savings are redirected to the fund

Advantages

Municipalities:

- Enable long-term and sustainable funding to their own projects via energy savings
- Can finance operational costs via fees to service providers, interest rates and energy savings

Other features

Projects financed by this model:

- Long-term and multi-aimed cities
- Any project which savings could justify setting up the fund and operational cost

Jurisdictions that applied this model:

- An example is Litomerice, Czech Republic

Disadvantages

Municipalities:

- Need political commitment, institutional and human capacity and time to establish the fund
- Recover costs only in the long-term
- Require dedicated and experienced staff for management and governance

Self-financing | External revolving fund with multiple financiers

Architecture

- Revolving fund uses external funding sources and lends to municipality(-ies)
- Initial capital can be provided from public and private sources
- Becoming self-sustaining over time, finance operational costs by services fees & interest rates

Advantages

Municipalities:

- Have a wide range of possible financial resources by being open to private investors
- Allow private investors to be part of urban development projects

Other features

Projects financed by this model:

- Scale and type of the project depends on available funds and priorities

Jurisdictions that applied this model:

- National level: Bulgaria and Croatia
- Municipal level: The Hague, Netherlands

Disadvantages

Municipalities:

- Are confronted with higher complexity in the initial setup and high cooperation between various stakeholders
- May be confronted with political concerns, given private entity management of public and private funds

Debt-financing

Debt financing

1) Loans (concessional or commercial)
2) Bonds

Debt | Bonds

Architecture

- Municipal bonds are issued by the local government or their agencies
- Bonds work similar to a loan, meaning the issuer has to pay an interest rate and/ or return the debt at maturity
- Bonds can be certified as *green bonds* by an independent institution

Advantages

Municipalities:

- Can issue bonds autonomously or in cooperation with bond agency
- Can decrease their cost of capital – lower interest rates compared to commercial loans

Other features

Projects that can be financed by this model:

- Any project, if the municipal has access to a bond agency

Jurisdictions that applied this model:

- Becoming more common in Europe, examples are Gothenburg (Sweden) & Varna (Bulgaria)

Disadvantages

Municipalities:

- Should cooperate with municipal bond agencies, if possible
- Need to prepare extensively and costly to issue bonds autonomously
- Need a good credit rating, if acting autonomously

Debt | Bonds case study: Gothenburg's Green Bonds (2013-ongoing)

Context:

- Gothenburg implemented its **Green Bond Program in 2013** to raise capital for climate change and environmental projects

Eligible projects:

- Mitigation, adaptation and climate resilient growth, and sustainable environment
- The projects have to be in line with the city's **Environmental and Climate Programmes**.

Financing structure:

- Gothenburg has been issuing bonds for last four years. They can be purchased on the capital market by any mainstream investor
- The total capital raised via financial markets was **EUR 0.46 billion** (SEK 4.36 billion)

Outcomes:

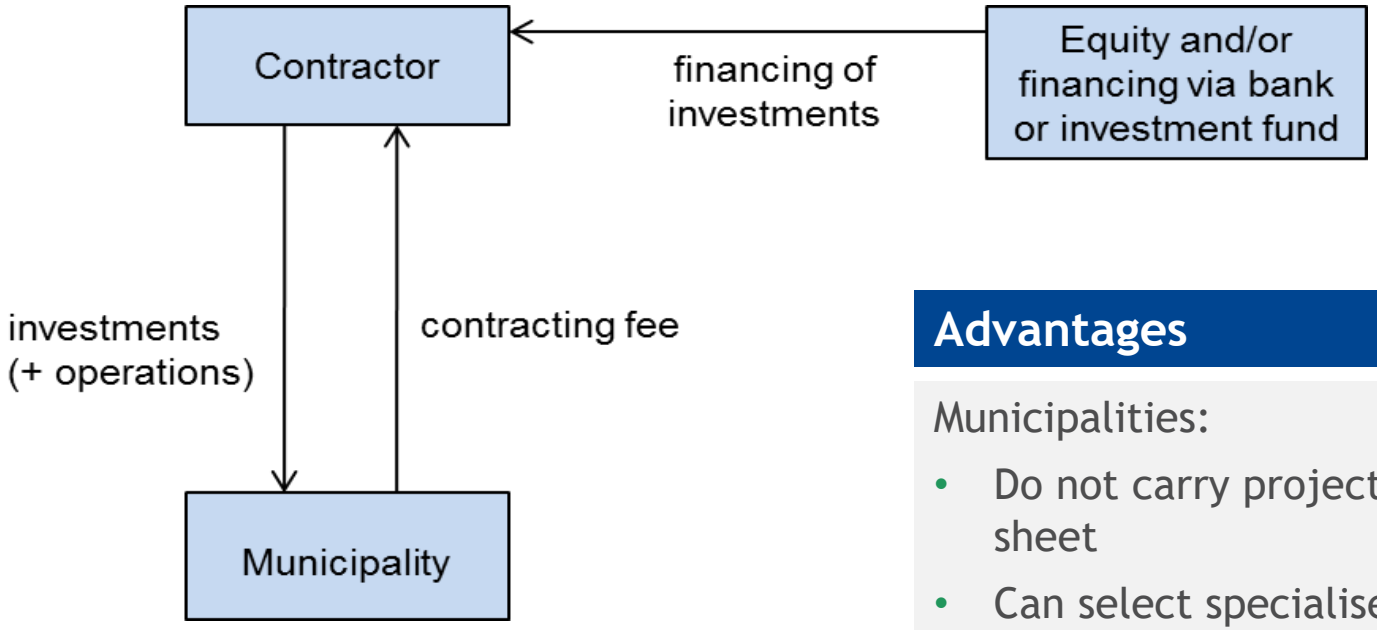
- Gothenburg was the first Scandinavian city and **the first city in the world to issue green bonds.**
- Since 2013, 11 projects have been financed with Gothenburg's green bonds, incl. energy efficiency measures in traffic lights, electric cars, bicycle infrastructure, sustainable housing, and district heating and other (as of 2016).

Financing by ESCOs and private contractors

Financing by ESCOs and private contractors

- **Contracting:**
  - Simple contracting model
  - Contracting with forfeiting and waiver of defence
- **Energy performance contracting:**
  - Guaranteed Savings
  - Shared Savings
  - Modernization with immediate savings of energy cost
  - Staggered savings
- **Leasing**
- **Concession**

Contracting | Simple contracting model



Advantages

Municipalities:

- Do not carry project cost on their balance sheet
- Can select specialised companies via a tendering process

Projects financed with this model

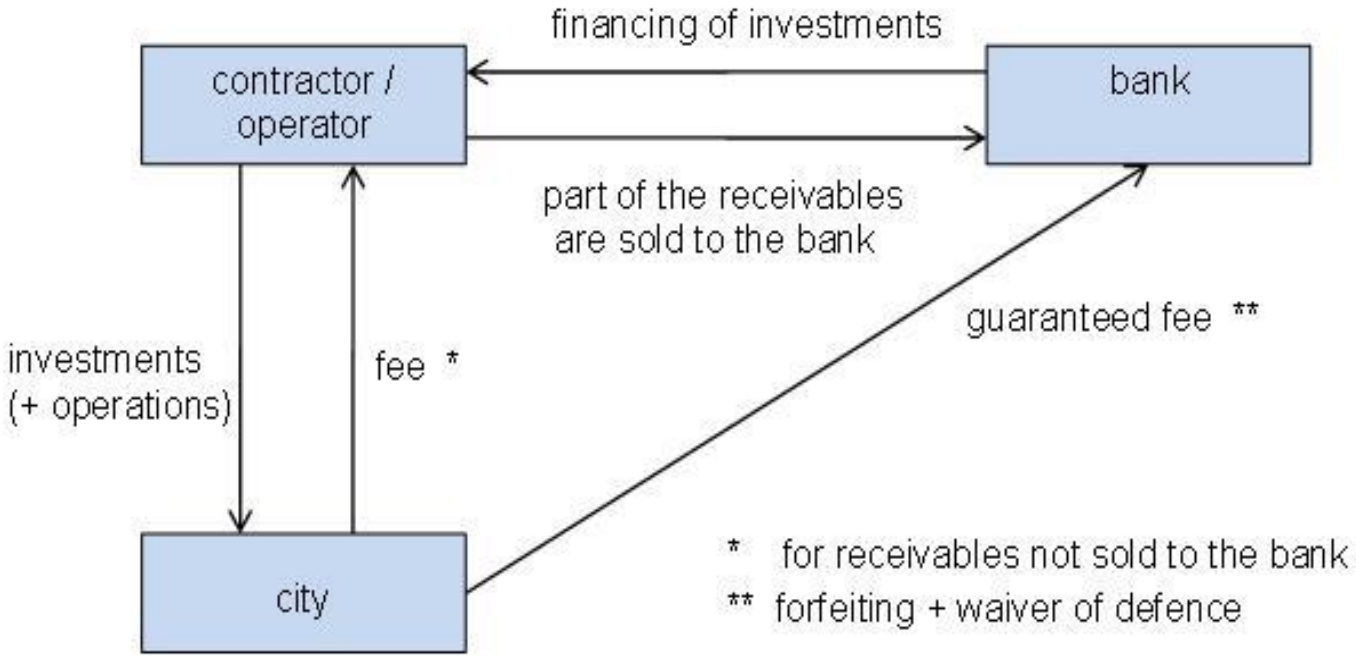
- There is no fixed size threshold, but a project volume of €0.5–1m is a reasonable minimum
- Widely applied for street lighting projects

Disadvantages

Municipalities:

- May face higher financing cost compared to concessional loans
- May face restrictions on use to public support

Contracting | Contracting with forfeiting and waiver of defence



Advantages

- project is not on municipal balance sheet
- specialised companies selected via a tendering process
- lower interest rates than in the simple contracting model

Disadvantages

- higher interest rates than in concessional loans
- high complexity
- must provide a guarantee for banks

Energy performance contracting

Energy performance contracting (EPC):

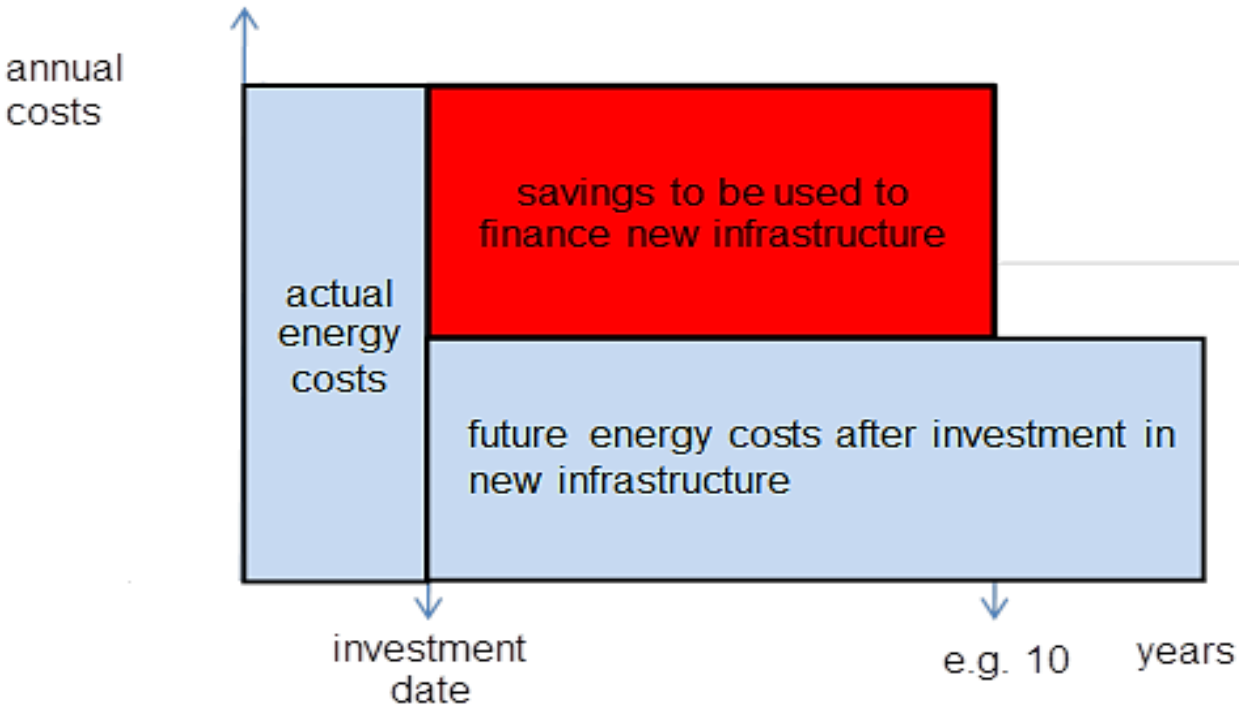
By the savings achieved:

- Guaranteed savings
- Shared savings

By the timing of modernisation:

- Modernization with immediate savings of energy cost
- Staggered savings
- Energy Performance Related Payment (EPRP)

EPC| Guaranteed Savings



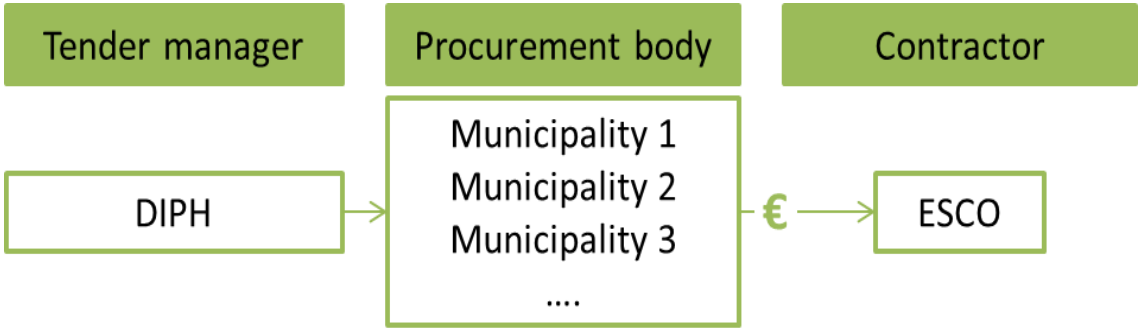
- Projects with a high energy cost savings potential
- Municipalities should have sufficient financial resources to pay the fees as set in the contract

Advantages	Disadvantages
• Can implement projects at a fixed rate, without spending peaks • Own the installed equipment after the contract expires • Transfer the risk to the contracting partner	• Need to bear high energy prices / cost, otherwise the payback time is too long for private contractors • Can hardly raise incentive for the contractor to go beyond the guaranteed savings

EPC| Guaranteed savings study: Huelva (2015-2027)

Challenge: Individual projects are often too small to attract ESCOs

Solution: Developing a grouped tender process: bundling projects of several municipalities and tendering them as a group

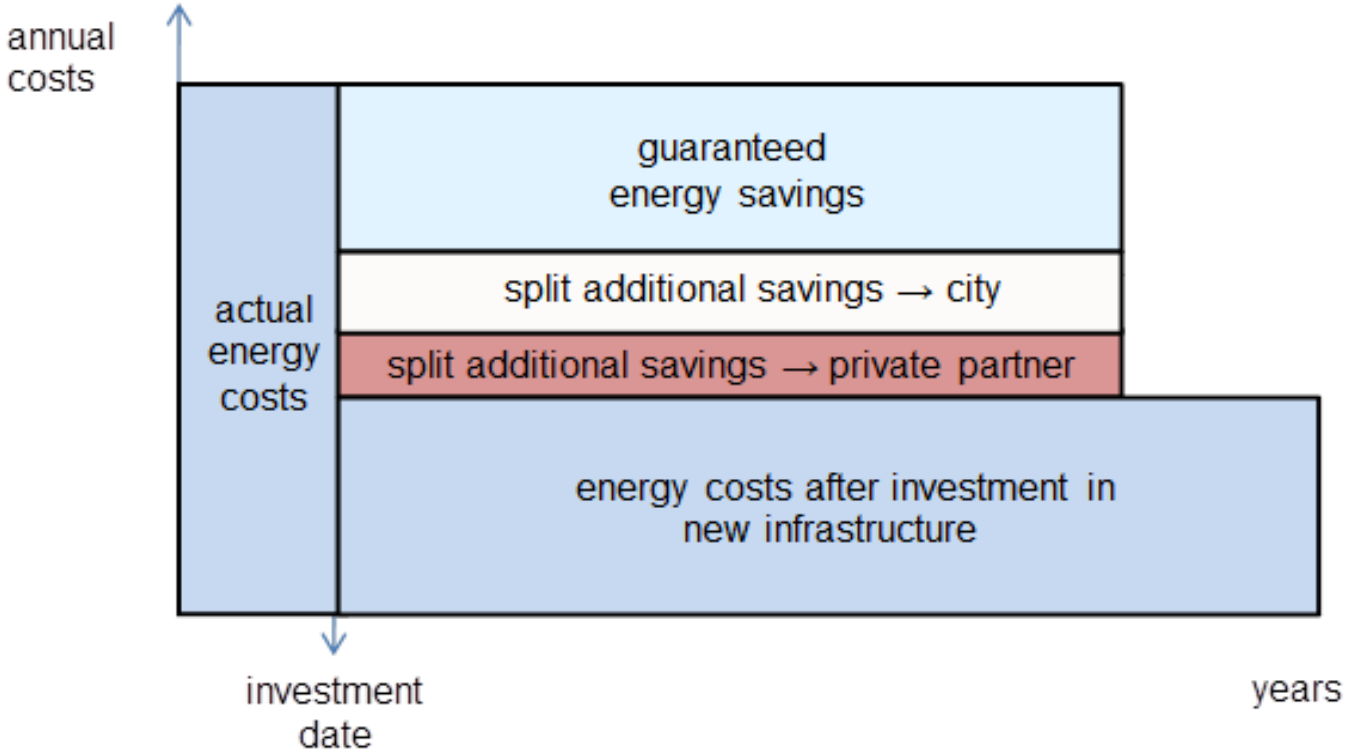


Project scope:

- Improving public lighting infrastructure and services in nine municipalities
- Mixture of energy service contract and energy performance contract with guaranteed energy savings
- Volume of EUR 7.1 million and average energy savings of 72.9 %.

Source: Diputacion de Huelva 2016.

EPC | Shared savings



- Projects with a high energy cost savings potential
- Municipalities should have sufficient financial resources to pay the fees as set in the contract

Advantages

- Same as in EPC with guaranteed savings
- Achieve higher savings by setting an incentive for the contracting partner

Disadvantages

- Need to bear high energy prices / cost, otherwise the payback time is too long for private contractors

EPC| Shared savings case study: Nauen (2011-2016)

Challenge:

- Budgetary constrains
- Outdated street lightning luminaries
- Uncertainty about future investment possibility

Project scope:

- Replacing all HPM-based luminaires, which are 45% of total ~2,350 luminaires

Contract:

- 5 years contract
- Modernization measures without LED technology
- Guaranteed energy savings of 43%
- Additional savings split 50/50 between the city and the private contractor

Outcomes:

- Achieved slightly higher energy savings than guaranteed

EPC | Modernization with immediate savings of energy cost

Concept:

- Implementing improvements as short as possible so that energy savings can be achieved as quickly as possible
- Can be with guaranteed or shared savings

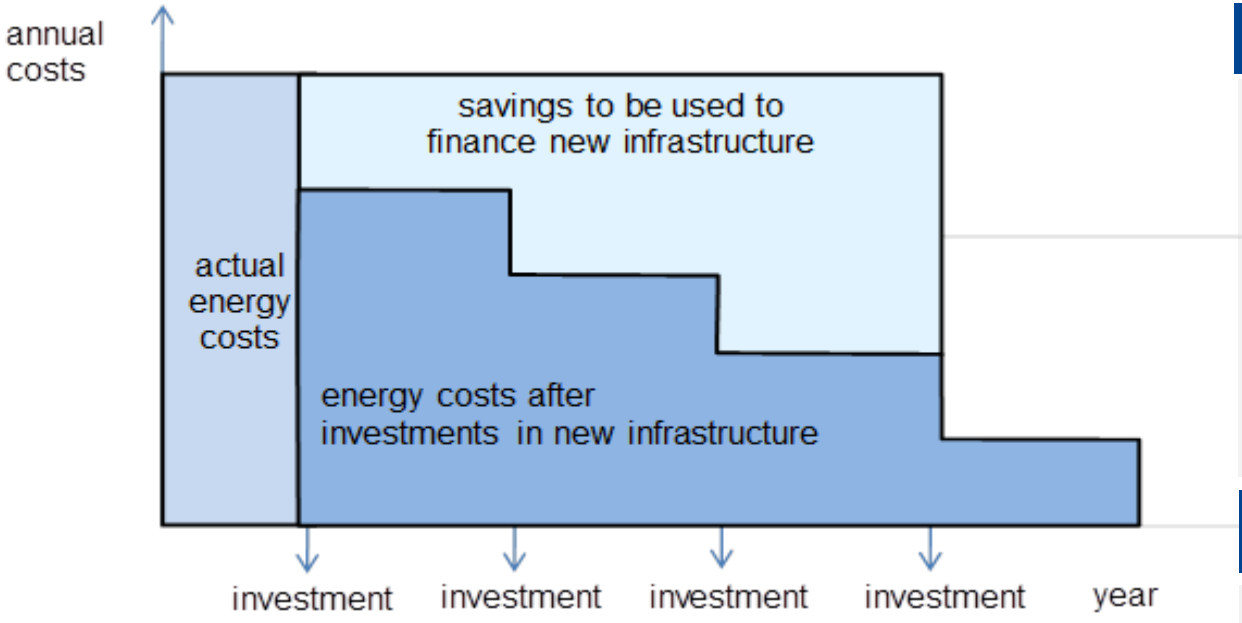
Advantages:

- Allows for maximum energy savings
- Because new technologies, e.g. LED lamps, require less maintenance, the associated costs will be lower too

Disadvantages:

- All luminaires will be modernised at the same time, regardless of age
- Prevents the city from modernising at a constant rate, e.g. 3% of existing infrastructure per year with the advanced technology
- Modernisation completed at the beginning of the contract will not incorporate any new technology at a later contract period
- By the time the work is complete, the street lighting is once again outdated

EPC | Staggered savings



Advantages

- Reasonable investment regime and modern infrastructure
- Suitable for projects with existing luminaries of different age and technology

Disadvantages

Whole amount of energy and maintenance cost savings at later stages of the contract

Case study: the city of Hilden

Scope:

- Modernisation of (almost all) 5,000 luminaires and 2400 poles
- Operations management, incl. energy supply

Contracting:

- Modernisation of the luminaires (the oldest first) at fixed intervals (after 5, 10, 15 and 20 years).
- Payments made by the city, but it recoups indirect costs in the form of energy savings.

Leasing and concession models

Concession:

- Outsourcing operation and maintenance of lighting infrastructure to a private sector company for a fixed fee by drawing up a concession agreement

Leasing:

1) Selling street lighting infrastructure to a private contractor conditional on upgrade, operation, and management
2) Leasing it back from a private contractor for a fixed fee over a set period of time
3) Transferring ownership rights are back to the municipality at the end of the leasing contract

Concession case study: Paris (2011-2021)

Context:

- Public lighting is the second-largest source of energy consumption in Paris
- A goal to reduce city GHG emissions by 75% between 2004 and 2050

Concession contract:

- Tender of EUR 450 million in concession fees to the private sector
- For the duration of the contract, the city transferred to EVESA the right to operate & maintain public street and traffic lighting, to provide technical support and assist in project and asset management
- EVESA has to guarantee energy savings of 42 GWh over 10 years
- Concession fees are financed from the city's local budget

Intended outcomes:

- EVESA seeks to reduce street lighting energy consumption by 30% by 2020 by refurbishing 1/3 of all lights within the contract period
- In 2011-2014, urban lighting emissions have already decreased by 24%

Leasing case study: Cesena (2015-2027)

Context:

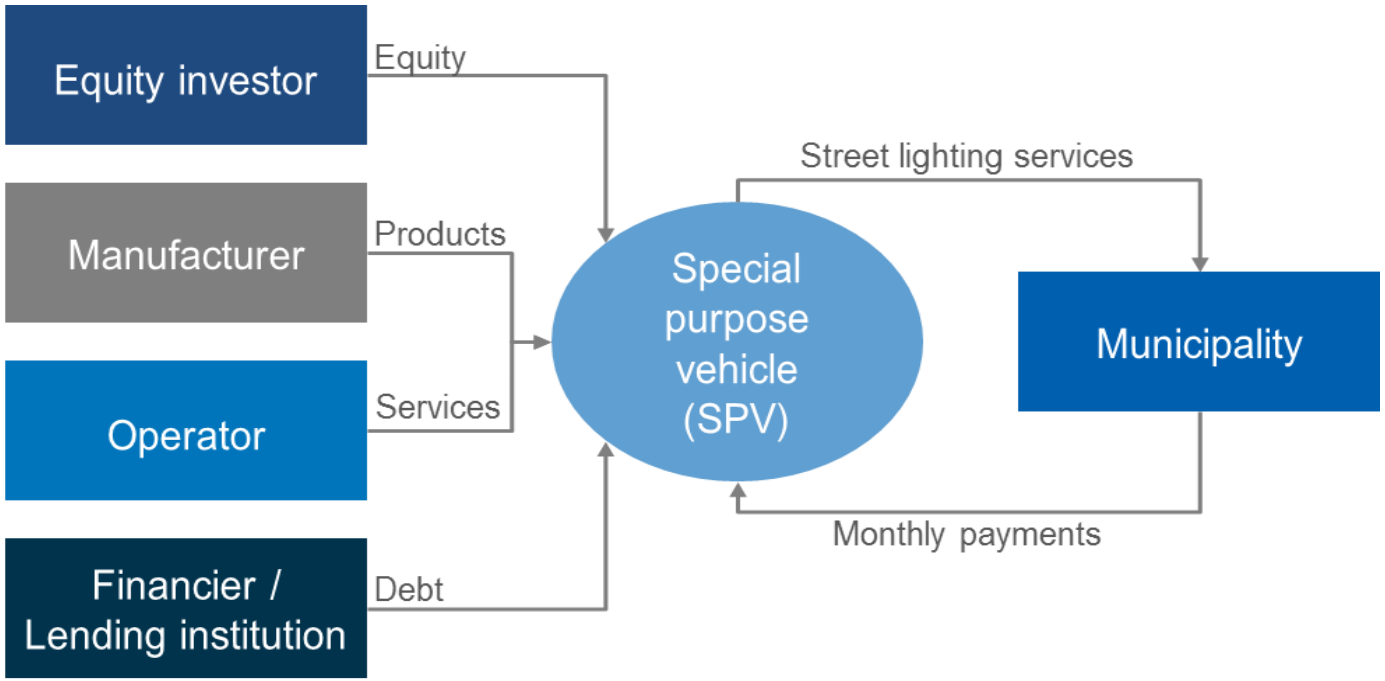
- Municipality objective is to decrease energy consumption by 30-40% and increase the quality of lighting in public spaces

Project scope:

- Transfer of the ownership and management of the majority of light points and traffic lights to Hera Luce Ltd:
  - 15,830 light points owned by Hera Luce Ltd
  - 5,236 remain in municipal property
  - After 2027, Cesena will regain ownership of these light points
- First project: €2.3m to replace the most outdated lights with LED luminaires (4,880 light points)
- Second project: investment plan and update 15,830 light points

Project finance

Project finance| Special Purpose Vehicles (SPV) in Public Private Partnerships (PPP)



Advantages

- Off-balance sheet finance
- Isolating project risks within SPV
- May foresee penalties if private partners fail to deliver the services

Disadvantages

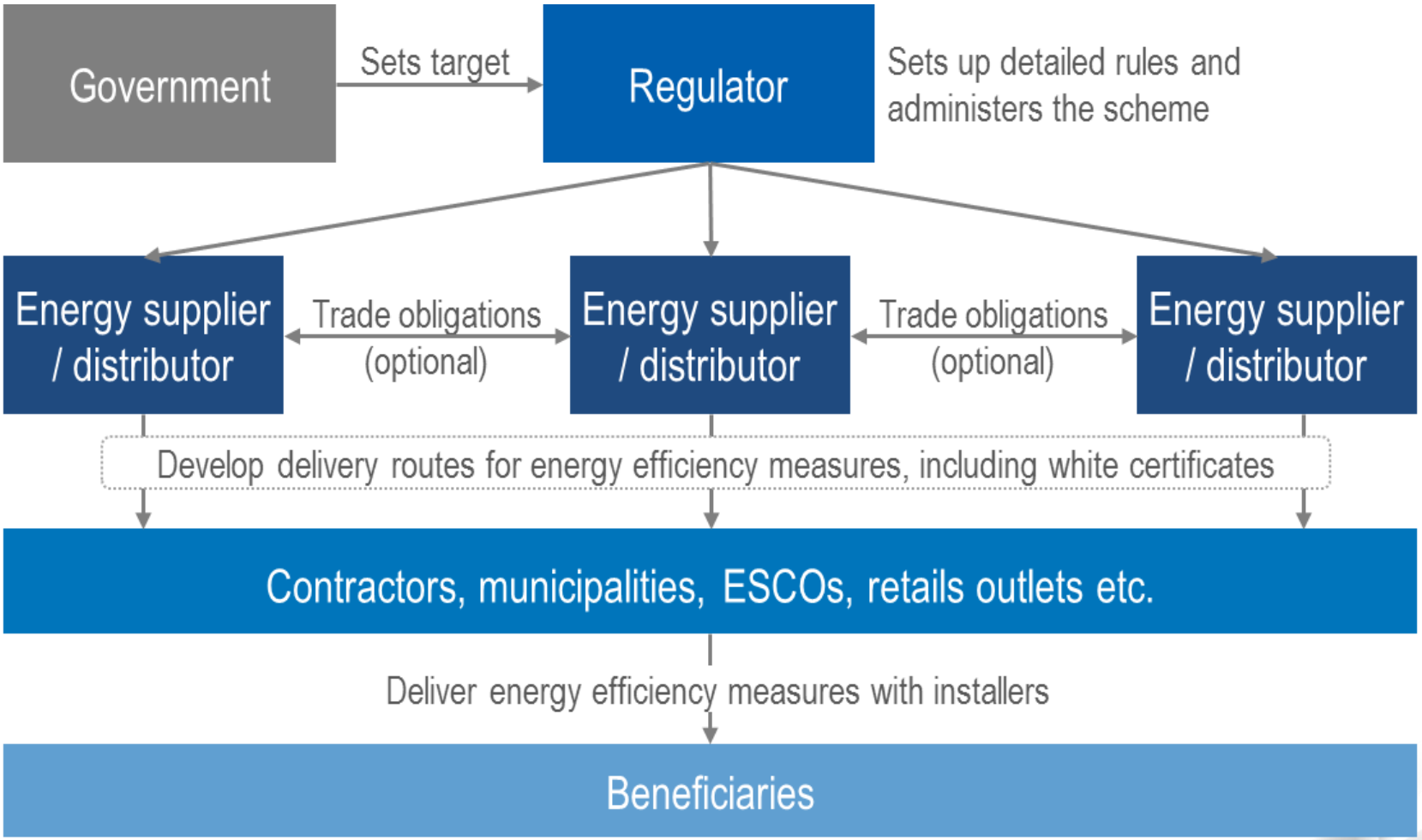
- High transaction costs related to the preparation and implementation of the special purpose vehicle
- For large projects only (> EUR 20 million) or consortium of several municipalities

Financing by utilities

Financing by utilities

1) Energy Efficiency Obligation Schemes / white certificates
2) On-bill financing

Financing by Utilities| model 1. Energy Efficiency Obligation Schemes (EEOS)



Source: Rosenow 2017.

White certificates case study: Italy (2004-ongoing)

Objective: Meeting EED requirements & boost ESCO market

Scope:

- Requires electricity and gas distributors with more than 50,000 customers to meet the primary energy saving targets via energy efficiency measure
- Efficiency measures cover all end-use sectors, except energy generation
- For each verified ton of energy saved entities receive a white certificate
- Entities can either implement measures themselves, outsource implementation, or buy the certificates

Implementation:

- 96% of the certificates are generated and traded by non-obligated parties
- As of 2015, 48mn certificates had been traded, 65% via bilateral agreements
- The scheme boosted the ESCO market. ESCOs account for 78% of the entities participating in the scheme, issuing 72% of total white certificates.
- In 2015, 64% of the certificates were issued for EE in the industrial sector, 4% of EE improvements related to lighting, 32% were in the civil sector

Financing by Utilities| On-bill financing

Architecture

- Utility provides loan for up-front investment to municipality
- Municipality repays loan via its electricity bills
- Utility can require and monitor the use of specific technology for the upgrades

Advantages

- Investment repaid through energy bills
- Simple implementation

Disadvantages

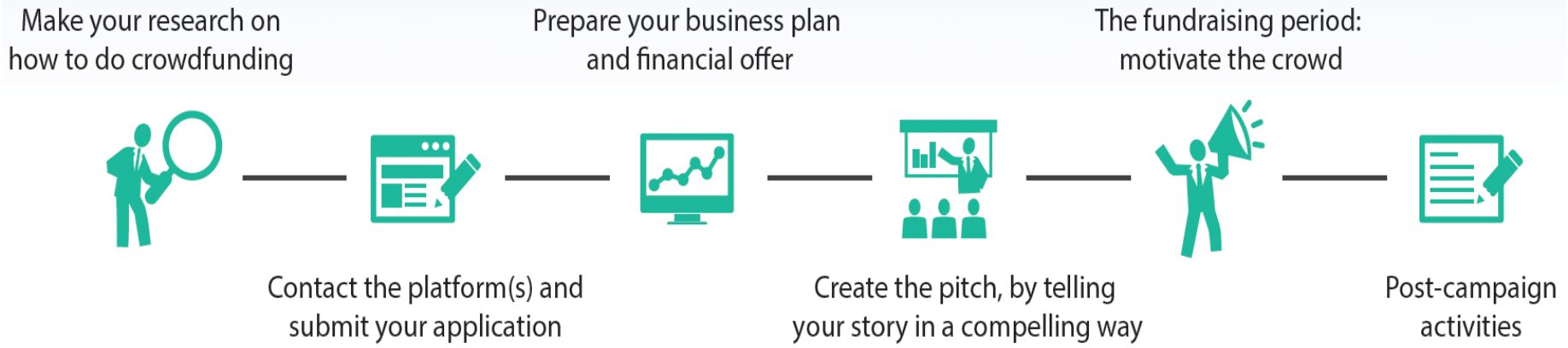
- Rare in Europe. In U.S. used to target home and business owners but also for municipalities

Case study: California

- Pacific Gas and Electric (PG&E) provides zero-interest loans of USD 5,000 – 250,000 to public institutions for up to 10 years for energy efficiency measures
- ~180,000 municipally-owned lights were updated, as of 2016
- Southern California Edison (SCE) provides similar loans of USD 5,000 - 250,000 for up to 10 years

Financing by citizens

Financing by Citizens | Crowdfunding



- Fundraising relatively **small amounts of money from a large number of people** or investors through online crowdfunding platforms
- **Community around the project** – often people contribute to a specific campaign because of their interest in the project, apart from the financial returns
- **Multiple risks**: no guarantee of sufficient funding; problems with the crowdfunding platform; investors may be inexperienced or wish to exit; the process is not regulated; and it may be challenging to fulfil commitments to a multitude of small investors etc.

Source: European Commission 2016

Crowdfunding study: Bettervest crowdfunding platform

- Germany-based crowdfunding platform for climate-change mitigation projects

- **50 energy-efficiency projects** from **€4,000-€600,000** in Germany and other countries, as of 2017

- **Example: lighting upgrades in a public school in Szeged, Hungary:**
  - The school raised €46,400 from 92 investors through Bettervest
  - Expected energy savings of more than 70% and significantly reduced energy and maintenance costs
  - After securing funds, the school signed a 10-year lease-purchase contract with LED-LIGHT-Germany.
  - The contract transfers the obligations towards crowd-investors from the school to LED-LIGHT-Germany – the contractor will have 7 years to pay back 100% of the funds borrowed from the crowd-investors plus 7% rate of return.
  - The school pays LED-LIGHT-Germany €6,542 per year for upgrades and installation work.

Conclusion

Re-cap

Self-financing

- Budget allocation
- Intracting
- Revolving fund

Debt-financing

- Concessional loans
- Commercial loans
- Bonds
- Institutional investors

Financing by a private contractor

- Simple contracting model
- Contracting with forfeiting and waiver of defence

Financing through energy savings (EPC)

- Guaranteed savings model
- Shared savings model
- Other energy performance contacting

Leasing or concession to a private partner

- Leasing
- Leasing or concession to a private partner

Project finance

- Special purpose vehicle (SPV)

Financing by utilities

- Energy Efficiency Obligation Schemes
- On-bill financing

Financing by citizens

- Crowdfunding

Conclusion

- **There is no one-size-fits-all** – different complexity, degree of autonomy of the municipality, risk sharing between municipality and private partner, number and kind of involved partners, costs, running time, etc.
- **Key considerations**:

  a) **Availability of public policies and funding**: budget allocations, grants, concessional loans, revolving schemes, white certificate schemes

  b) **Project size and bankability**:

  - The larger the project, the greater the need for private sector engagement
  - Should meet private investors risk-return requirements

  b) **Maturity of the market for ESCO and energy service providers**: in mature markets, advantageous terms for EPCs, leasing, and concession models, incl. bundling several small-scale projects

  c) **Municipality's borrowing capacity & finance from commercial financial institutions**:

  - Loans, bonds, project finance, equity, and other financial instruments
  - Projects must be financially sustainable
  - Cost of capital higher than through public support programmes

More information:

https://www.interreg-central.eu/Content.Node/Dynamic-Light/Guidelines-financial-models.html

Aleksandra Novikova, PhD
aleksandra.novikova@ikem.de
www.ikem.de

Kateryna Stelmakh
kateryna.stelmakh@ikem.de
www.ikem.de