Rollen til norsk vannkraft i 2050 – scenarioer for Norge som leverandør av balansekraft

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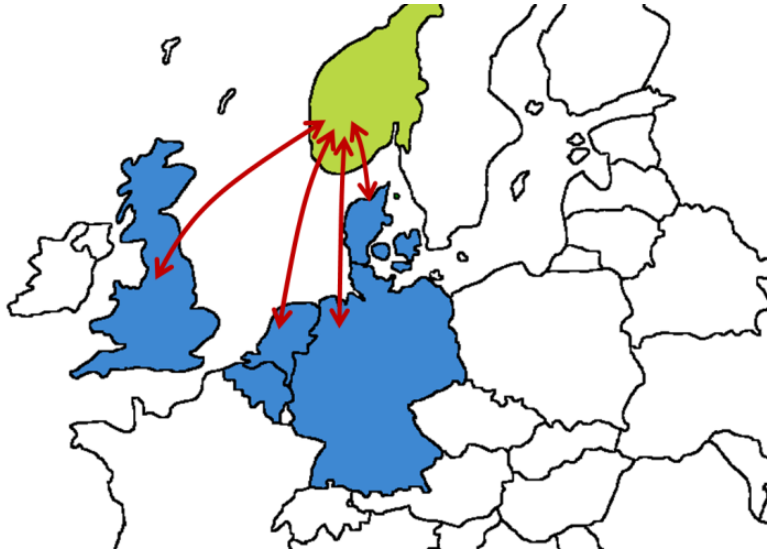
HydroBalance – Miljømessige, tekniske, økonomiske og samfunns-messige utfordringer

Okt 2013 - Okt 2017

Budsjett 25 Mio NOK



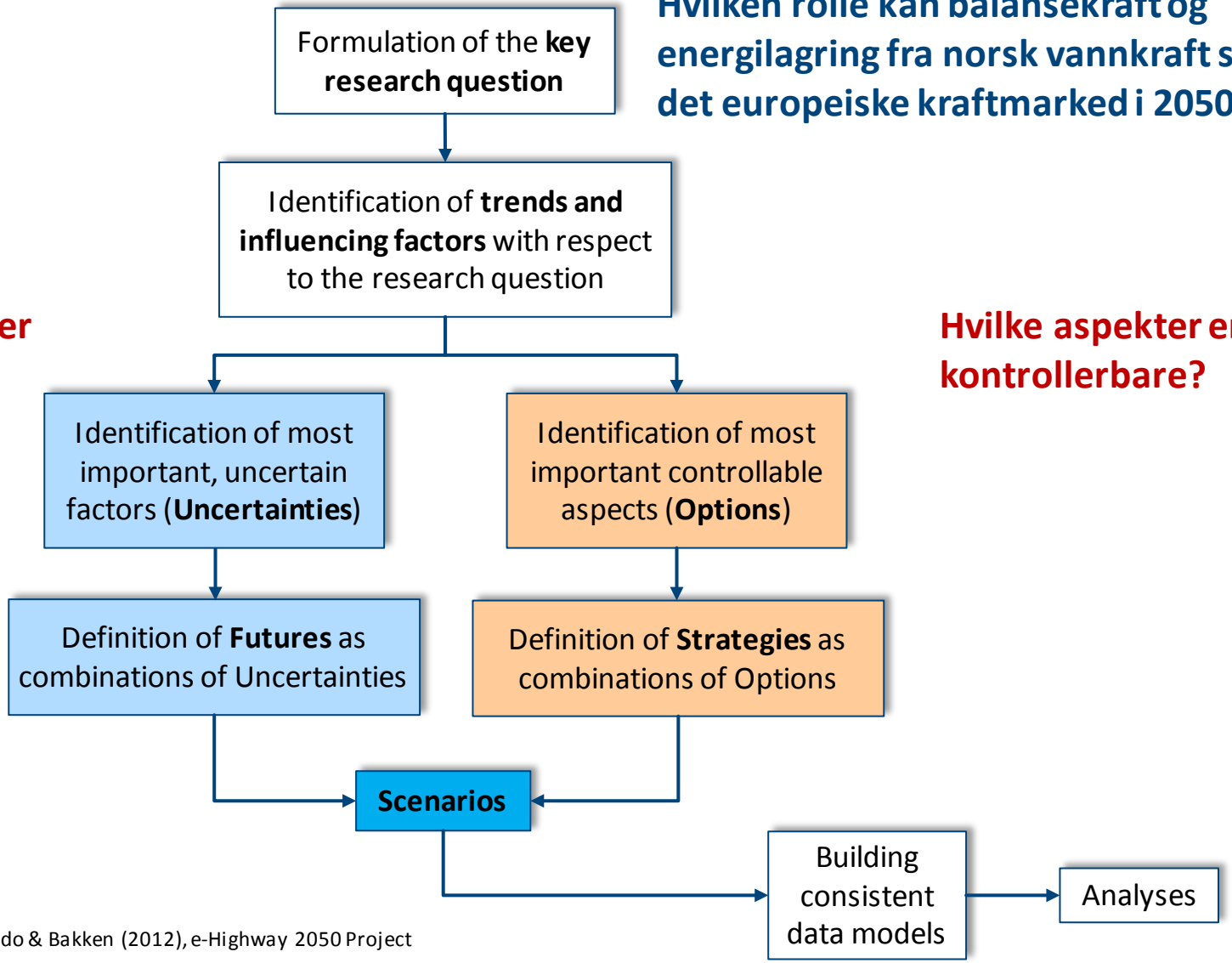
- Scenarioer for ulike fremtider til det norske vannkraft-systemet i 2050
- Analyser, simuleringer og case-studier av
  - energisystemet
  - energimarkedet
  - miljøkonsekvenser
  - regulatoriske rammeverket og samfunnsaksept
- Lage et veikart

Scenariobygging: tilnærmingen

Hvilken rolle kan balansekraft og energilagring fra norsk vannkraft spille på det europeiske kraftmarked i 2050?

Hvilke faktorer er viktige?

Hvilke aspekter er kontrollerbare?



Source: Huertas-Hernando & Bakken (2012), e-Highway 2050 Project

Scenarioer

	Strategies	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Futures		Active climate policy	Moderate expansion	Value creation	Nordic only
Future 1	Medium	**1**	**2 = A**	**3**	4
Future 2	Niche market	**5**	6	**7 = C**	8
Future 3	Various flexibility	**9 = B**	**10**	**11**	12
Future 4	Critical supply	13	14	15	**16 = D**

Fremhevete tall: Relevante scenarioer

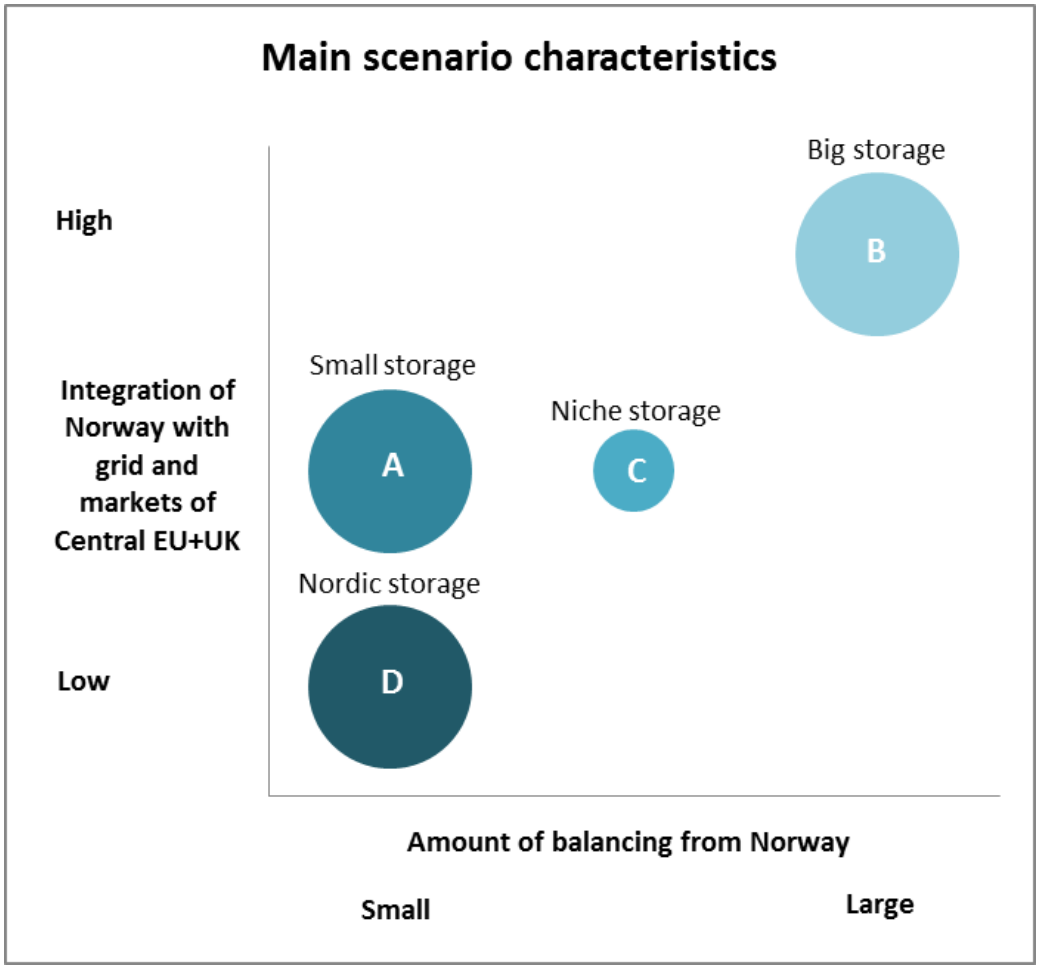
Grå bakgrunn: Scenarioer med lignende resultat

Ramme: Fire utvalgte scenarioene

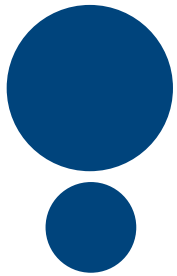
Utvalgte scenarioene:

- A – Liten lager
- B – Stor lager
- C – Nisjelager
- D – Nordisk lager

Hovedtrekk langs tre dimensjoner



Bubble size: **Balancing on**



- all time scales

- long time horizons only

Scenario A – Liten lager

Uncertainties in Future 1	**Medium**
Technology	
Variable RES share of electricity generation	Medium
Expansion of European transmission grid	Moderate
Deployment of CCS	Yes
Market	
Competition from alternative flexible technologies	Low
EU regulatory framework and market integration	Fully integrated
Policy	
Ambitions of countries to connect to Norway	Moderate
Options in Strategy 2	**Moderate expansion**
Expansion of Norwegian transmission grid	Moderate
New PSPP and upgrade of existing HSPP	Moderate
Support of variable RES in Norway	Moderate
Ambitions of Norway to build interconnectors	Moderate

Scenario B – Stor lager

Uncertainties in Future 3	**Various flexibility**
Technology	
Variable RES share of electricity generation	High
Expansion of European transmission grid	Strong
Deployment of CCS	No
Market	
Competition from alternative flexible technologies	Low
EU regulatory framework and market integration	Fully integrated
Policy	
Ambitions of countries to connect to Norway	Strong
Options in Strategy 1	**Active climate policy**
Expansion of Norwegian transmission grid	Strong
New PSPP and upgrade of existing HSPP	Strong
Support of variable RES in Norway	Strong
Ambitions of Norway to build interconnectors	Strong

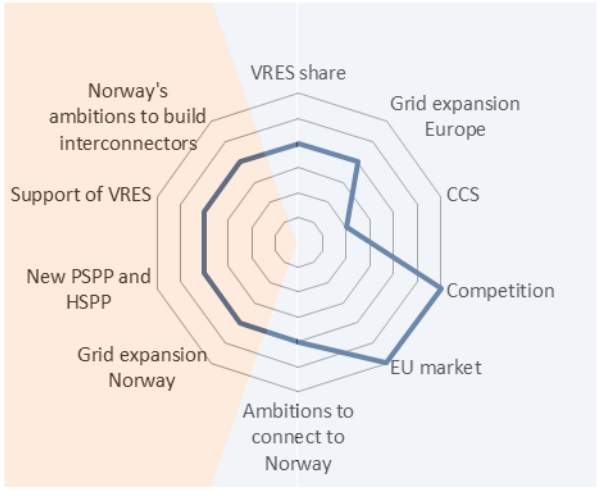
Scenario C – Nisjelager

Uncertainties in Future 2	**Niche market**
Technology	
Variable RES share of electricity generation	High
Expansion of European transmission grid	Moderate
Deployment of CCS	No
Market	
Competition from alternative flexible technologies	High
EU regulatory framework and market integration	Day-ahead only
Policy	
Ambitions of countries to connect to Norway	Moderate
Options in Strategy 3	**Value creation**
Expansion of Norwegian transmission grid	Strong
New PSPP and upgrade of existing HSPP	Strong
Support of variable RES in Norway	Low
Ambitions of Norway to build interconnectors	Strong

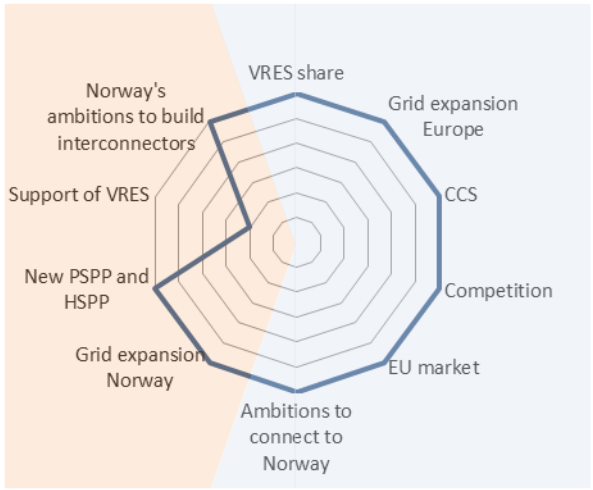
Scenario D – Nordic storage

Uncertainties in Future 4	**Critical supply**
Technology	
Variable RES share of electricity generation	High
Expansion of European transmission grid	Limited
Deployment of CCS	No
Market	
Competition from alternative flexible technologies	Low
EU regulatory framework and market integration	Day-ahead only
Policy	
Ambitions of countries to connect to Norway	Strong
Options in Strategy 4	**Nordic only**
Expansion of Norwegian transmission grid	Strong
New PSPP and upgrade of existing HSPP	Limited
Support of variable RES in Norway	Strong
Ambitions of Norway to build interconnectors	Low

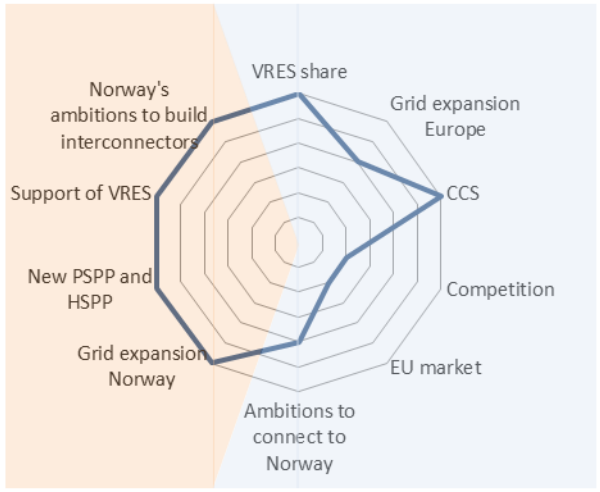
Scenario A - Small storage



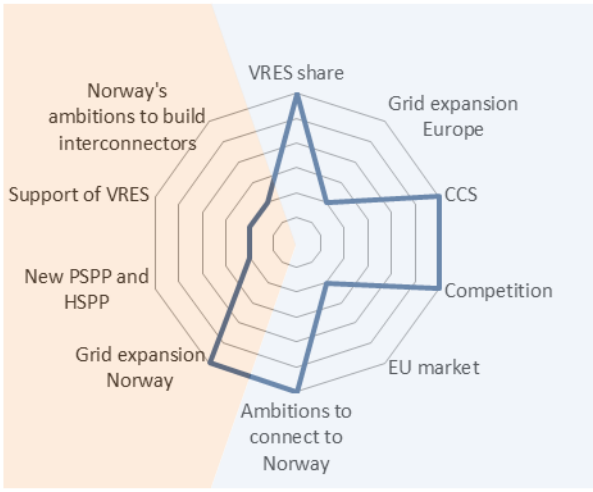
Scenario B - Big storage



Scenario C - Niche storage

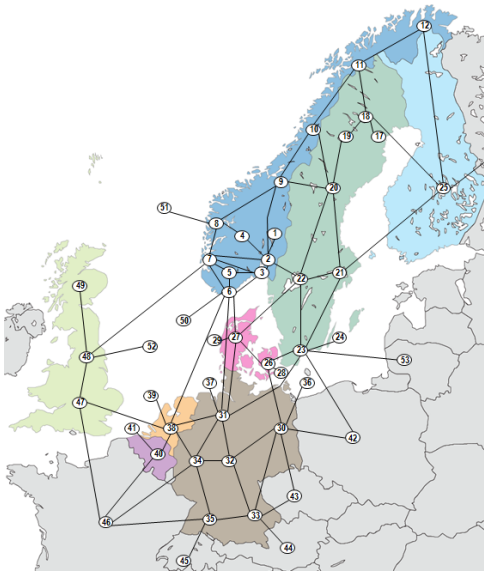


Scenario D - Nordic storage

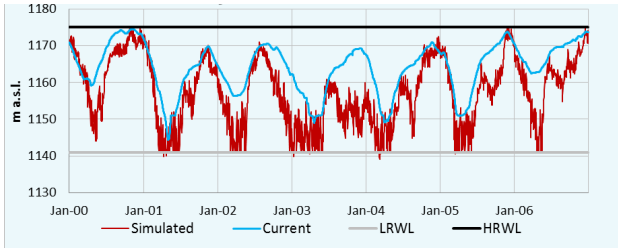


Bruk av scenarioene

- Energisystemmodellering – systemperspektiv
  - El-markedmodell
  - Balansekraftbehov
  - Alternative teknologier

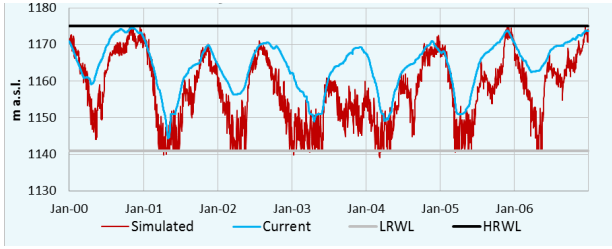


- Forretningsmodeller – perspektiv fra en kraftprodusent
  - El-markedmodell
  - Simuleringer for spesifike case



Bruk av scenarioene

- Endrete driftsmønstre: effekter av hurtigere og hyppigere vannstandsendringer på fiskepopulasjoner
  - Sammenheng mellom miljøeffekter og magasintype, klima, vassdrags-karakteristikk
  - Virkninger av regulering på fisk så langt
  - Virkninger av fremtidig regulering



- Regulatorisk rammeverk og samfunnsaksept
  - Regelverk i ulike land (NO, GB, DE)
  - Syn blant stakeholdere
  - Stakeholder intervjus: kommunisere ulike fremtidsbilder





Takk for oppmerksomheten!

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