



# PLANNING INSTRUMENTS FOR SMART ENERGY COMMUNITIES



**A Smart Energy Community** *is an area of buildings; infrastructure and citizens sharing planned societal services\*, where environmental targets are reached through the integration of energy aspects into planning and implementation. The Smart Energy Community aims to lower dependency on fossil fuels by becoming highly energy efficient and increasingly powered by renewable and local energy sources. Its spatial planning and localization considers reduction of carbon emissions also through its relationship with the larger region, both through the design of energy systems and by including sustainable mobility aspects of the larger region. It further encourages sustainable behavior through its overall design from building and citizen scale to community scale. The application of open information flow, a large degree of communication between different stakeholders and smart technology are central means to meet these objectives.'*

*By societal services is here meant 'samfunnstjenester' as in the Norwegian Planning and Building Act 12.7 : such as energy delivery, transportation and road net, health and social services, kindergartens, play areas and schools*



## Planning Wheel









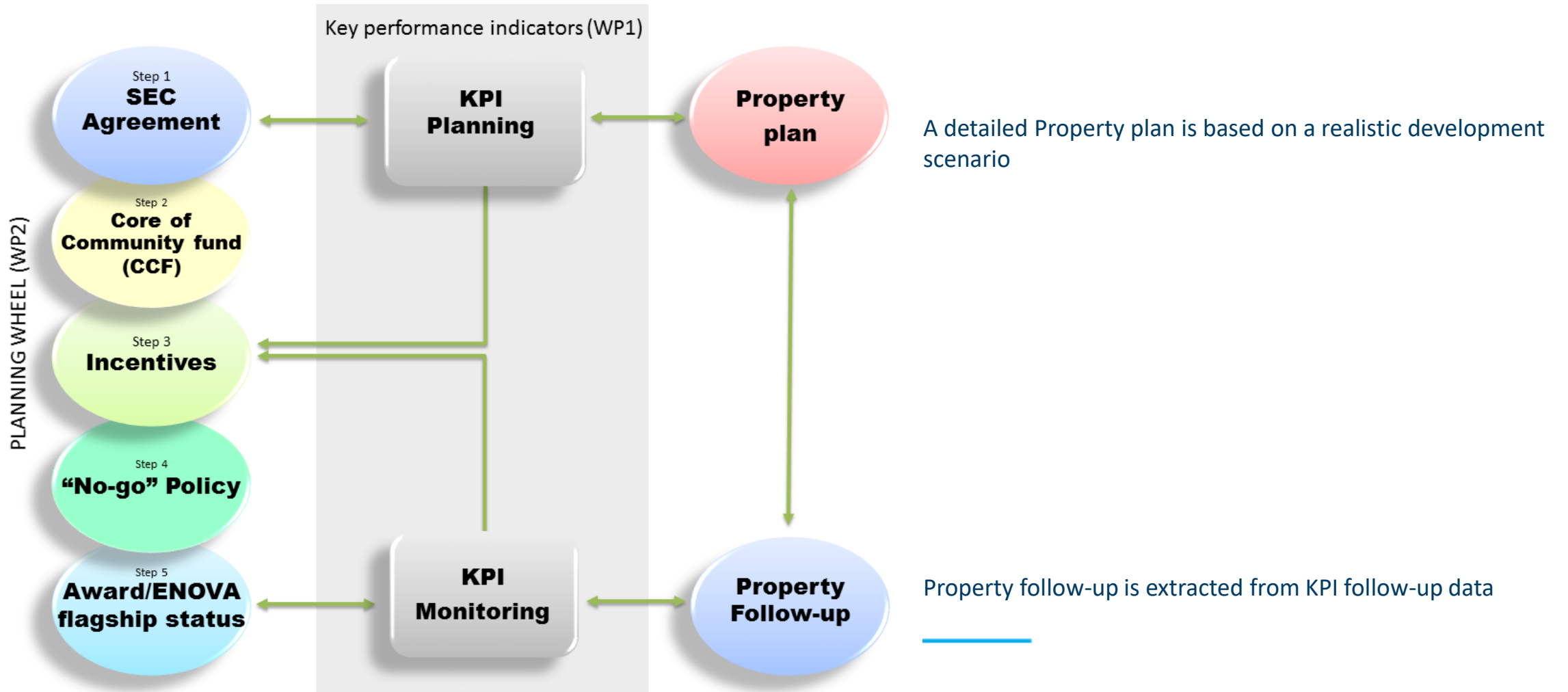








# Indicators for Decision Making in SEC Agreement and Evaluation

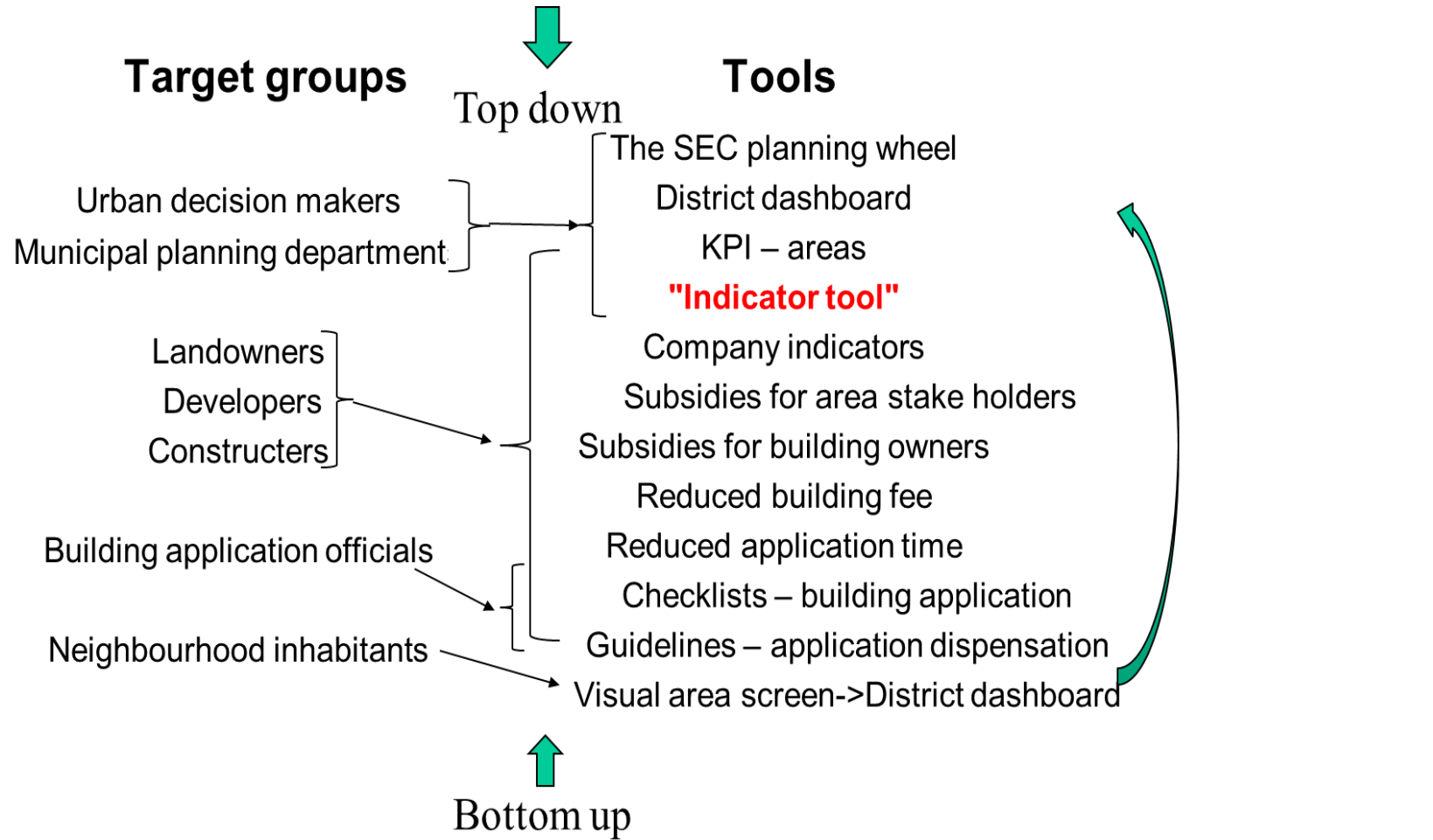




# Indicator tool

- Why PI SEC Indicator tool?
- Step by step introduction
- Interplay with the Planning wheel
- Demonstration of Excel and Web-based versions
- SWOT
- Future development

# Tool overview





Missing link



## Urban planning:

- Define goals
- Realistic scenarios
- Close gaps
- Target incentives

## Estate development

- Define goals
- Reveal deviation

## Indicators

- Define baseline
- Measure progress
- Adjust plans

# Step 1 – Defining the project

**PI-SEC KPI planning TOOL** Front Page  
 Neighbourhood: Furuset

Key data, goals and indicators				
KEY DATA	Now End of project			
Project timeframe	2015 2030			
Population				
Number of jobs				
Area				
Number of buildings				
Area of buildings				
GOALS	KPI	Unit	Comparison	Relative to Goal at EoP
<input type="button" value="Add"/> <input type="button" value="Remove"/>				
Energy Consumption	Energy use total	/m2 BRA	% Reduction	Baseline 20
Energy Consumption	Electricity consumption total	/inhabitant	Absolute	10000
Carbon Emission	Energy/buildings	/inhabitant	% Reduction	Baseline 50
Energy Generation	RES produced Electricity	/inhabitant	Absolute	Initial 200

Menu

Create Baseline	Calculate Project
Create Scenario	

# Step 2 – Building a neighborhood

PI-SEC KPI planning TOOL		Initial Situation		2015			
Neighbourhood		Furuset					
Buildings		Add	Upgrade	Demolish			
General description							
Building	Category	Year of construction	Area [m2]	Ownership	residents/ employees [#]	Res above 13y/ Other Users [#]	
Furuset senter: kjøpesenter, bibliotek, svømmehall	Cultural building	1960		3500 Private		5	100
Furuset senter: kjøpesenter, bibliotek, svømmehall	Comercial building	1960		6500 Private		60	200
Furuset senter: kjøpesenter, bibliotek, svømmehall	Office building			9600 Private			
Furustien barnehage. Parkering	Kindergarten			400 Public			
Papyrusbygget: lager og kontorer. (Huser bla Dekkm	Office building			4000 Private			
Papyrusbygget: lager og kontorer. (Huser bla Dekkm	Comercial building			600 Private			
Papyrusbygget: lager og kontorer. (Huser bla Dekkm	Industry/Workshop			12400 Private			
Furuset forum: Ishall, håndballhall, noen kontorer	Sports Facility			16500 Public			
Scala barnehage, friområde	Kindergarten			600 Public			
Bakers bakeri (produksjon), Først laboratorium	Office building			3600 Private			
Bakers bakeri (produksjon), Først laboratorium	Industry/Workshop			3600 Private			
Suveren rørmøbelfabrikk	Industry/Workshop			4800 Private			
Øvre Furuset borettslag, byggeår 1980, planlegger c	Residential apartment building			22700 Private		505	
Nordre Gran borettslag, byggeår 1978, opprusting ut	Residential apartment building			32300 Private		719	
Granstangen borettslag, byggeår 1979, opprusting f	Residential apartment building			17400 Private		387	
Granstangen borettslag, byggeår 1979, opprusting f	Residential apartment building			22000 Private		489	
Gransletta borettslag, byggeår 1978, opprusting ute	Residential apartment building			9100 Private		202	
Gransletta borettslag, byggeår 1978, opprusting ute	Residential apartment building			9900 Private		220	
Gransletta borettslag, byggeår 1978, opprusting ute	Office building			6000 Private			
Gransletta borettslag, byggeår 1978, opprusting ute	Comercial building			2000 Private			
Kurland borettslag, byggeår 1978, fasader pusset op	Residential apartment building			34500 Private		768	
Ulsholt borettslag, byggeår 1978, fasader pusset op	Residential apartment building			22900 Private		509	
Lager	Industry/Workshop			26500 Private			
Furuset sykehjem	Nursing home			9300 Public			
Ny Gran ungdomsskole (bygges nå, FutureBuilt-pros	Kindergarten			4100 Public			
Ahmadiyya-moskeen	Cultural building			4000 Private			
Furuset skole	School			10000 Public			
Gran skole	School			8000 Public			
Kurland barnehage	Kindergarten			500 Public			
Del av Furuset senter	Office building			11500 Private			
Del av Furuset senter	Sports Facility			3000 Private			
Moske, næringsbebyggelse	Cultural building			1000 Private			

Infrastructure						
General description				Energy performance		
Outdoor lighting		Year of installation	# units	Energy performance Category	Energy consumption [kWh/unit]	
Lighting		1980	1000	Low efficiency	550	
Snow Melt Systems		Year of installation	Size [m2]	Energy performance Category	Energy consumption [kW/m2]	Efficiency/COP [-]
Snow Melt		1980	500	Low efficiency	350	0,9

## Local energy plant

Energy Source				Heating to District Heating system		Cooling to District Cooling system		Electricity to grid	
Type	Energy Source	CO2 Emission [g/kWh]	Efficiency [%]	Capacity [kW]	Production [kWh]	Capacity [kW]	Production [kWh]	Capacity [kW]	Production [kWh]
CHP	Pellets	19	85%	400	2500000			200	1250000
Solar PV	Sun	0	100%					500	500000

## District Heating

Energy Source				Distribution		
Heat Source	Coverage [%]	CO2 Emission [g/kWh]	Production efficiency [%]	Distribution losses		
Electricity		28,2%	123	0,95	10%	
Heat Pump		7,9%	123	3,125		
Solar Collector			0	1		
Waste Heat			0	0,9		
Waste Incineration		57,6%	11	0,9		
Wood Chips			18	0,9		
Pellets		1,7%	19	0,9		
Bio-oil		3,6%	10	0,9		
Bio-gas			10	0,9		
Fossil Oil		0,2%	268	0,9		
LPG		0,8%	235	0,9		



# Step 3 – Creating a baseline scenario

**PI-SEC KPI planning TOOL** [Front Page](#)  
 Neighbourhood: **Furuset**

Key data, goals and indicators	
KEY DATA	Now End of project
Project timeframe	2015 2030
Population	
Number of jobs	
Area	
Number of buildings	
Area of buildings	

GOALS	Add	Remove	KPI	Unit	Comparison	Relative to Goal at EoP				
Energy Consumption			Energy use total	/m2 BRA	% Reduction	Baseline	20			
Energy Consumption			Electricity consumption total	/inhabitant	Absolute		10000			
Carbon Emission			Energy/buildings	/inhabitant	% Reduction	Baseline	50			
Energy Generation			RES produced Electricity	/inhabitant	Absolute	Initial	200			

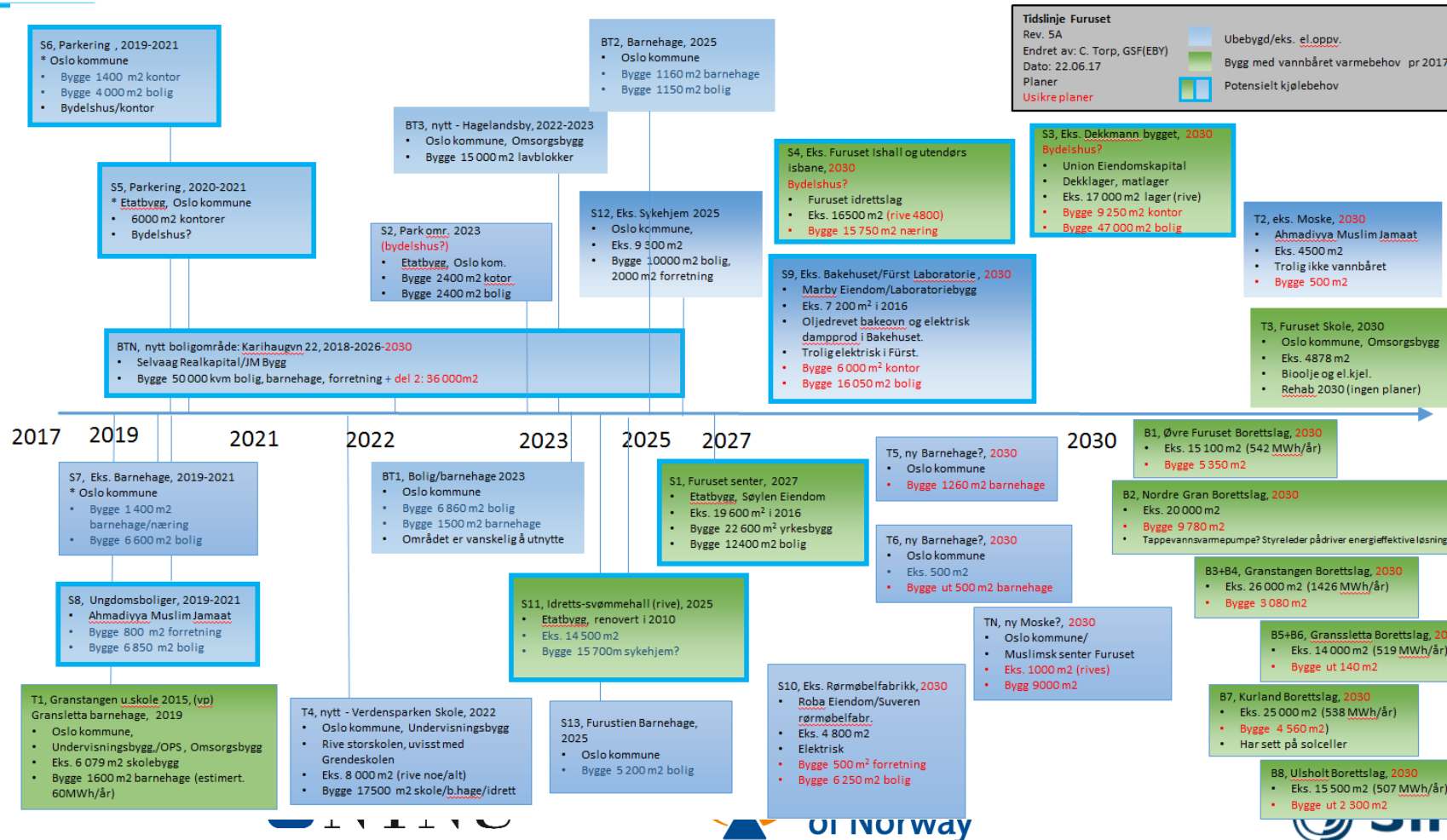
Menu

Create Baseline

Create Scenario

**Calculate Project**

# Step 3 – Creating a baseline scenario



# Step 3 – Creating a baseline scenario

PI-SEC KPI TOOL		Baseline	2030	
Neighbourhood		Furuset		
Buildings	Add	Upgrade	Demolish	
General description				
Building	Category	Year of consr	Area [m2]	Ownership
Furusetrenter:kjøperenter, bibliotek, summe	Cultural building	1960	3500	Private
Furusetrenter:kjøperenter, bibliotek, summe	Comercial building	1960	6500	Private
Furusetrenter:kjøperenter, bibliotek, summe	Office building		9600	Private
Furuset barnehage, Parkering	Kindergarten		400	Public
Pappyrubygget: lager og kontorer. (Huset ble C	Office building		4000	Private
Pappyrubygget: lager og kontorer. (Huset ble C	Comercial building		600	Private
Pappyrubygget: lager og kontorer. (Huset ble C	Industry/Workshop		12400	Private
Furuset forum: Ishall, håndballhall, noen kontor	Sports Facility		16500	Public
Scala barnehage, friområde	Kindergarten		600	Public
Bakers bakeri (produksjon), Furst laboratorium	Office building		3600	Private
Bakers bakeri (produksjon), Furst laboratorium	Industry/Workshop		3600	Private
Suveren narmabelfabrikk	Industry/Workshop		4800	Private
Øvre Furuset barrettblokk, byggeår 1980, planl	Residential apartment building		22700	Private
Nordre Gran barrettblokk, byggeår 1978, appurt	Residential apartment building		32300	Private
Granntangen barrettblokk, byggeår 1979, appurt	Residential apartment building		17400	Private
Granntangen barrettblokk, byggeår 1979, appurt	Residential apartment building		22000	Private
Granløtta barrettblokk, byggeår 1978, appurtin	Residential apartment building		9100	Private
Granløtta barrettblokk, byggeår 1978, appurtin	Residential apartment building		9900	Private
Granløtta barrettblokk, byggeår 1978, appurtin	Office building		6000	Private
Granløtta barrettblokk, byggeår 1978, appurtin	Comercial building		2000	Private
Kurland barrettblokk, byggeår 1978, farader pur	Residential apartment building		34500	Private
Urholt barrettblokk, byggeår 1978, farader pur	Residential apartment building		22900	Private
Lager	Industry/Workshop		26500	Private
Furusetrykehjem	Nursing home		9300	Public
Ny Gran ungdomskole (bygges nå, FutureBuild	Kindergarten		4100	Public
Ahmediyyarmarken	Cultural building		4000	Private
Furusetkole	School		10000	Public
Granuskole	School		8000	Public
Kurland barnehage	Kindergarten		500	Public
Del av Furusetrenter	Office building		11500	Private
Del av Furusetrenter	Sports Facility		3000	Private
Marka, næringsbebyggelse	Cultural building		1000	Private
Furusetrenter:kjøperenter, bibliotek, summe	Residential apartment building		10000	Private

# Step 4 - Creating development scenarios

**PI-SEC KPI planning TOOL** [Front Page](#)

Neighbourhood: **Furuset**

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**Key data, goals and indicators**

KEY DATA	Now	End of project
Project timeframe	2015	2030
Population		
Number of jobs		
Area		
Number of buildings		
Area of buildings		

GOALS	Add	Remove	KPI	Unit	Comparison	Relative to Goal at EoP				
Energy Consumption			Energy use total	/m2 BRA	% Reduction	Baseline	20			
Energy Consumption			Electricity consumption total	/inhabitant	Absolute		10000			
Carbon Emission			Energy/buildings	/inhabitant	% Reduction	Baseline	50			
Energy Generation			RES produced Electricity	/inhabitant	Absolute	Initial	200			

Menu

Create Baseline

Calculate Project

Create Scenario

# Step 4 - Creating development scenarios

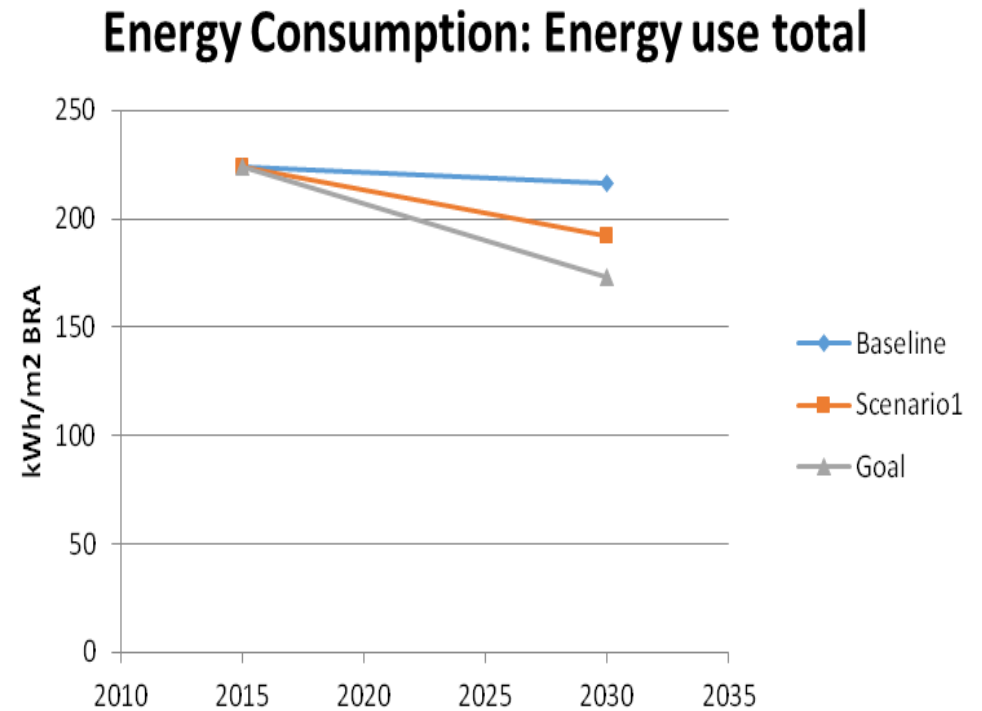
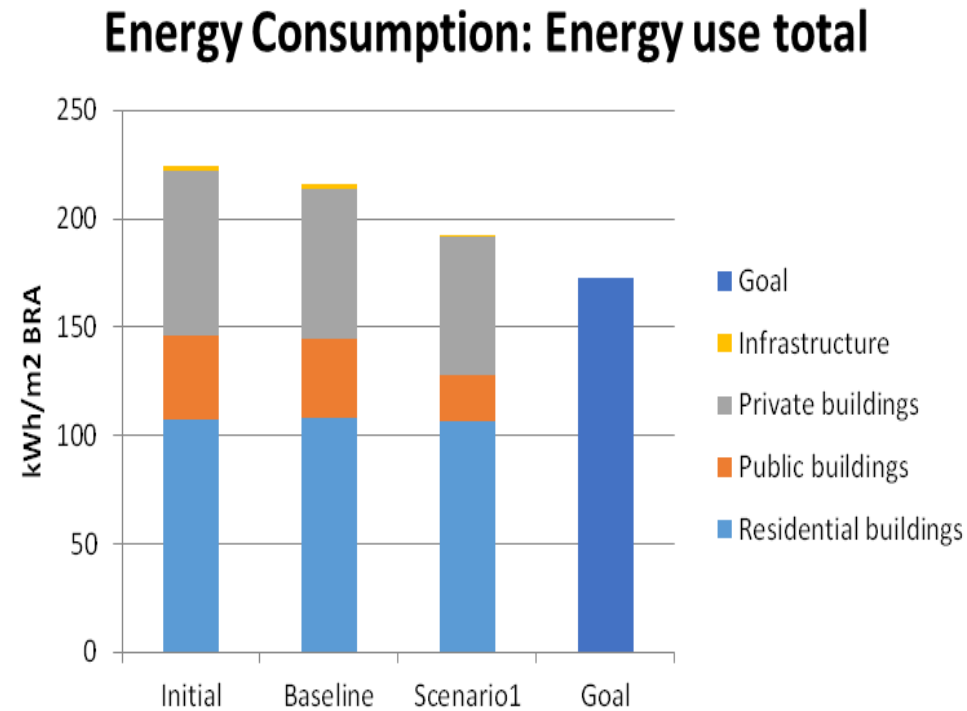
Neighbourhood																
Buildings	Add	Upgrade	Demo													
General description				Energy performance					Renewable energy production							
Building	Area [m2]	Ownership	ts/ employ ees	Energy certificate	Performance input	Heating [kWh/m2]	Water [kWh/m2]	Cooling [kWh/m2]	Electricity [kWh/m2]	Solar Thermal (calculated)			Solar PV (total)			
										Size [m2]	Peak production [kWp]	Yearly production [kWh]	Size [m2]	Input type	producti on [kWp]	Yearly production [kWh]
Øvre Furuset borettslag, byggeår 1980, planlegger c	22700	Private	505	B	Low energy	30	29,8	0	33	678,2	678,16	474709				
Nordre Gran borettslag, byggeår 1978, opprusting ut	32300	Private	719	B	Low energy	30	29,8	0	33	550,0	550,02	675467				
Granstangen borettslag, byggeår 1979, opprusting f	17400	Private	387	B	Low energy	30	29,8	0	33	296,3	296,30	363874				
Granstangen borettslag, byggeår 1979, opprusting f	22000	Private	489	B	Low energy	30	29,8	0	33	374,6	374,63	460070				
Gransletta borettslag, byggeår 1978, opprusting ute	9100	Private	202	B	Low energy	30	29,8	0	33	155,0	154,96	190302				
Gransletta borettslag, byggeår 1978, opprusting ute	9900	Private	220	B	Low energy	30	29,8	0	33	168,6	168,58	207032				
Gransletta borettslag, byggeår 1978, opprusting ute	6000	Private		B	Low energy	23,2	5	9,8	63,2				125	Auto	20	20000
Gransletta borettslag, byggeår 1978, opprusting ute	2000	Private		B	Low energy	30,4	10,5	18,7	72,8				100	Auto	16	16000
Kurland borettslag, byggeår 1978, fasader pusset op	34500	Private	768	B	Low energy	30	29,8	0	33	587,5	587,49	721474				
Ulsholt borettslag, byggeår 1978, fasader pusset op	22900	Private	509	B	Low energy	30	29,8	0	33	390,0	389,95	478891				
Lager	26500	Private			TEK 87	134	10	32	75							
Furuset sykehjem	9300	Public		A	Passivhouse	20,2	29,8	11	70				250	Auto	40	40000

# Step 4 - Creating development scenarios

District Heating					
Energy Source					Distribution
Heat Source	Coverage [%]	CO2 Emission [g/kWh]	Production efficiency [%]	Distribution losses	
Electricity	0,0 %	123	0,95	10 %	
Heat Pump	0,0 %	123	3,125		
Solar Collector		0	1		
Waste Heat		0	0,9		
Waste Incineration	100,0 %	0	0,9		
Wood Chips		18	0,9		
Pellets	0,0 %	19	0,9		
Bio-oil	0,0 %	10	0,9		
Bio-gas		10	0,9		
Fossile Oil	0,2 %	268	0,9		
LPG	0,8 %	235	0,9		

# Step 5 – Calculation & Analyzing data

## Step 6 – KPI follow-up



# Excel or Web-platform?

Excel: Planning - Web: Planning and indicator follow-up

## Strengths

- Enabling simultaneous use by multiple users
- More options for data import and indicator follow-up

## Weaknesses

- More time-consuming to develop
- Require internet to use

# SWOT

## Opportunities

- More options for enlarged functionality, for instance support a district dashboard or show energy performance among property owners.
- Simpler to add-on with data-collection og data processing. More suitable for indicator follow-up.

## Threats

- System communication is complicated.
- Data import is often a challenge regardless of data-platform.



# Further development

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0-6 months

- Test Indicator tools on ZVB and Furuset
- Discuss with stakeholders

6-12 months

- Develop and retest
- Web-based platform (3 PM)

9-15 months

- Final version – Excelbased or web-based

**Refinement of planning wheel and indicators**

**Ensure a good relationship between the larger picture, city planners negotiation role and detailed energy designs from the beginning**

**Financing models for societal core with public transport hub, and renovation of older building coops**

**Sustainable development**

**Mechanisms for life cycle view on community planning**

***'A smart city is socially smart, where citizens participate'***



smart people ask questions



 NTNU

 SINTEF