At modellere er at måle fremad

Modelleringsperspektiv

… i optimering af driften …

Morten Grum
Krüger

Hvordan fører
Storm and Waterwater Informatics
til bedre drift?

Modeller i driften

Hvad kan de bidrage med?

Hvorfor netop nu?

Modeller i driften

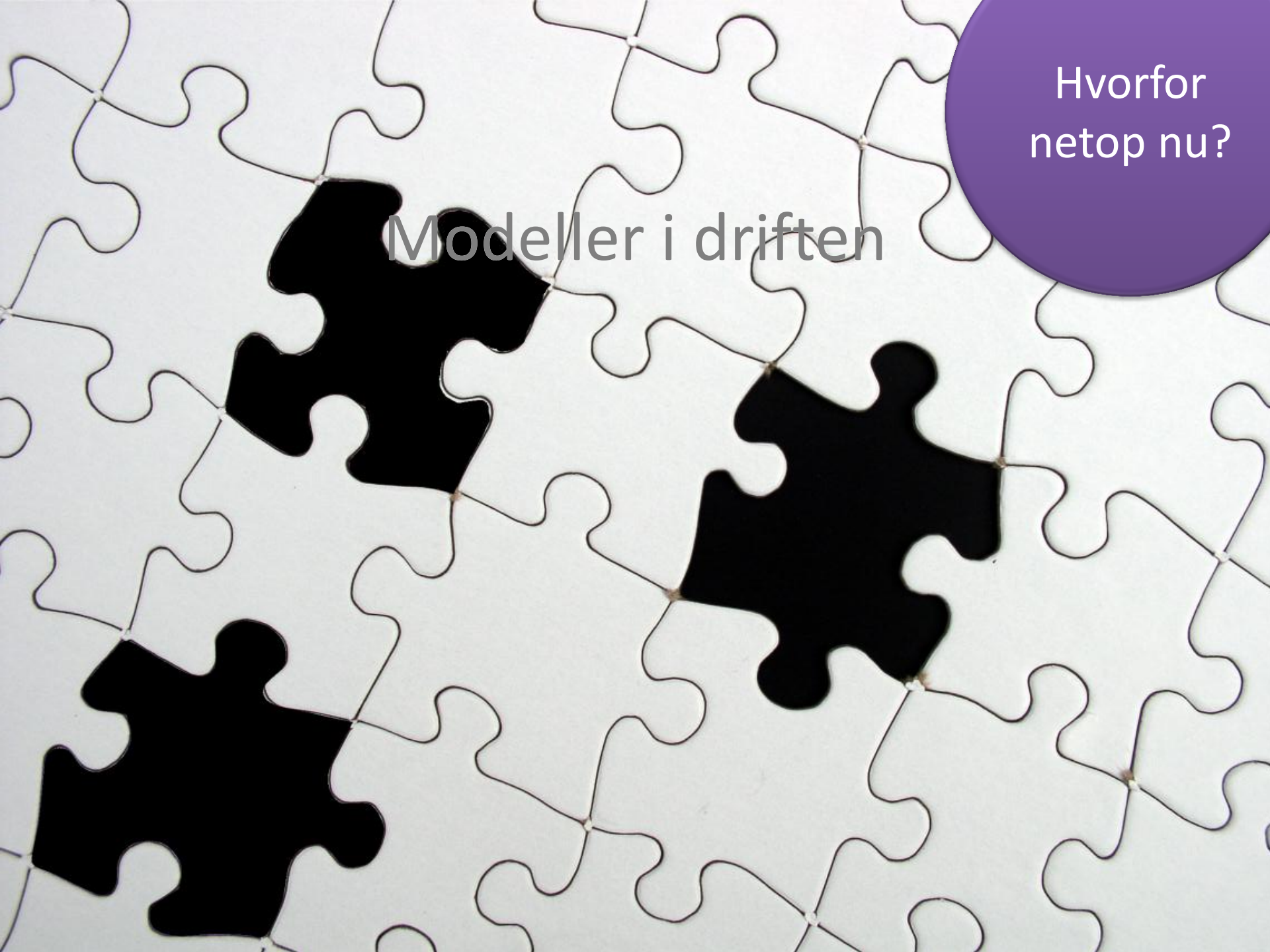
Hvad kan de bidrage med?

Hvad sker der i fremtiden?

Hvad sker der hvis vi handler anderledes?

Beregne parametre vi ikke måler

Validerer og lappe på måledata

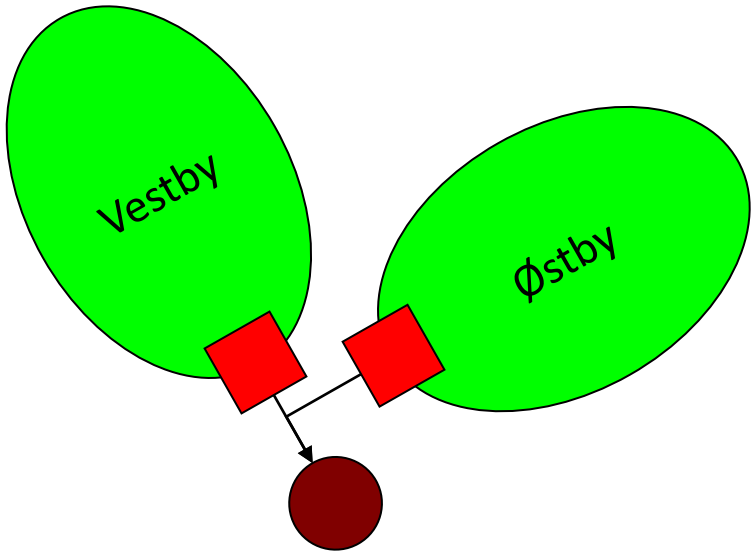

Hvorfor
netop nu?
Modeller i driften

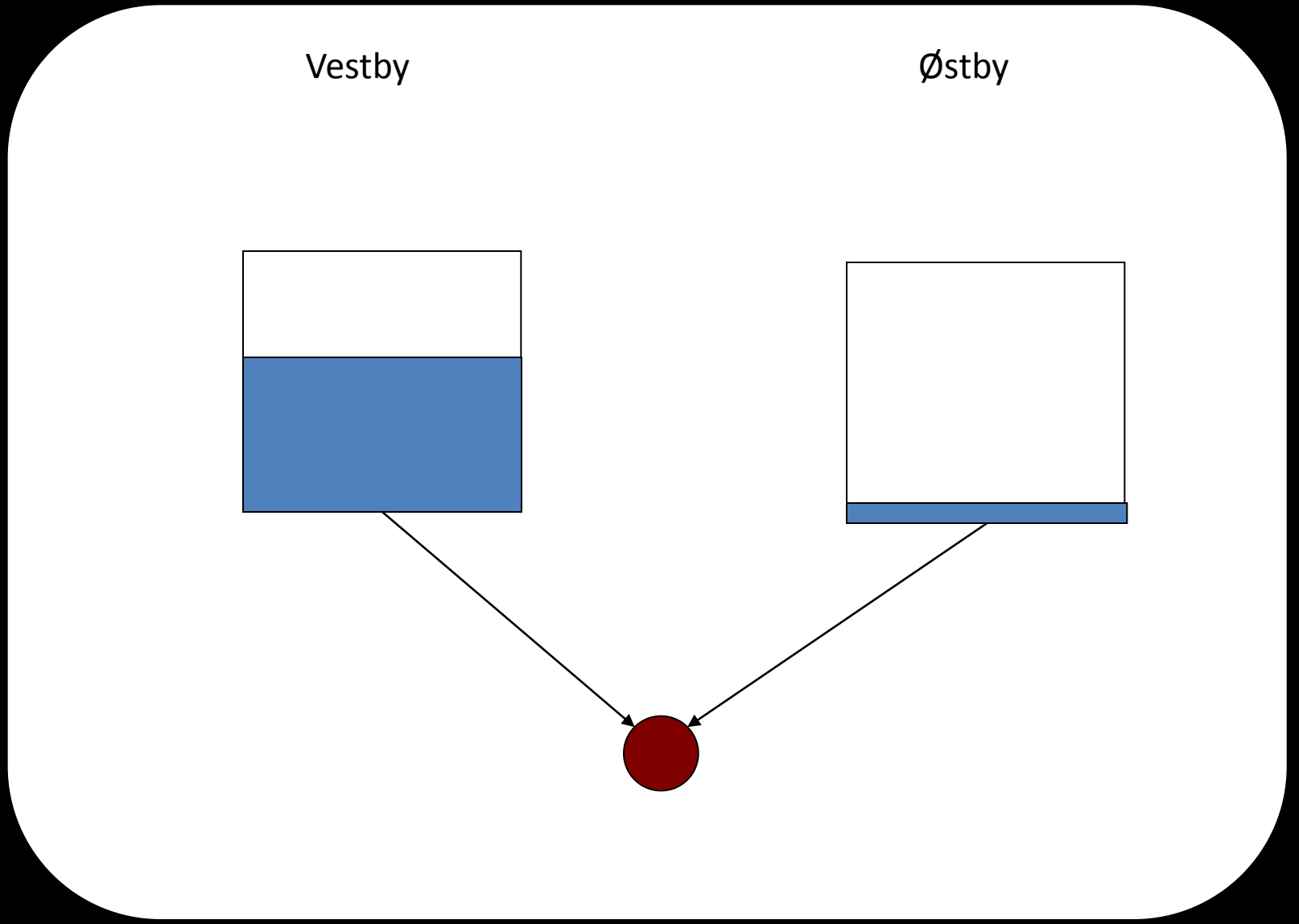
Hvorfor netop nu?

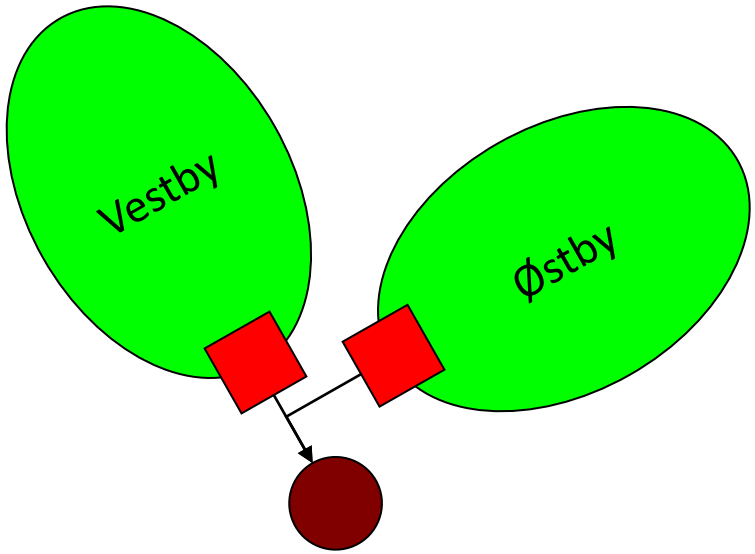
Modeller i driften

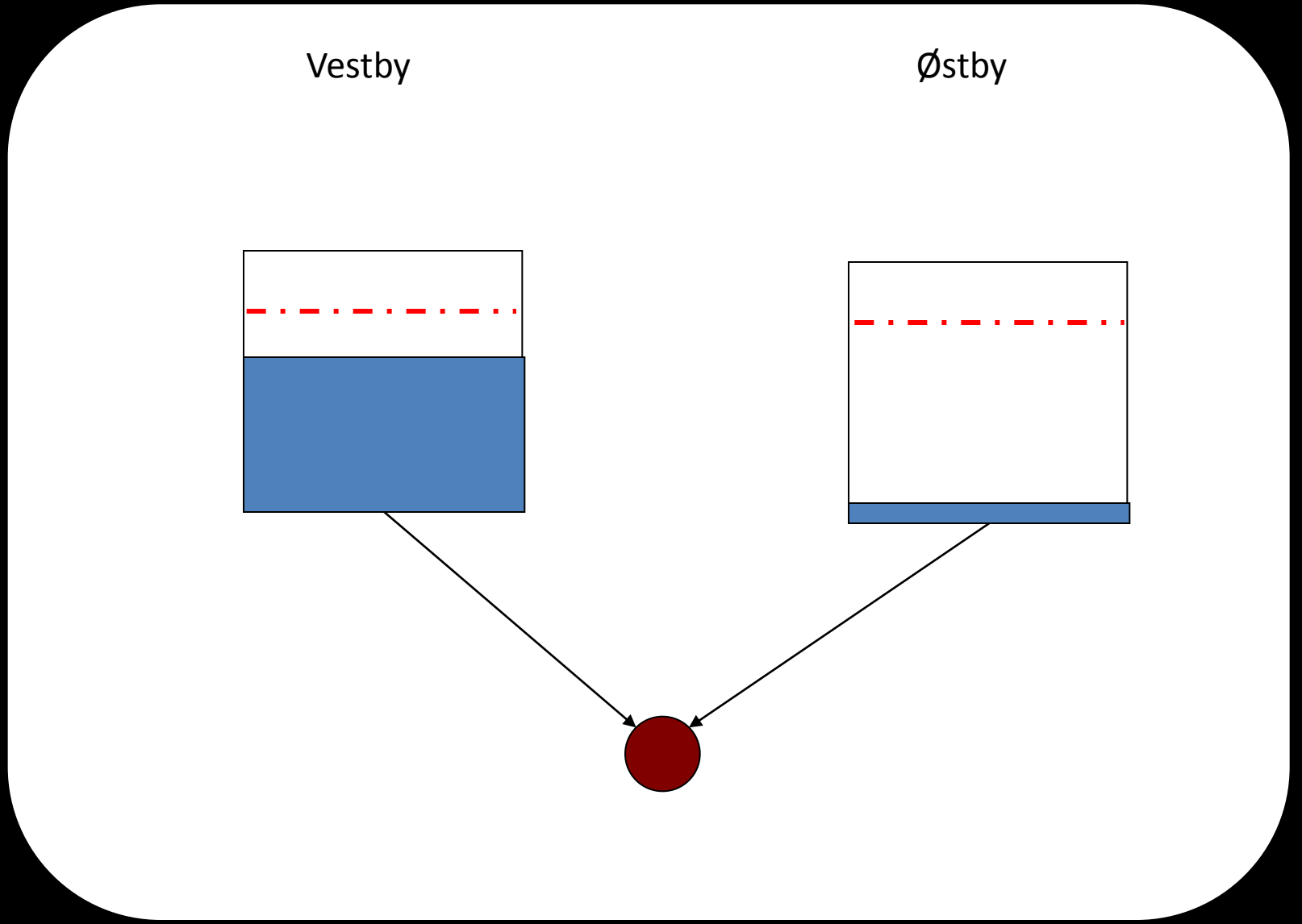
Integreret styring

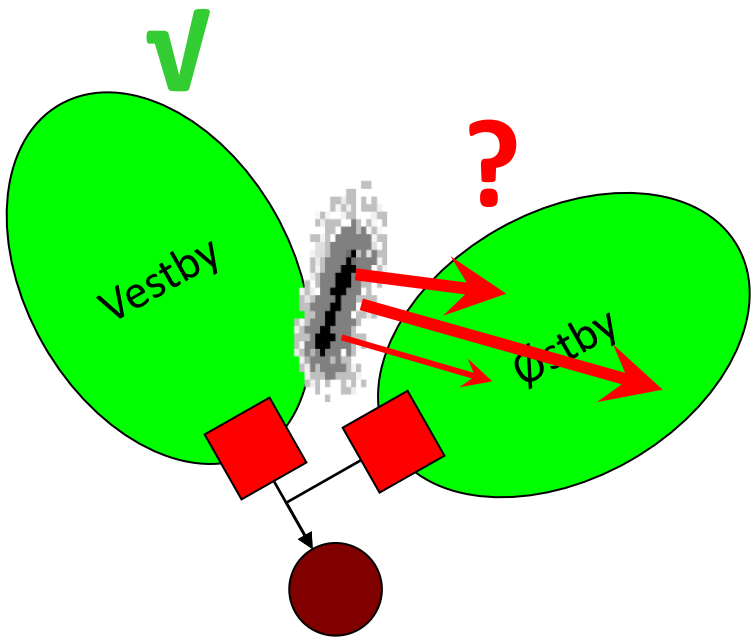
DORA
Dynamic Overflow Risk Assessment

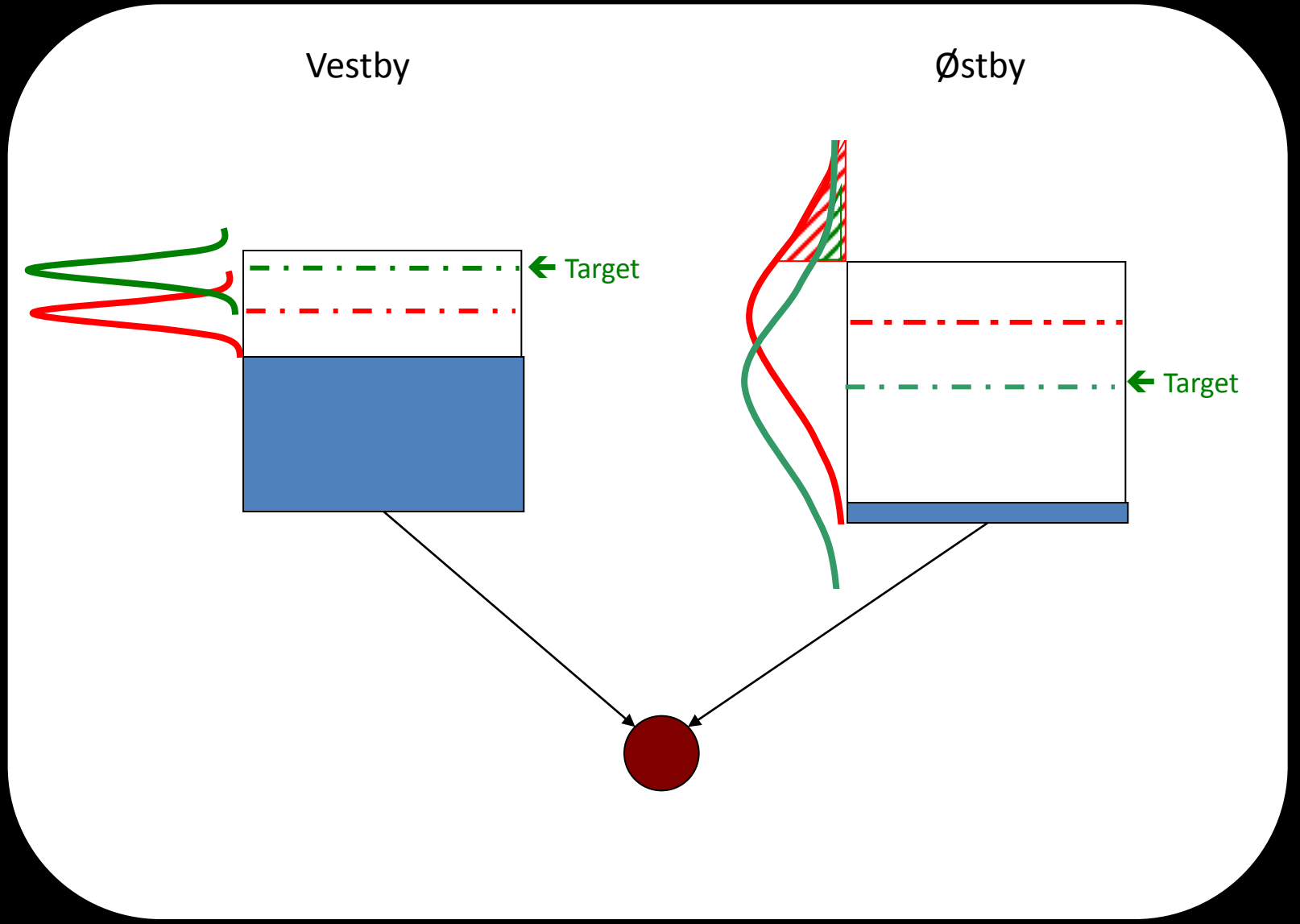

Vestby
Østby

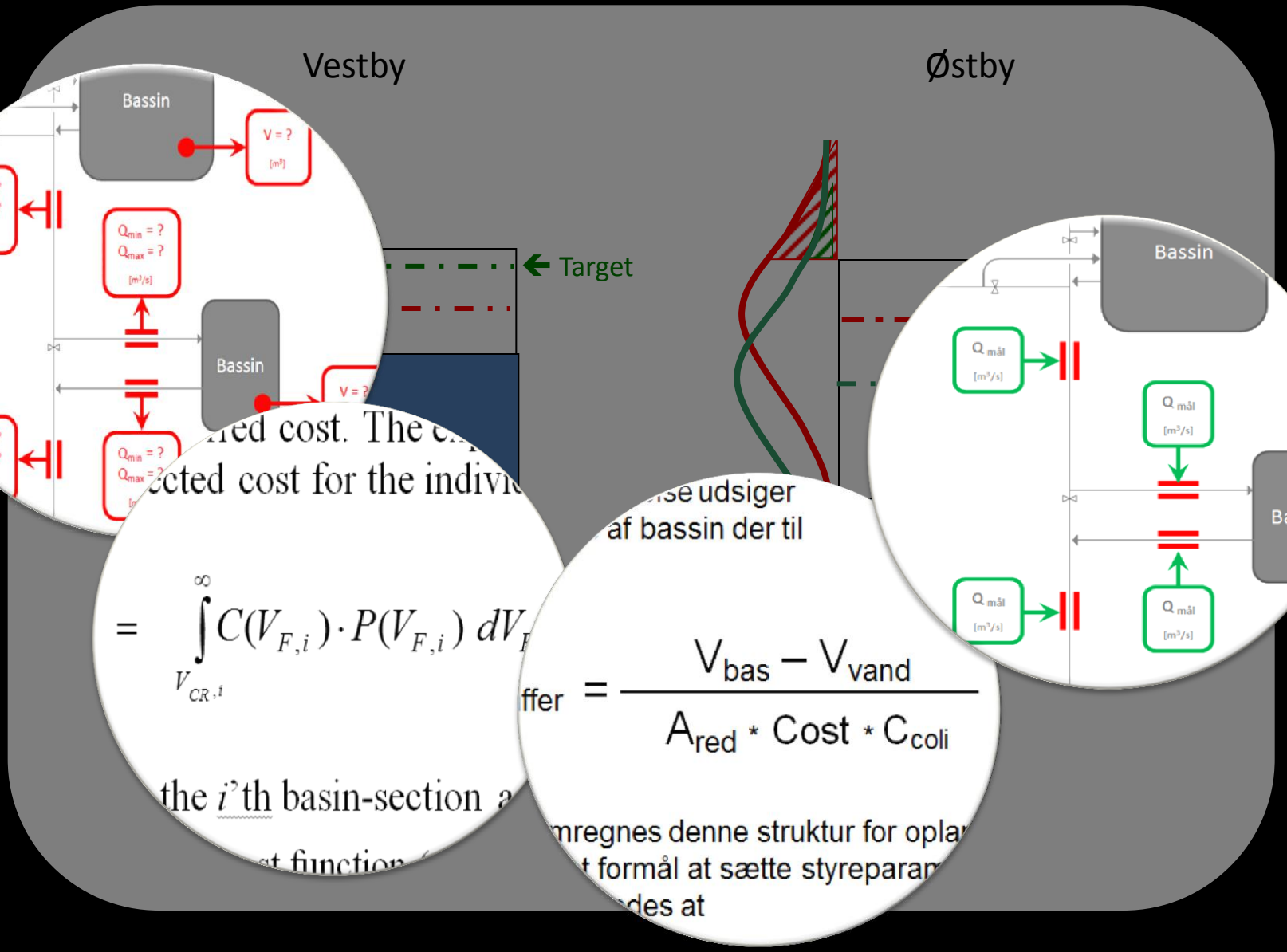

Vestby
Østby


Vestby
Østby


Vestby
Østby


√
?
Vestby
Østby


Vestby
Østby
Target
Target


Vestby
Østby
Bassin
V = ?
[m³]
Qmin = ?
Qmax = ?
[m³/s]
Bassin
Target
Bassin
Qmål
[m³/s]
Bassin
$= \int_{V_{CR,i}}^{\infty} C(V_{F,i}) \cdot P(V_{F,i})\, dV$
$\text{ffer} = \frac{V_{bas} - V_{vand}}{A_{red} * Cost * C_{coli}}$

DORA
Dynamic Overflow Risk Assessment

- Aarhus
- HOFOR/Lynetten
- Spildevandscenter Avedøre

METSAM – udvikling og demonstration

Full-Scale Demonstration

Primary aims:
- protect water environment
- protect bathing waters

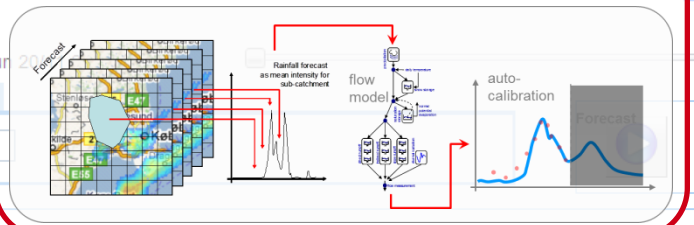
Objectives: to minimize …
- combine sewer overflow
- storage investments

Real Time Control Methodology:
- ***radar based flow forecast*** – with auto-calibrating real time models
- ***dynamic risk assessment algorithm*** to optimize storage and treatment
  - considering forecasted flow, recipient sensitivity, current storage, treatment capacity, …
- real time hydrodynamic modeling for performance evaluation

Collection Systems:
- combined sewer
- two treatment plants
- 43000 acres
- 1.1 mil. Person Equivalents

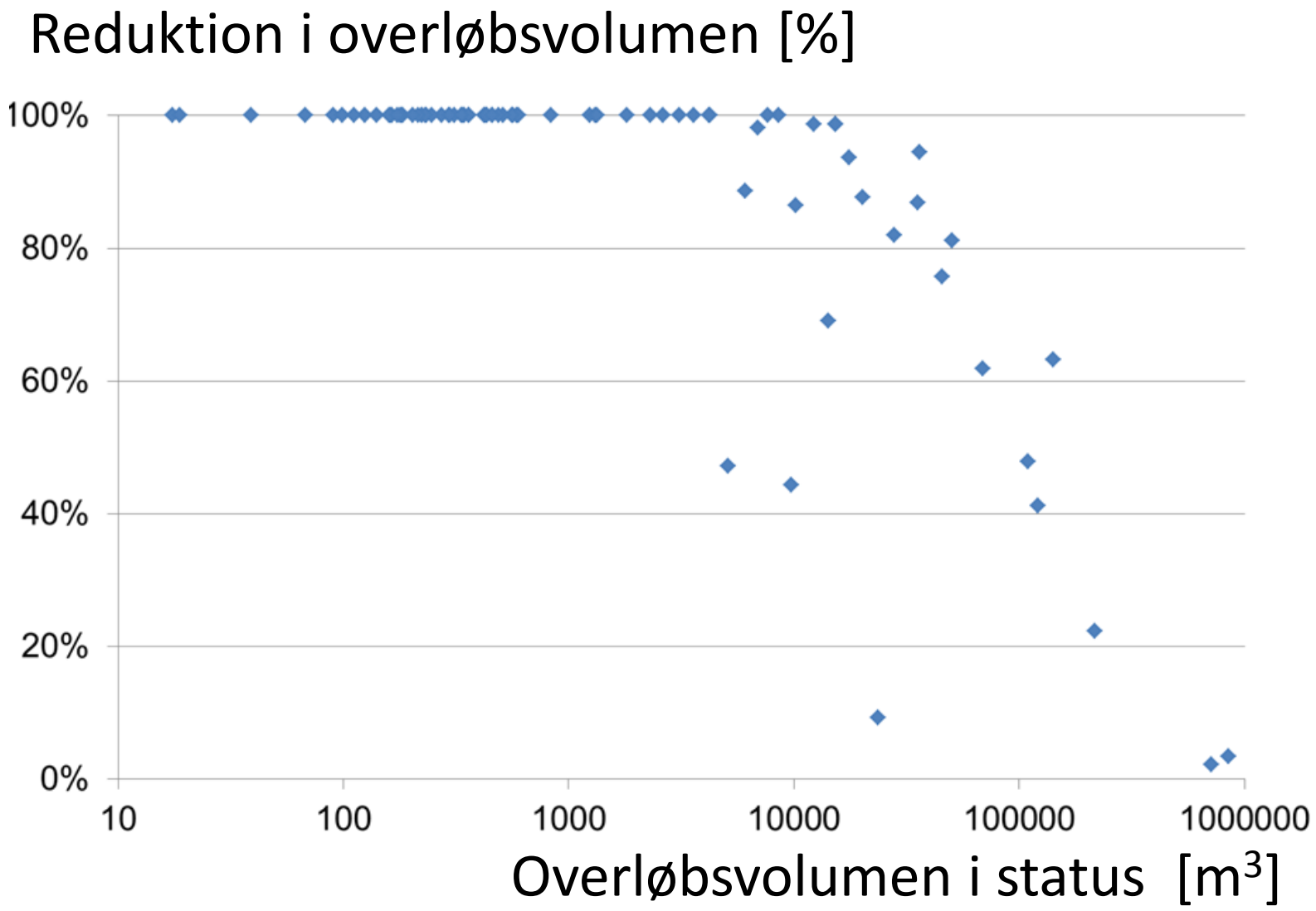
- Advanced data quality control
- Web based user interface
- 24x7 server based solution
- SCADA connectivity

Radar based flow forecasts:



Intelligence Inside

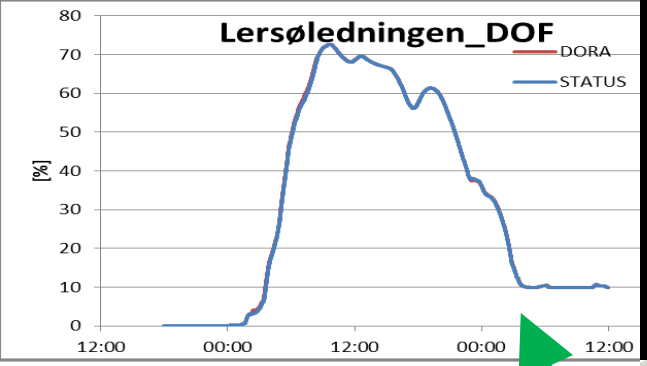
HOFOR/Lynette opland

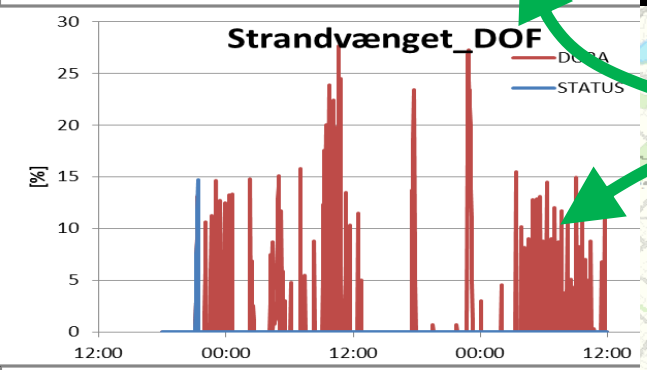


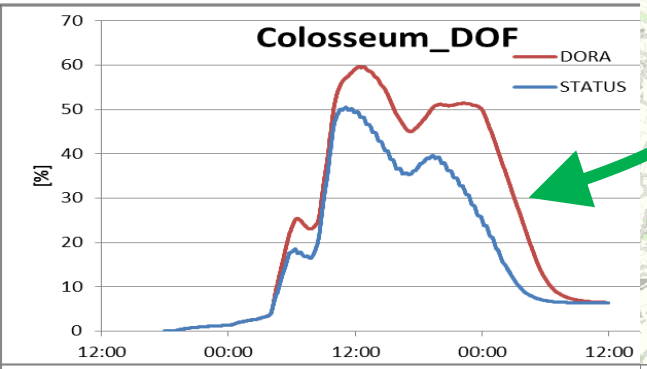
(foreløbige beregninger fra METSAM)

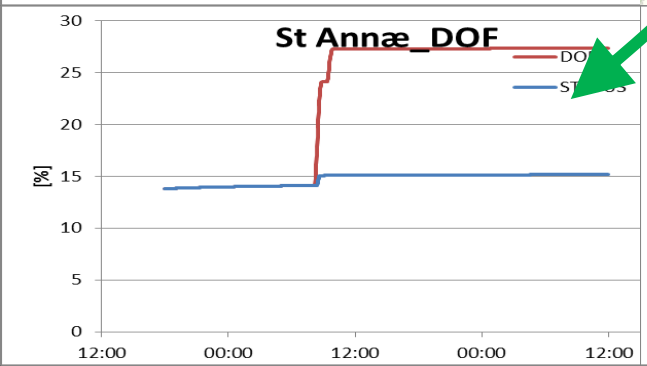
Fyldningsgrad

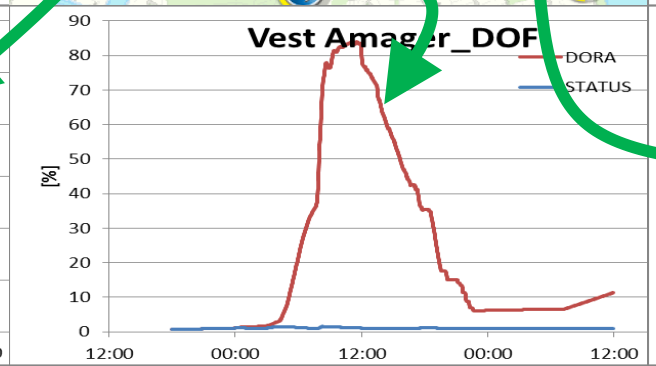
Status
Med DORA

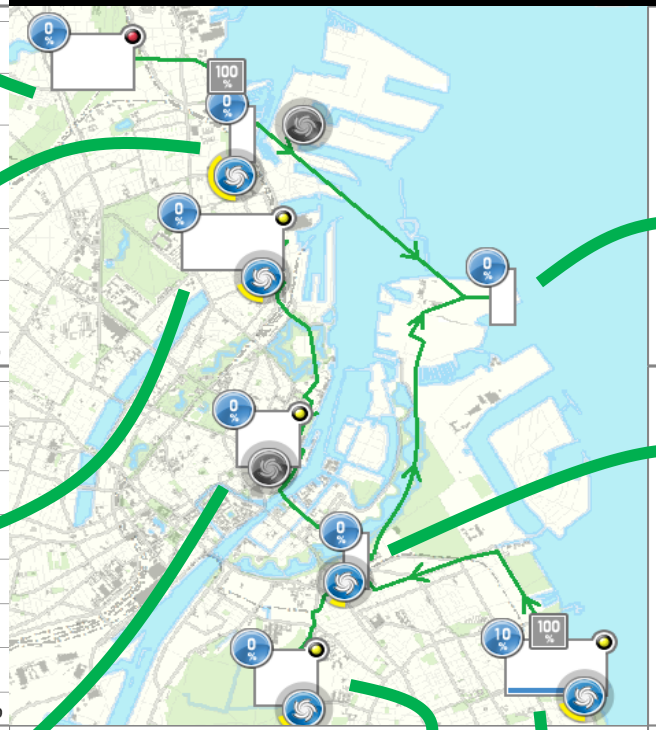


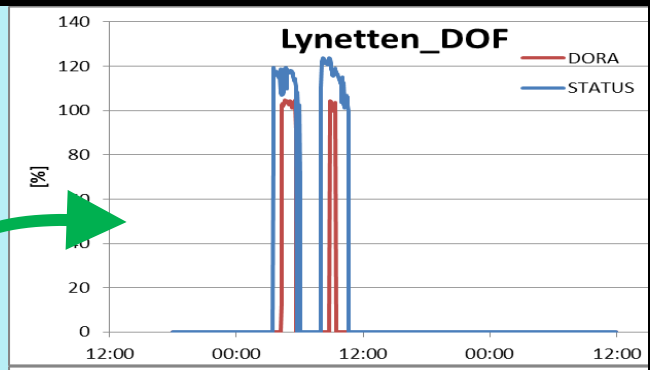


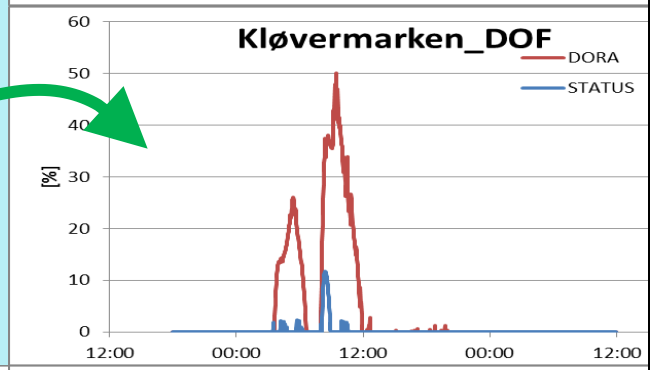


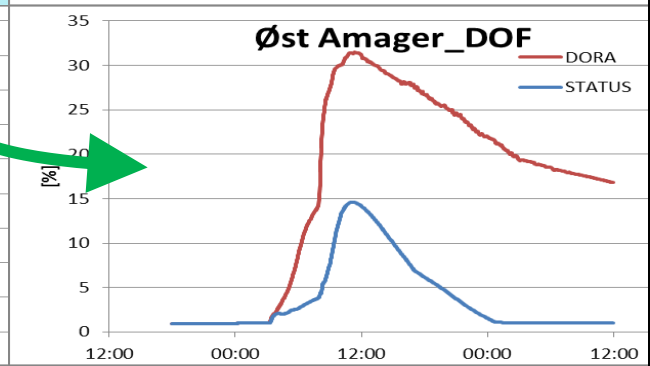


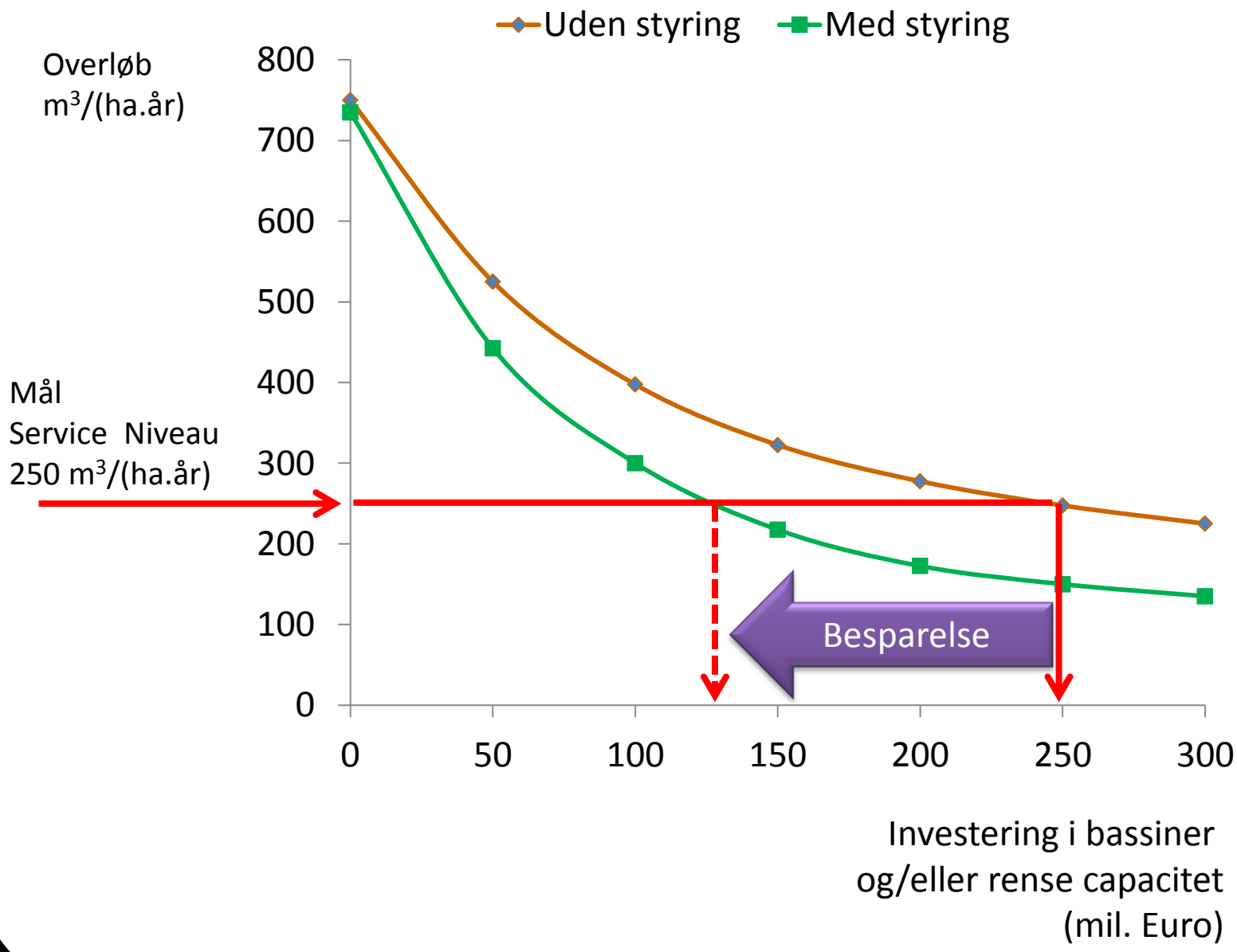




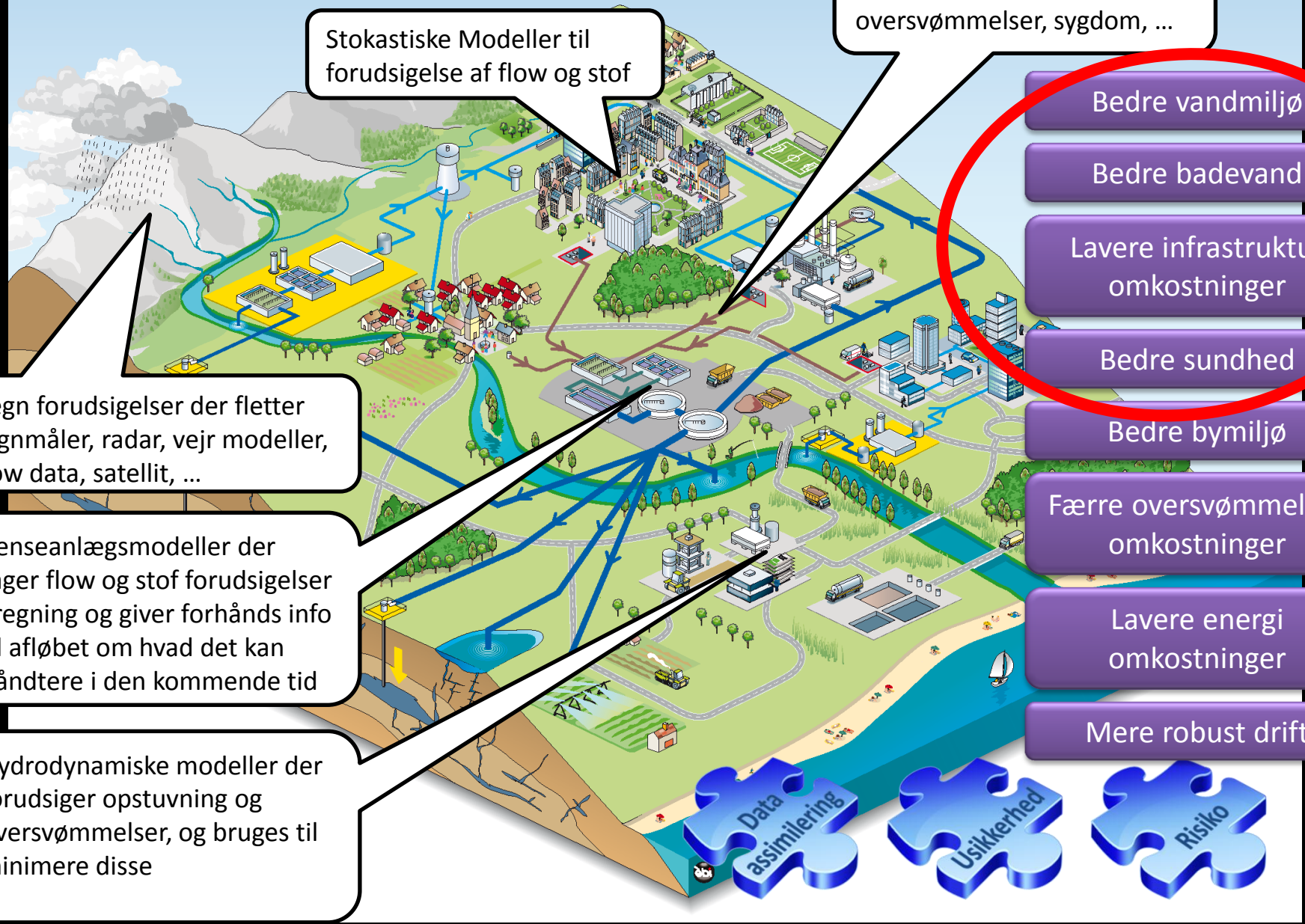







Uden styring
Med styring
Overløb
m3/(ha.år)
800
700
600
500
400
300
200
100
0
Mål
Service Niveau
250 m3/(ha.år)
Besparelse
0
50
100
150
200
250
300
Investering i bassiner
og/eller rense capacitet
(mil. Euro)

Modelleringsperspektiver



Integreret styring baseret på risiko for overløb, oversvømmelser, sygdom, …

Stokastiske Modeller til forudsigelse af flow og stof

Regn forudsigelser der fletter regnmåler, radar, vejr modeller, flow data, satellit, …

Renseanlægsmodeller der tager flow og stof forudsigelser i regning og giver forhånds info til afløbet om hvad det kan håndtere i den kommende tid

Hydrodynamiske modeller der forudsiger opstuvning og oversvømmelser, og bruges til minimere disse

- Bedre vandmiljø
- Bedre badevand
- Lavere infrastruktur omkostninger
- Bedre sundhed
- Bedre bymiljø
- Færre oversvømmelses omkostninger
- Lavere energi omkostninger
- Mere robust drift

Data assimilering

Usikkerhed

Risiko

Fremtiden er gået i gang

SWI
Intelligence Inside

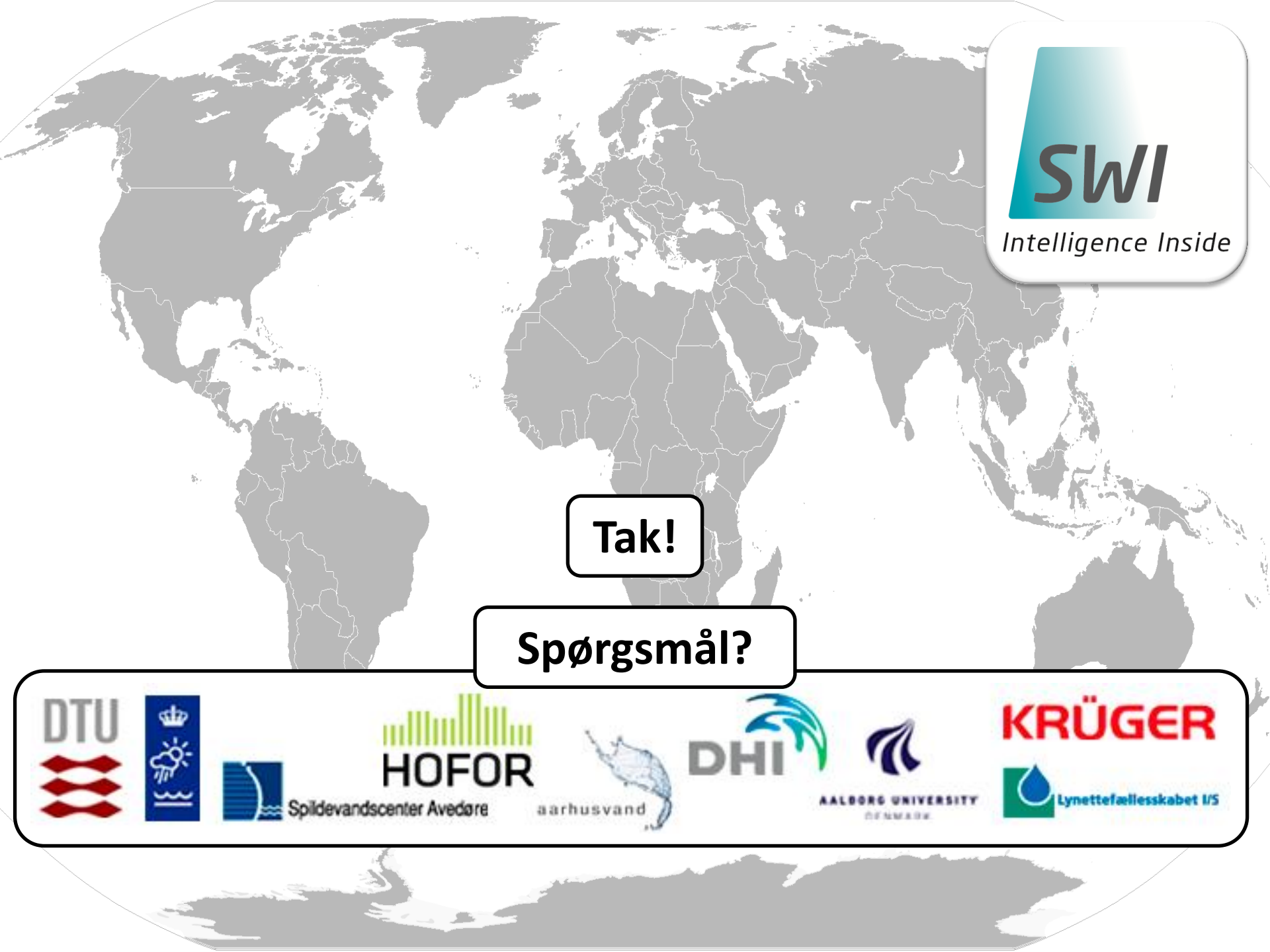
Renseanlæg Aalborg Øst og Vest
Radar baserede flow forecast til regnstyring

Renseanlæg Lynetten
Radar baserede flow forecast til regnstyring

Aarhus: afløb + renseanlæg
Samstyring Dynamic Overflow Risk Assessment (DORA)

HOFOR + Renseanlæg Lynetten
Integreret styring (Dynamic Overflow Risk Assessment)

Spildevandscentre Avedøre
Integreret styring (Dynamic Overflow Risk Assessment)


SWI
Intelligence Inside
Tak!
Spørgsmål?
DTU
HOFOR
Spildevandscenter Avedøre
aarhusvand
DHI
AALBORG UNIVERSITY
DENMARK
KRÜGER
Lynettefællesskabet I/S