



# How to make CBA easier? – Tools developed for the energy sector in Lithuania

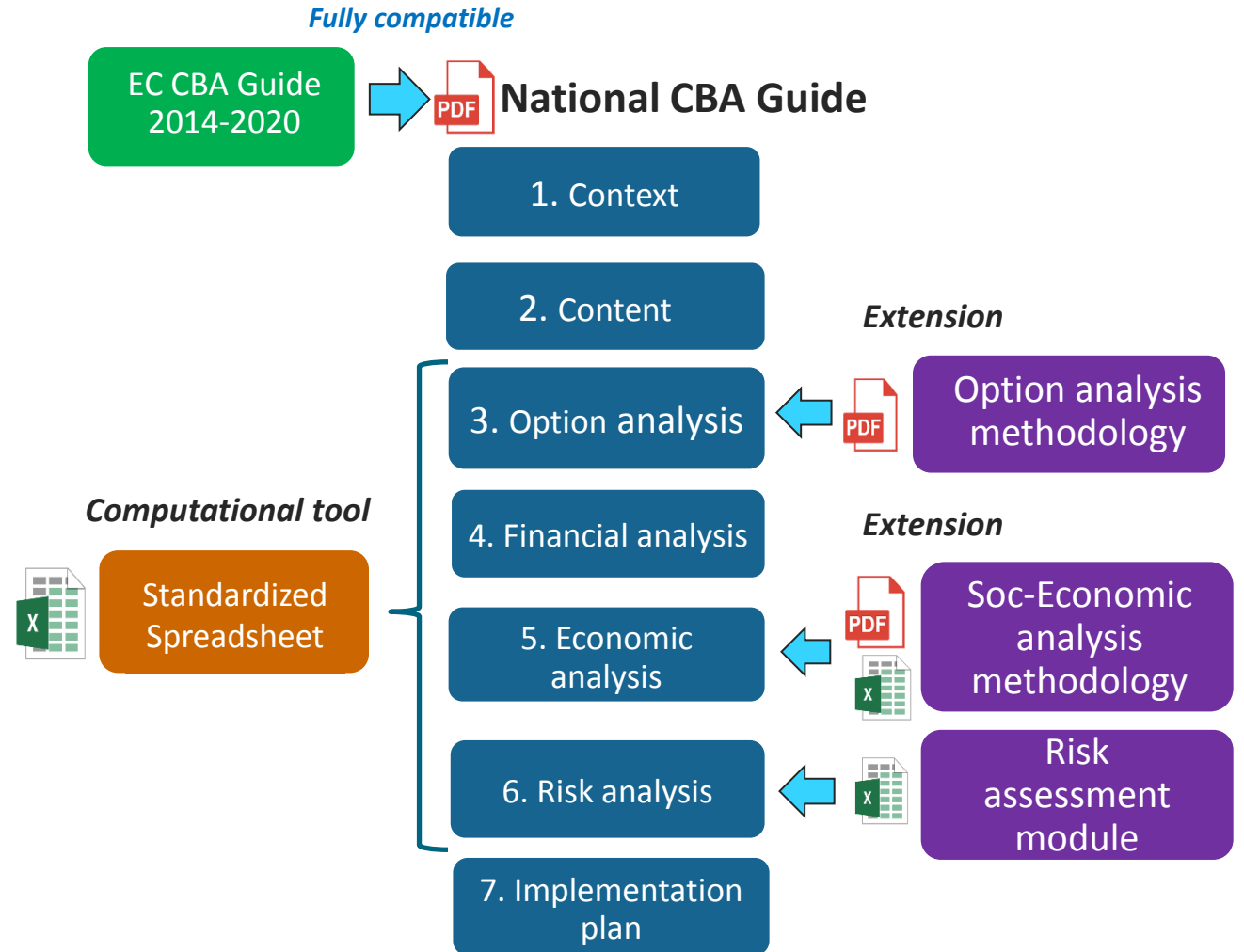
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*DG REGIO-JASPERS CBA Forum meeting on energy sectors  
Brussels (BE), 15 – 16 May 2018*

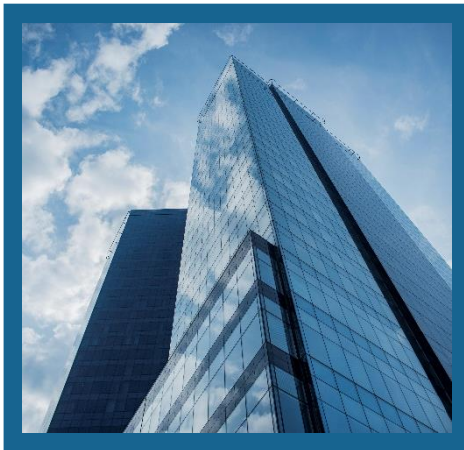
# Framework of national CBA methodological documents

- National CBA guide as a practical tool:  
**Guide + Spreadsheet + Supporting methodologies**
- CBA is applied for all IPs of which capital investments exceed 300.000 EUR
- IP is about the changes in provision of public services or performance of administrative functions, not about construction and equipment





# Option analysis: investment objects



**ENGINEERING  
INFRASTRUCTURE**



**EQUIPMENTS &  
MACHINERIES**



**BUILDINGS**



**INTANGIBLE  
ASSET**



**TRANSPORT  
EQUIPMENT**

# Option analysis: investment objects and the must analyzed alternatives

Every object has 2 – 5 investment object's types for which the lists of predetermined alternatives must be analyzed



**BUILDINGS**

## **Type 1 - New building construction:**

1. Construction of new building
2. Provision of distance services for IP's target groups
3. Reconstruction of the current asset
4. Rent of premises
5. Purchase of existing premises in the market

## **Energy sector: house rehabilitation**

### **Type 2 – Improvement of the existing building's technical and functional properties:**

1. Improvement of existing building's characteristics
2. Sale of an existing building and the purchase of a new one satisfying technical and functional characteristics
3. Purchase of equipments needed to ensure building's technical and functional performance characteristics

### **Type 3 - Enlargement of existing building:**

1. Enlargement of existing building
2. Optimization
3. Rent of premises

### **Type 4 - Completion of building started to build:**

1. Completion of building started to build
2. Refusal of existing building and construction of a new building
3. Rent of premises

### **Type 5 – Change of purpose of building :**

1. Change of purpose of building
2. Rent of premises

Analysis of additional alternative is always welcome!

# Option analysis: investment objects and the must analyzed alternatives

## Energy sector: electricity, gas, renewables...



### ENGINEERING INFRASTRUCTURE

#### Type 1 – Construction of new engineering infrastructure:

1. Construction of new engineering infrastructure
2. Improvement of existing engineering infrastructure characteristics
3. Rent of engineering infrastructure
4. Provision of services by purchasing services in the private market

#### Type 2 – Improvement of existing engineering infrastructure characteristics:

1. Improvement of existing engineering infrastructure characteristics
2. Replacement of existing engineering infrastructure
3. Provision of services by purchasing services in the market

#### Type 3 - Replacement of existing engineering infrastructure:

1. Replacement of existing engineering infrastructure to technology A
2. Replacement of existing engineering infrastructure to technology B
3. Provision of services by purchasing services in the market

**Most commonly found!**

Comparison of technology A with technology B

Analysis of additional alternative is always welcome!

Observed benefits:



More efficient use of public resources

# Option analysis: functions of spreadsheet

ENERGETIŠKAI EFEKTYVIŲ BŪSTŲ ĮRENGIMAS AR ĮSIGIJIMAS PAGAL SOCIALINIO BŪSTO FONDO PLETROS PROGRAMĄ

Projekto ataskaitinis laikotarpis

PVM tarifo pasirinkimas

Investavimo objekto ir ekonominės veiklos sektoriaus projekto tipo pasirinkimas

Choice of alternative's sheet

Main investment object (A)

Investment object (A) Type of Investment object

Nr.	Investment object (A)	Type of Investment object	Action
A. 1.	Construction of new engineering infrastructure	Rent of engineering infrastructure	START
A. 2.	Improvement of existing engineering infrastructure characteristics	Additional option	START
A. 3.			START
A. 4.			START
A. 5.			START
A. 6.			START

Pažymėkite, pirkimo PVM

Press „RESTORE“ in a case you want that the original alternate's worksheet will be loaded

RESTORE

CLOSE

Press „CLOSE“ in a case you do not want any additional changes in worksheets

# Formation of alternatives

## For rational comparison

### Effectiveness

The budget for capital investments is the same in all options and the option with the largest outputs is considered as the most beneficial

**Example:** *house rehabilitation*

energy consumption reduction for the same money in all alternatives



OR



### Efficiency

The same results are determined to achieve in all options and the option with the lowest costs is considered as the most beneficial

**Example:** *house rehabilitation*

the same energy consumption class in all alternatives



# Economic analysis: conversion factors

How to make the calculation of shadow prices easier?

Centralized  
Calculation

Conversion factors		Values of CFs													
		Health care	Social security	Education and science	Transport	Energy	Development and information society	Environment protection	Urban development	National defence	Justice / law enforcement	Public security	Tourism	Public inf. for business	Culture
KK6	Materials	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977	0,977
	Energy														
KK7.1	Electricity	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986	0,986
KK7.2	Petrol	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415	0,415
KK7.3	Diesel	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535	0,535
KK7.4	Natural gas (heating)	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97
KK4	Project preparation, supervision, testing [= Qualified work]	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947
KK8	Waste disposal [= Standard CF]	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998
KK11	Construction	0,884	0,885	0,885	0,884	0,884	0,884	0,884	0,884	0,888	0,884	0,884	0,884	0,884	0,884
KK12	Periodical and scheduled maintenance	0,863	0,862	0,868	0,879	0,861	0,89	0,86	0,861	0,873	0,863	0,863	0,86	0,865	0,86
KK13	Replacement and renewal of depreciated elements	0,896	0,903	0,903	0,895	0,900	0,902	0,896	0,892	0,898	0,896	0,896	0,896	0,896	0,896
KK9	Other services [= Standard CF]	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998
KK10	Equipment	0,907	0,921	0,921	0,906	0,91	0,91	0,908	0,911	0,908	0,907	0,907	0,908	0,908	0,908
KK1	Standard conversion factor	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998
KK3	Qualified work	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947	0,947
KK2	Unqualified work	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842	0,842
KK5	Land	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KK14	Transfers	0	0	0	0	0	0	0	0	0	0	0	0	0	0

# Economic benefits: street lighting

How to evaluate?



VS

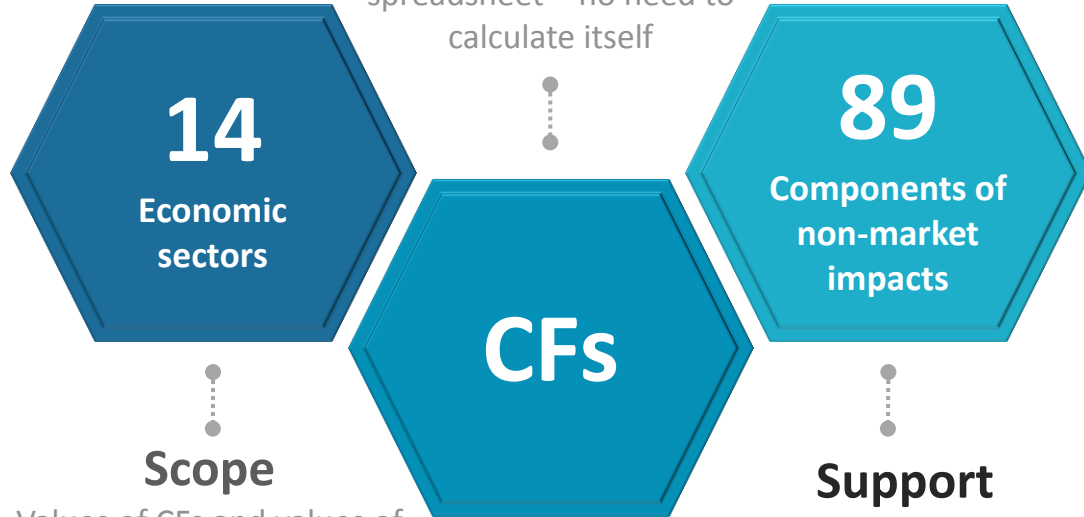


# Economic analysis : CFs and assessment of economic benefits



## Practical solution

CFs are already included in the annually updated IP's spreadsheet – no need to calculate itself



Values of CFs and values of external soc-eco impacts for this number of sectors are provided and annually updated considering economic data

A list of components are constantly enhanced and values of external socio-economic impact for 40 years are provided

## Sectors:

1. Health care
2. Social security
3. Education and science
4. Transport
5. Energy
6. Development and information society
7. Environment protection
8. Urban development
9. National defence
10. Justice / law enforcement
11. Public security
12. Tourism
13. Public inf. for business
14. Culture

## Economic benefits:

- Increase of security and reliability of energy supply
- Increase and diversification of energy supply to meet increasing demand
- Reduction of energy costs for substitution of the energy source
- Market integration
- Improved energy consumption efficiency
- Variation of CO2 emissions
- Variation of air pollutant emissions

Question for the audience:

What is the value of CO2 per ton (2018)?

- a) 9,95 EUR/h
- b) 12,50 EUR/h
- c) 17,25 EUR/h
- d) 25,00 EUR/h
- e) 33,00 EUR/h

# Economic analysis : CFs and assessment of non-market impacts



Some of 89 Components of evaluation of economic benefit (Values in euro)

Sector	Component	Units (of which an estimate is multiplied)	2018	2019	2020	2021	2022	2023	2024	2025	2026	t+n	2065
Energy	1. Increase of security and reliability of electricity supply (country)	kWh	4,13	4,32	4,51	4,70	4,90	5,12	5,35	5,59	5,83	---	31,91
Energy	2. Increase of security and reliability of heating energy supply (country)	kWh	2,27	2,38	2,48	2,59	2,70	2,82	2,95	3,08	3,21	---	17,58
Energy	3. Increase of security and reliability of gas supply (country)	Working day	59,49	62,24	64,98	67,79	70,67	73,82	77,10	80,54	84,12	---	460,02
Energy	Decrease of CO2	t	33,00	34,00	35,00	36,00	37,00	38,00	39,00	40,00	41,00	---	85
Energy	4. Reduction of energy costs for substitution of the energy source	kWh	<i>Individual calculation according to the methodology provided</i>										
Energy	5. Improved efficiency of heating energy consumption in buildings	kWh	<i>Individual calculation according to the methodology provided</i>										

## Observed benefits :



Less subjectivity on economic analysis



Less specific skills needed – more time left to focus on demand and cost analysis



Time saving on rutin tasks



Better quality of IP preparation

# House rehabilitation:

Improved energy consumption efficiency of buildings

	Temperature before the IP, (°C)	Temperature after the IP, (°C)	Normative temperature, (°C)	Annual actual heating costs without the IP, Eur	Annual heating costs recalculated to keep the normative temperature, Eur	Heating costs after the IP, Eur	Annual actual cost savings calculated on the market prices, Eur	Annual actual cost savings recalculated on the shadow prices	Economic benefit "Improved energy consumption efficiency"	Economic benefit: Cash flow individually calculated
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = (4) - (6)	(8) = (7)* KK	(9) = ((5) - (4))*KK	(10) = (8) + (9)
No. 1	18	18	18	1000	1000	800	200	195,4	0	195,4
No. 2	18	20	20	1000	1300	900	100	97,7	293,1	390,8
No. 3	18	22	22	1000	1500	1000	0	0	488,5	488,5

# Calculation of economic benefits:



# template for house rehabilitation Integrated in the Spreadsheet

Year	Calendar year	Actual electricity consumption before the IP, MWh	Actual heating season, days	Normative heating season, days	Actual electricity consumption is recalculated to the normative heating season, MWh
1	2013	5	140	210	8
2	2014	7	160	210	9
3	2015	6	156	210	8
4	2016	6	146	210	9
5	2017	7	156	210	9
<b>Average:</b>		6,2			8,6

Last known actual price must be used

Conversion factors are calculated by the special institution and do not need to be calculated individually

FINANCIAL BENEFIT						ECONOMIC BENEFIT			
Energy consumption before the IP recalculated to the normative year, MWh	Actual energy consumption before the IP (average of the last 5 years)	Energy consumption after the IP for the normative year, MWh	Actual energy consumption reduction, MWh	Price of 1 MWh, EUR	Actual annual decrease (-) / increase (+) in heating costs, EUR	Economic benefit "Improved energy efficiency", MWh	Conversion factor	Economic benefit "Improved energy efficiency", EUR	
(1)	(2)	(3)	(4) = (2) - (3)	(5)	(6) = (4)*(5)	(7)=(1)-(2)	(8)	(9)=(5)*(7)*(8)	
Heating	250	158	120	38,0	60	-2282,81	92,0	0,977	5390,29
Electric energy heating)	12	9	0	8,6	165	-1412,98	3,4	0,988	560,21
Electric energy (except heating)		0	0	165	0,00				
<b>Sum</b>					<b>-1412,98</b>			<b>5950,50</b>	

Value is used as an economic benefit. The same value is used for all reference period

Annual emission reduction (+) / increase (-) t CO2e / year	Energy conversion to pollution factor, t/MWh to t CO2 e/year	Heating	Electric energy
14,92		0,233	0,707

Control for CO2 calculation		
CO2 heating	CO2 electric energy	CO2 total
8,86	6,05	14,92

Value is used in line D1.3 of option data sheet. The same value is used for all reference period

Sector	Component	Primary sector (when component comes from another sector)	Primary component (when component comes from another sector)	Is it fully compatible with the original component?	Unit which are multiply by the value of component	2018	2019	2020	2021	2022	2023	2024
Energy	Decrease of CO2 emissions (central value)	Transport	Decrease of CO2 emissions (central value)	Yes	Ton	25,00	25,00	40,00	40,00	40,00	40,00	40,00
	Decrease of CO2 emissions, EUR							596,77	596,77	596,77	596,77	596,77

Values considered as the economic benefit, EUR



# Calculation of economic benefits: template for street lighting

*Integrated in the Spreadsheet*

Year	Calendar year	Actual use life of devices, hour	Power of devices, W	Actual electricity consumption before the IP, MWh	Annual use of device in time in accordance with the applicable statutory requirements, hour	Actual energy consumption before the project has been recalculated to the applicable statutory requirements, MWh
1	2016	2 841	751 951	2 136	3 984	2 996
2	2015	2 841	751 951	2 136	3 984	2 996
3	2014	2 841	751 951	2 136	3 984	2 996
4	2013	2 841	751 951	2 136	3 984	2 996
5	2012	2 841	751 951	2 136	3 984	2 996
<b>Average:</b>				<b>2136</b>		<b>2996</b>

Conversion factors are calculated by the special institution and do not need to be calculated individually

	Annual use of the device in accordance with valid legal requirements, hour	Annual planned use of the device after implementation of the IP, hour	Planned reduction of energy consumption, %	Planned electricity consumption before the IP, MWh	Actual electric energy consumption before the IP (average of 5 years), MWh	Electric energy consumption after the implementation of the IP, MWh	Actual electric energy reduction, MWh	FINANCIAL BENEFIT		ECONOMIC BENEFIT		
								Price of 1 MWh, EUR	Actual annual decrease (-) / increase (+) in electric energy costs, EUR	Economic benefit "Improved energy efficiency", MWh	Conversion factor	Economic benefit "Improved energy efficiency", EUR
	(1)	(2)	(3)	(4)	(5)	(6) = (4)*(1-(3))	(7) = (5) - (6)	(8)	(9) = (7)*(8)	(10) = (4)*(2)/(1)-(5)	(11)	(12) = (8)*(10)*(11)
<b>Electricity</b>	3 984	3 984	65,79%	2996	2136,401	1024,831	1112	107,663	<b>-119 675</b>	859	0,988	<b>91 412</b>

**Windows User:**  
If the device is planned to be operated in accordance with legal requirements, the number indicated in the C52 box should be indicated

Annual emission reduction (+) / increase (-) t CO2e / year	785,88
--	--------

Energy conversion to pollution factor, t/MWh to t CO2e/year	Control for CO2 calculation	
	Electric energy	CO2 Total
	0,707	785,88

**Windows User:**  
Value is considered as an economic benefit. The same value is used for all reference period

Sector	Component	Primary sector (when component comes from another sector)	Primary component (when component comes from another sector)	Is it fully compatible with the original component?	Unit which are multiply by the value of component	2019	2020	2021	2022	2023	2024	2025	2026
Energy	Decrease of CO2 emissions (central value)	Transport	Decrease of CO2 emissions (central value)	Yes	Ton	25,00	40,00	40,00	40,00	40,00	40,00	40,00	40,00



# Risk assessment

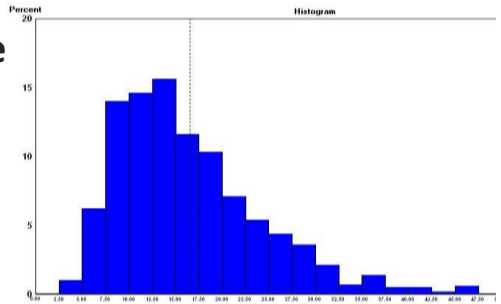
Sensitivity analysis  
Scenario analysis,  
Probabilities,  
Monte Carlo



70% confidence level



MS Excel Spreadsheet  
Risk assessment module



Statistics is based on Lithuanian experience in IP implementation



## Observed benefits:



Lithuania specific risk estimates are calculated – less subjectivity



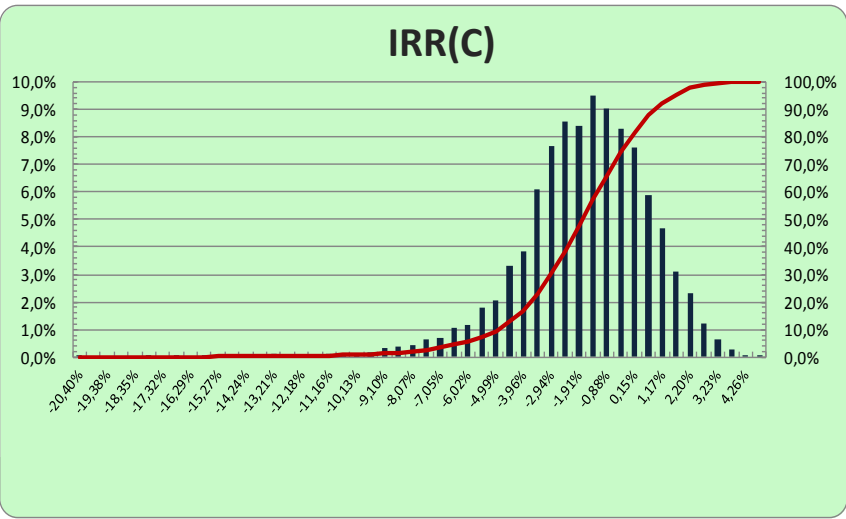
Risk analysis is easy to perform – less specific skills are required



Time saving



82,2K. Eur savings (due to application of empirically-grounded risk estimates) in contingent liabilities related to every 1 mln. Eur of investments



# Development steps

Government has designated to CPMA functions to act as the national methodological and consultancy center for public private partnership (PPP) and concession projects

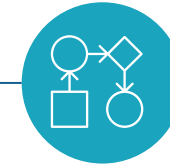


2010

PPP COMPETENCE CENTRE

2010 - 2015

CAPACITY BUILDING



Capacity building project was implemented, methodologies and training programs developed,

The Center received additional functions to act as to methodological and consultancy center for all investment projects, financed from the EU structural funds during 2014-2020



2014

METHODOLOGICAL SUPPORT CENTER FOR ALL IP

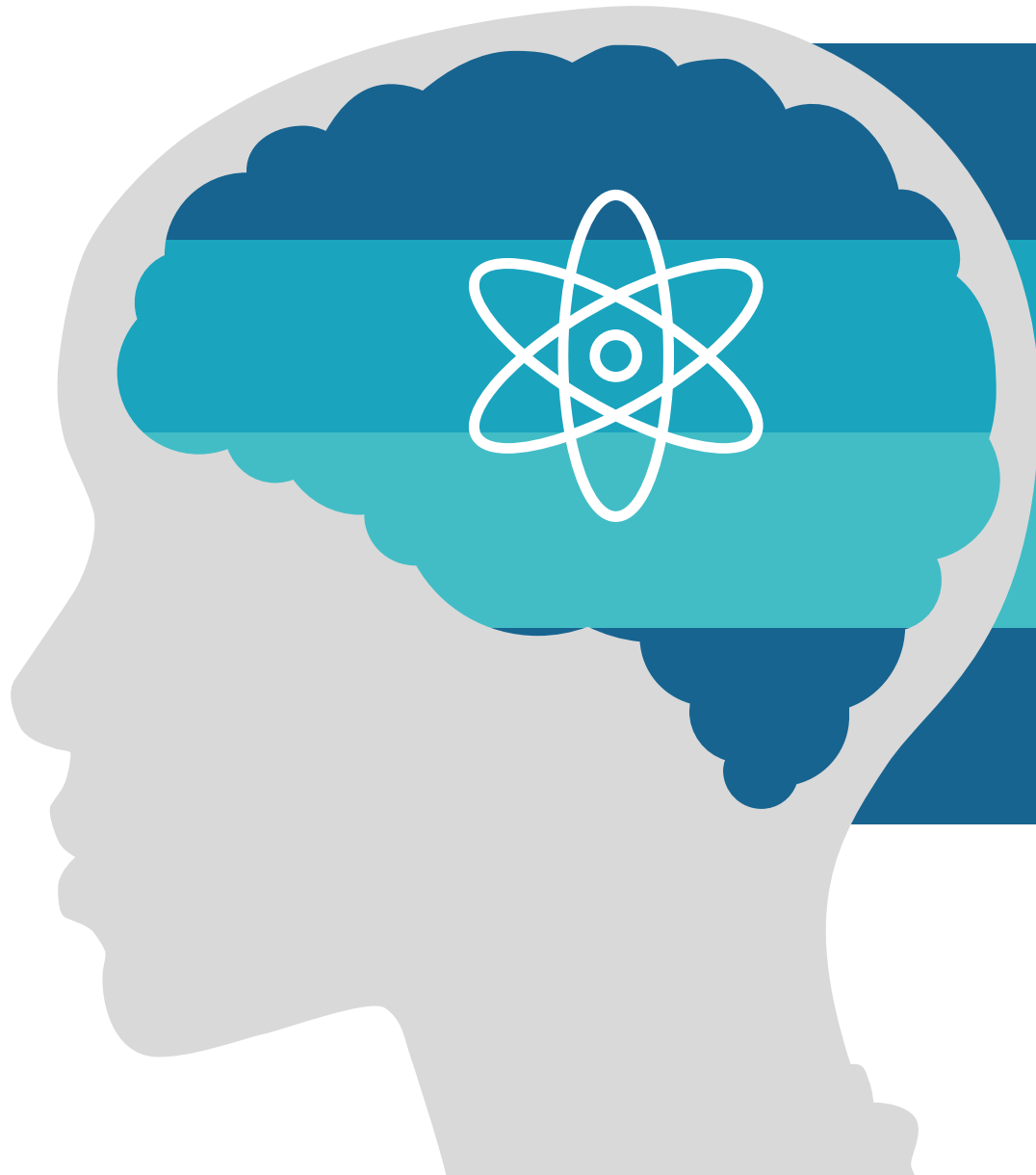
2017

INDEPENDENT PROJECT ASSESSMENT



LR Seimas designated the additional function: to assess all PPP projects and to provide the conclusion on their social economic impact to society and added value of partnership

# Why is the centralized competence needed?



01

## Cheaper and more effective

We are not rich enough to rely on private consultants, we better go for simplification and standardization

02

## Independent

We do not belong to any sector, we report to the Ministry of Finance and Government

03

## Public interest

It is not possible to ensure high level of expertise in all state and municipal institutions, and we need good knowledge and expertise to understand and protect the tax payers interest

04

## Common practice

We seek to ensure the same level of quality of the projects in any sector



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# More Information

**For info or further questions on this seminar and the activities of the JASPERS Networking Platform, please contact the JASPERS Networking and Competence Centre at the following email:**

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**JASPERS Networking Platform:**

[www.jaspersnetwork.org](http://www.jaspersnetwork.org)

