HOW CAN WE **CHOOSE KEY PERFORMANCE INDICATORS** THAT CAN MEASURE PROGRESS IN **DIFFERENT LOCAL COMMUNITIES** IN THE TRANSITION TOWARDS LOW-CARBON COMMUNITIES?

Synne Krekling Lien, Kari Sørnes, Harald Taxt Walnum, Åshild Lappegard Hauge, Karen Byskov Lindbeg

- Planning Instruments for Smart Energy Communities (PI-SEC)
- 2016-2019
- SINTEF and NTNU in co-operation with Norwegian municipalities
- Funded by The Research Council of Norway
- Toolbox for planning of smart energy communities
- Local energy demand contribute to global warming
- Increased attention on local action

NTNU
Norwegian University of Science and Technology

The Research Council of Norway

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Plans released to transform London into a zero-carbon city

Ambitious plans have been released this week which seek to transform London into one of the world's greenest cities.

11 May 2018 | Adam Wentworth

World

Freiburg leading Germany's green energy revolution

Europe's economic powerhouse determined to cut CO2 and close all nuclear plan

Margaret Evans · CBC News · Posted: Dec 10, 2015 4:25 PM ET | Last Updated: December 12, 201

Solar panels are a common sight on residential roofs in Freiburg. Homeowners who help provide power to the electricity grid receive a feed-in tariff from utility companies. (Margaret Evans/CBC)

Living the green dream -- a zero emissions city district

April 24, 2013 - 06:26

The researchers behind a climate neutral housing district in Trondheim often hear their plan blasted as utopian. And it is. But that doesn't make it impossible or unrealistic.

Keywords: Climate, green housing, planning, Social geography

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By: Marte Dæhlen

One of the architectural proposals for the future Brøset District – in winter.

(Illustration: SLA)

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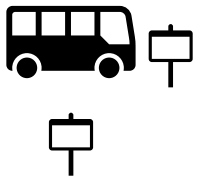
Key Performance Indicators - parameters that measure progress towards an intended goal in a project

"This area should have good access to public transport!"

Walking distance to station

Number of access points within 500 m



Departures per day

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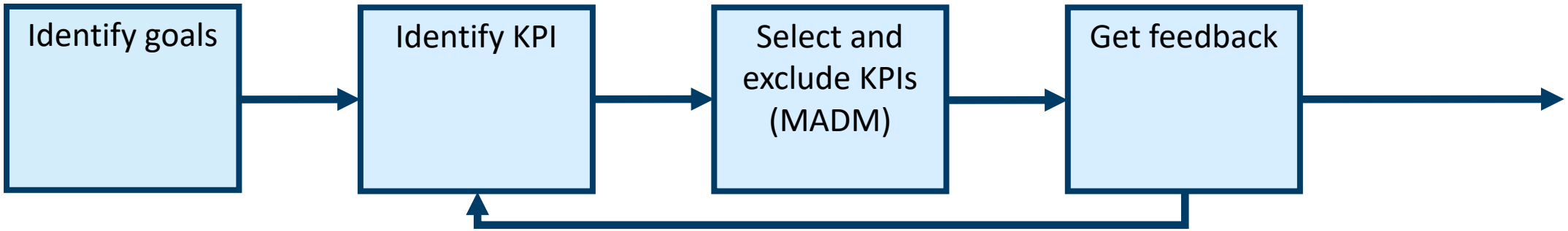
How can we **choose a set of KPI (key performance indicators)** that can be used to measure progress in **different local communities** with high ambitions on energy efficiency and emissions?

Methodology for choosing KPIs



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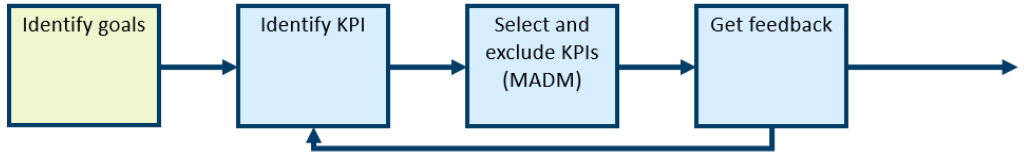
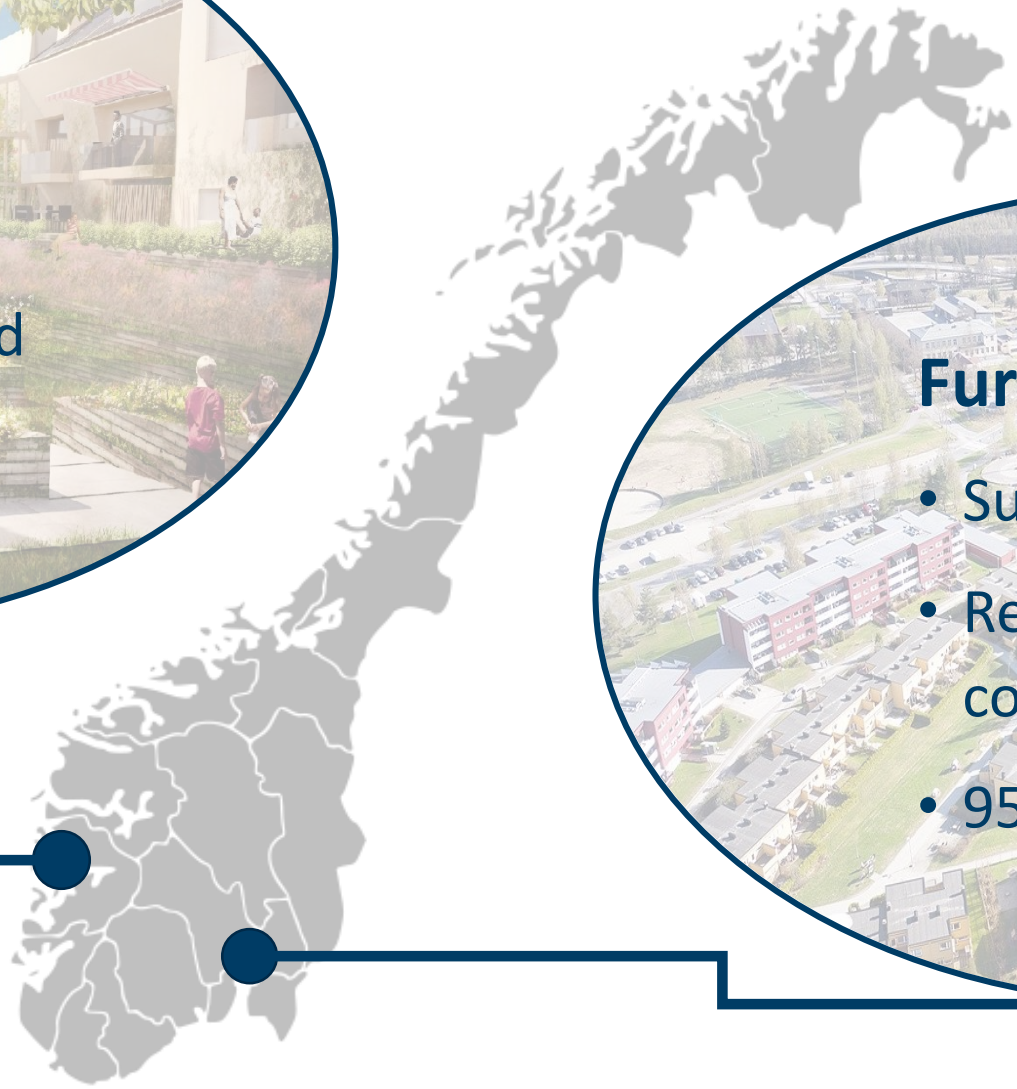
We want to **choose a set of KPI** that can be used to measure progress on **energy efficiency and emissions** in **a general pilot** with high ambitions in **Norway**



Zero Village Bergen

- New development
- 600-800 dwellings and community centre



Furuset in Oslo

- Suburb from 1970's
- Residential, public and commercial buildings
- 9500 inhabitants

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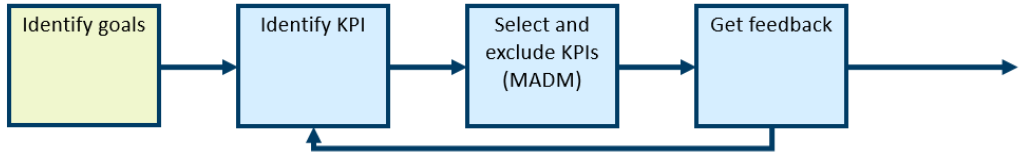
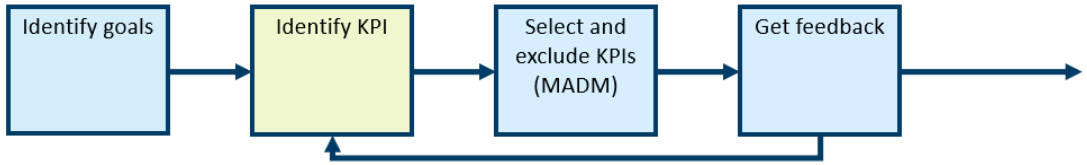


Identifying (local, regional and national) goals

- Cross-scale goal
- Literature study
- Goals sorted by theme

Table 1. Some of the goals and targets identified at different scales that are relevant to the development of the local urban communities Ådland and Furuset in Norway.

Scale	Themes	Source	Main goals	Main KPIs
Country	Energy consumption Carbon emissions	EU Energy performance of buildings directive (European Parliament 2010, 2018)	Improve energy efficiency of buildings New buildings should be nearly Zero-Emission Buildings (nZEB) by 2020	Energy use (kWh) CO2-emissions
	City environment	Pollution Control act (Lovdata 1981)	Protect outdoor environment against pollution and better the waste treatment	Concentration levels of pollutants (PM, SOx, NOx, ...)
City	Carbon emissions Energy consumption	Green strategy for Bergen municipality(Bystyret Bergen 2016) (Bergen kommune 2016)	Fossil free building sector in Bergen by 2030	CO2-emissions Energy use (kWh)
	Green mobility	Urban Environment	Enable more people to use public transport, cycling and walking	Public transport use
Neighbourhood	Carbon emissions Energy generation	Voluntary certificates and standards for pilot project	Sustainable neighbourhoods The greenhouse gas emissions related	Energy use (kWh) Power



Identifying possible key performance indicators (KPIs)

- Some goals are specifically linked to an indicator

  "All fossile oil for heating removed by 2020" KPI: Number of oil burners/boilers

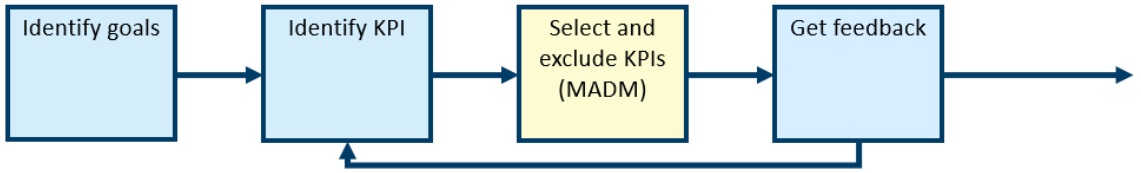
Some goals are not

"Energy efficiency should be increased" – several indicators and units can be used

"The neighbourhood should promote a good and healthy life" – must be quantified

- Systematic literature study
- 220 indicators identified

Selecting most relevant KPIs



- Multiple attribute decision making (MADM, Yoon and Hwang)
- Strategies used when deciding in problems that involve multiple, and usually conflicting criteria (attributes)

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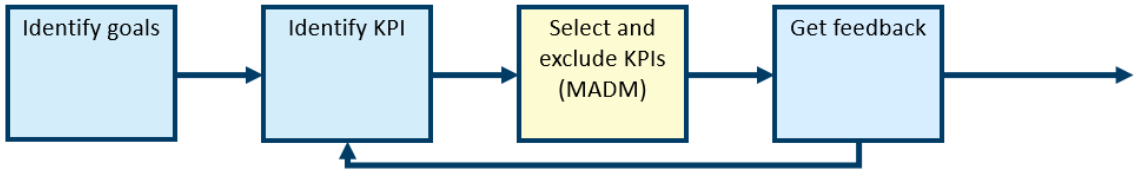
Selecting most relevant KPIs



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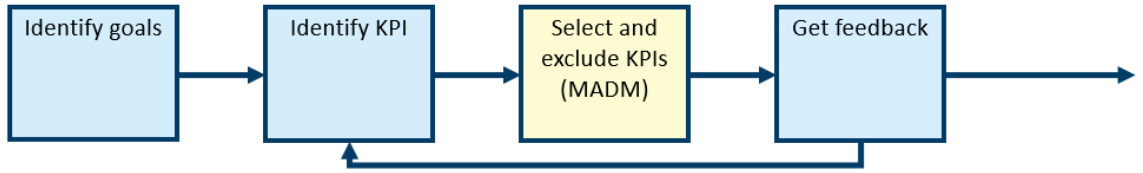

Selecting most relevant KPIs

1	Relevance
2	Availability
3	Measurability
4	Reliability
5	Scalebility
6	Familiarity
7	Phase application

- Step 1: Decide and rank decision criteria (attributes)
- Step 2: Rate all indicators on decision kriteria from 1 (not at all) to 5 (very)

  "Electricity use is very relevant (5), but not always available (3.5), but easy to measure (4)….."
- Step 3: Exclude irrelevant and redundant indicators based on score

This process reduced the number of indicators from 220 to 21!

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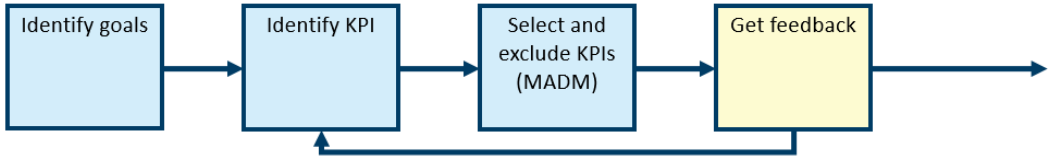

User Feedback – are the chosen KPIs relevant and useful?

- Testing the indicators on the cases
- 12 Group interviews with the users

"[…] We are to a very little degree premise givers for buildings, however, mobility we can out strong guidance on."
(Municipality)

"It is essential to include [emissions from] materials."
(Energy consultants)

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Chosen KPI-set for Norwegian communities transitioning

Indicator (high level)	Indicator unit
Energy use total	kWh, /m2, /inhb., /user
CO2 emissions	Tonnes CO2-eq, /m2, /inhb, /user
% of renewable energy sources (RES) in district heating	% of total mix
% of buildings with Energy Certificate at each of the grades	% of total stock
Installed Capacity of RES	kW, /m2, /inhb, /user
Generated energy by RES	kWh, /m2, /inhb., /user
# Buildings with installed Solar PV	Total number
# Buildings connected to a thermal district infrastructure	Total number
% of travels by bike, walking or public transport	% of each mode of transport
# fossil free construction sites	Total number
Registered oil boilers	Total number

Experience from using the methodology and conclusions

- The method is applicable and was used for a norwegian case, but can be time consuming
- Getting feedback from the users is useful but challenging
- Users give valuable feedback on indicators in their daily work
- "Availability" more imporant than "Relevance" for the users
- Chosen indicator set may not be relevant for future applications
- The methodology and the KPI identified will be used in different projects

https://www.ntnu.edu/smartcities/pi-sec

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