

The Future of the Oil & Gas Industry

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⇒ Global perspective

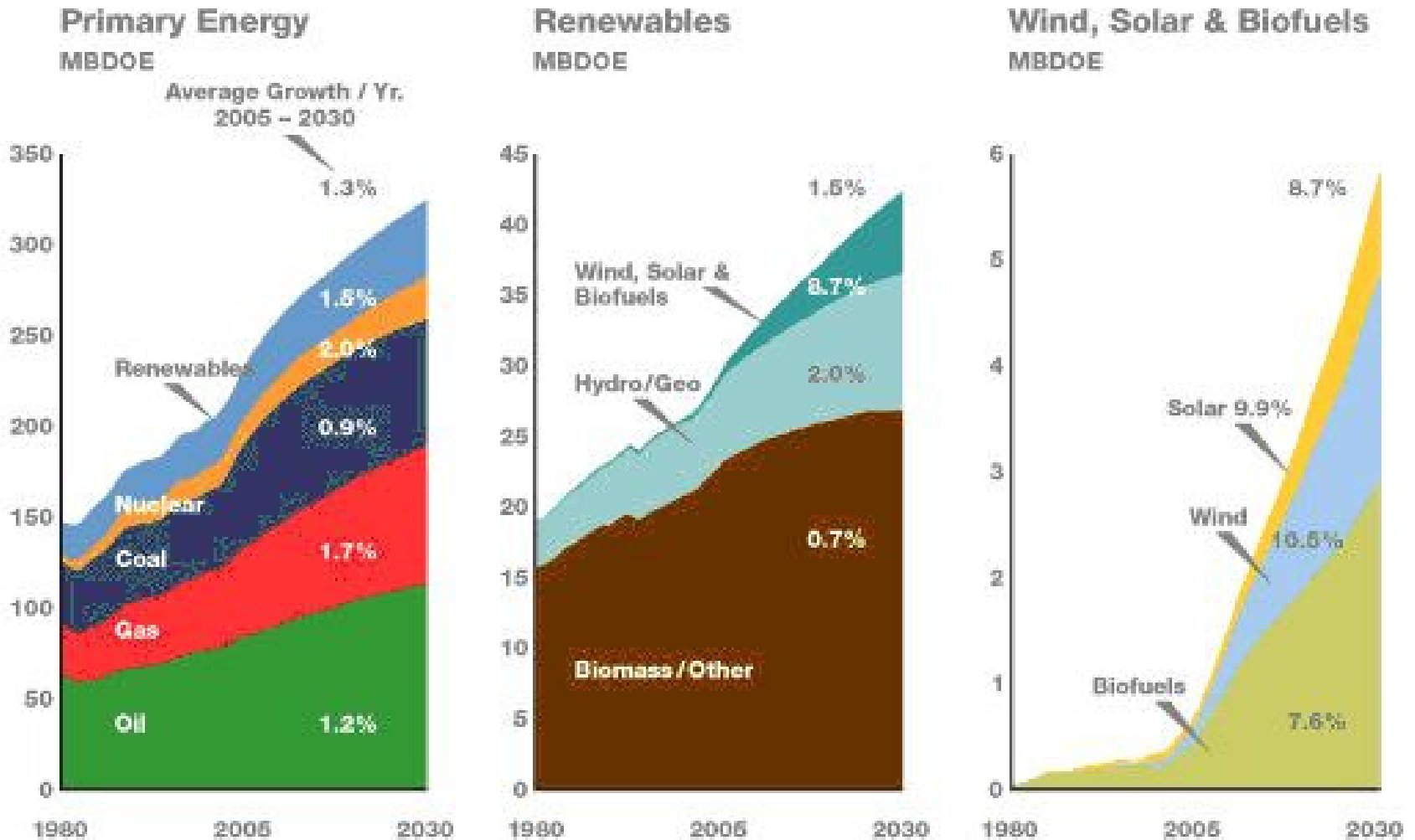
- ⇒ Fundamentals and uncertainties
- ⇒ Short run: Dealing with recession
- ⇒ Medium run: Global reconciliation?
- ⇒ Long run: Fossils or renewables?

⇒ NCS perspective

- ⇒ 2009: Political change
- ⇒ The ongoing battle between paradigms
- ⇒ CSR: Parroting or participation?
- ⇒ Protecting the knowledge base
- ⇒ Access to acreage
- ⇒ Diversity and competition
- ⇒ Understanding innovation

Growing energy demand; few alternatives

World Energy Demand – Primary Energy Supplies



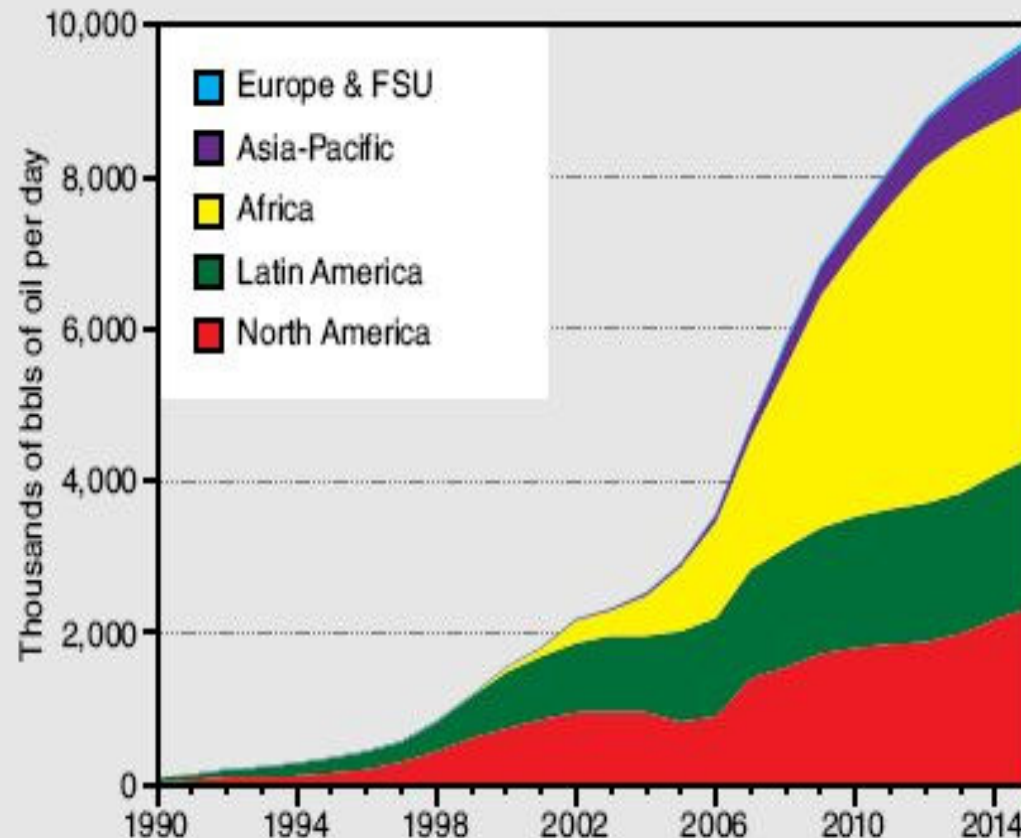
No end to energy resources

- ⇒ Plenty of oil & gas for overseeable future:
 - ⇒ Superdeep water
 - ⇒ Resources below unconventional geological layers, like sub-basalt (Norwegian Sea, UK, Jan Mayen), subsalt (Brazil), old/deep formations (GoM)
 - ⇒ Middle East highly under-explored (Iraq, Saudi)
 - ⇒ Polar basins (Antarctica?)
 - ⇒ Unconventional oil: Oil sands (Canada), shale oil (US)
 - ⇒ Unconventional gas in hydrates, coal (also the NCS), shale gas (US)
 - ⇒ Dark horse or pure fiction? Russian theories about abiotic oil/gas.
- ⇒ Plenty of coal “everywhere”
- ⇒ No technological limits to substitution
 - ⇒ Gas to liquids
 - ⇒ Coal gasification
- ⇒ Nuclear
- ⇒ Solar, wind, waves, bio, geothermal
- ⇒ Eventually: Solar from space
- ⇒ A matter of technology, supply, demand, and the price mechanism

Today's unconventional is tomorrow's conventional

“Deep water” > 1000 ft. Global production history starts 1990.

Offshore production: Deep water oil from 1990



Energyfiles Ltd

NCS:

Ekofisk: 70-75 m

Statfjord: Ca. 150 m

Gullfaks (up to 200 m) considered Norway's first deep water project. First oil in 1986.

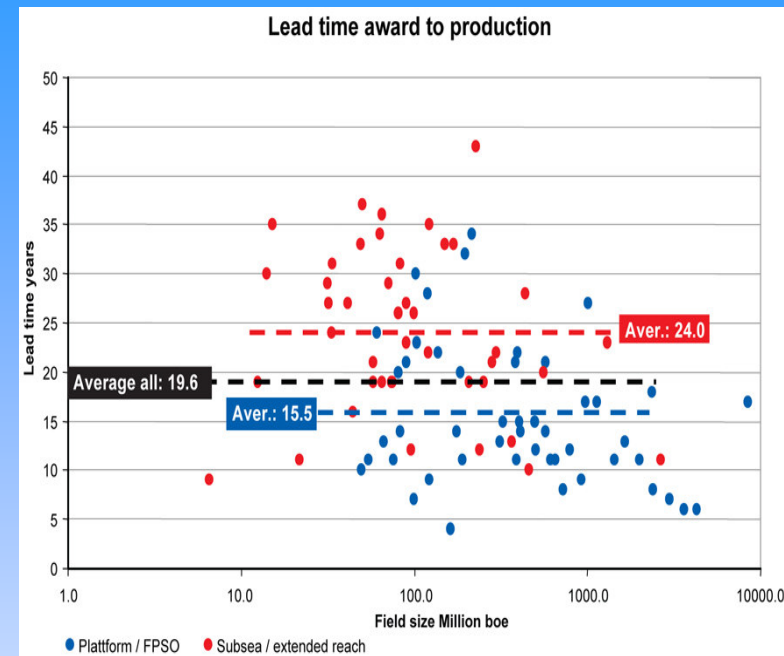
Snorre (300-350 m) first true deep water field, first oil 1992.

Troll, Heidrun (300-350 m) first production 1995.

Ormen Lange (800-1000 m) production start in 2007.

Market properties

- Exceptionally long lead times
 - Both supply and demand side
 - Low short-term, high long-term price elasticity
 - Little change before heavy investment
- High knowledge content = capacity constraints
- Partial markets not very transparent
 - Over/under-investment likely
- Interaction with finance markets
- New instruments for futures trading
- Poor understanding of history
- Poor understanding of technology
- Analysts single-minded on conventional oil
- **All combine to cyclical and unpredictable market**



Politics

- ⇒ Western nations scared about security of supply
 - ⇒ Increasing tension in times of perceived shortage
 - ⇒ Cannon boat diplomacy, even wars
 - ⇒ Third world producers respond with increasing resource nationalism
 - ⇒ Protectionism
 - ⇒ Reinforces cycles
 - ⇒ But little evidence that fears are real
- ⇒ Politicians tend to interfere with selective policies
 - ⇒ Environment
 - ⇒ “Favourite son” industries
 - ⇒ Pressure groups
 - ⇒ Consumer subsidies
 - ⇒ Reduces market efficiency and prolongs cycles

Natural limits to growth for fossils?

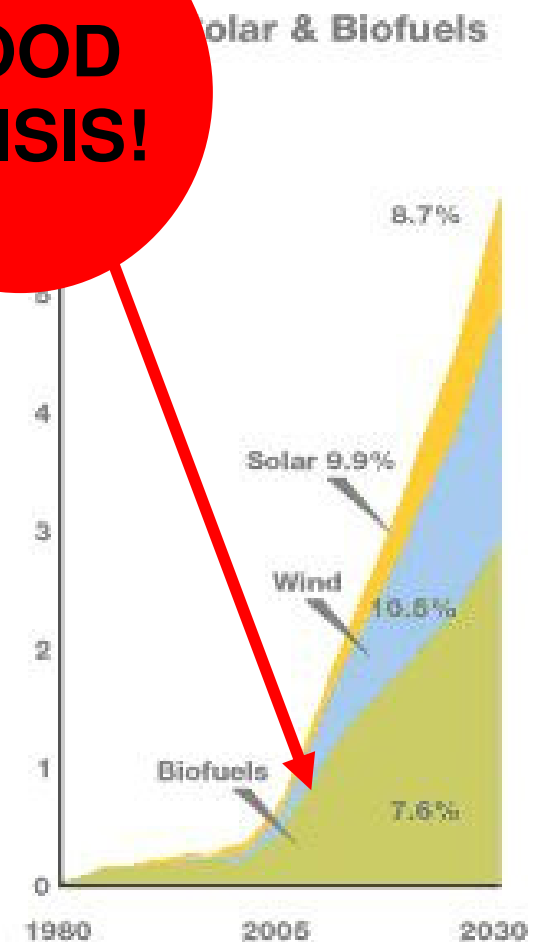
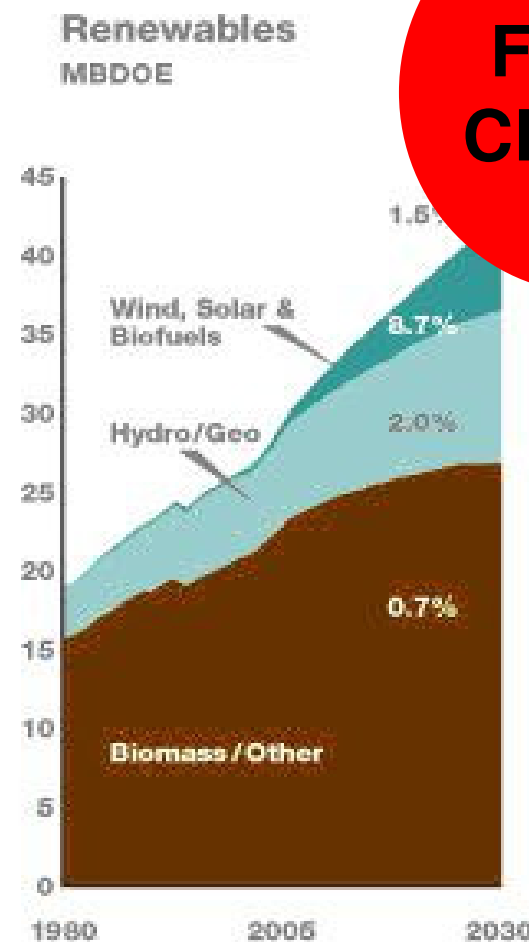
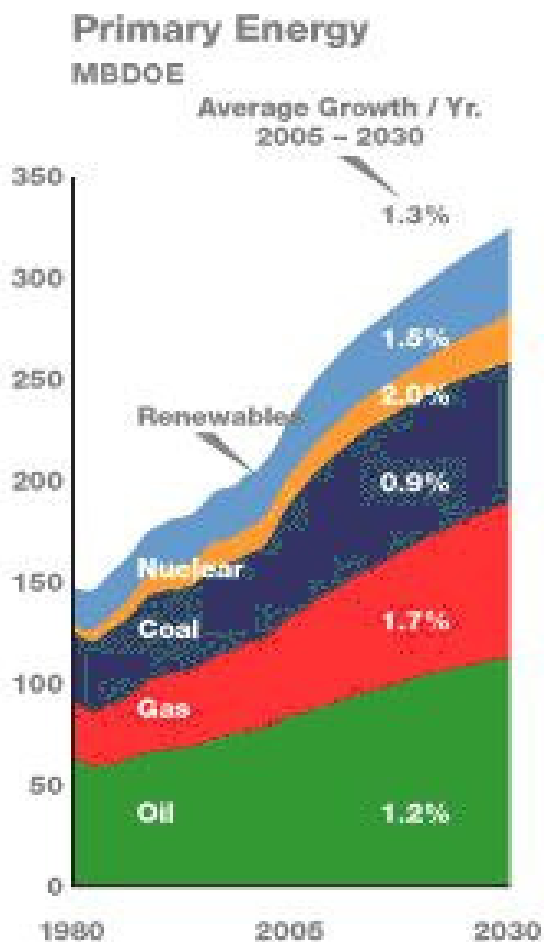
- ⇒ Today's big issue: Climate change
 - ⇒ Do we have to phase out fossil energy?
 - ⇒ But major uncertainty about underlying science
 - ⇒ Paradigm will change if earth goes into cooling phase; may or may not happen in years to come
 - ⇒ Huge challenge for oil & gas industry for the duration
 - ⇒ Can be met by applying technology: CCS, electrification etc
 - ⇒ No fundamental problem, again a matter of costs, prices, and technology
 - ⇒ But how do we deal with evident "risk" that the climate paradigm will go away?

Natural limits to growth for renewables (“?” deleted!)

- ⇒ Huge area requirements (not only biofuels)
 - ⇒ Crowds out food production
 - ⇒ Conversion of land means once-off CO2 emissions that it might take decades to win back
 - ⇒ Crowds out forests, reducing CO2 absorption
 - ⇒ Progressively larger NIMBY effects
- ⇒ Labour intensive
- ⇒ Many have dubious energy balances when all is counted
- ⇒ Profitability without subsidies a moving target
- ⇒ Most of the side effects are ignored by politicians
- ⇒ Will meet more unexpected scaling problems
- ⇒ Problems much more fundamental than for oil & gas

Very good reasons why ExxonMobil doesn't expect a "green energy revolution"

World Energy Demand – Primary Energy Supply



**FOOD
CRISIS!**

Effects of recession

- ↗ Times of recession are times of facing up to realities
- ↗ Huge evaporated values will have to be paid
- ↗ Taxes, interest rates or inflation will cut down everybody's real incomes
- ↗ Jobs, welfare, and economy will top all agendas
- ↗ Governments' budgets will tighten
- ↗ Energy prices cannot be allowed to rise
- ↗ Environment, climate and renewables will be put on hold
- ↗ Politicians will need excuses
- ↗ No warming since 1998 is a fine excuse
- ↗ More attention to less dogmatic climate science

Italy will sign EU climate plan with revision clause: report

19 October 2008, 00:59 CET

(ROME) - Italy will sign the EU's climate plan in December but only on condition the deal is revisited at the end of 2009 once real costs have been analysed, ANSA news agency reported Saturday.

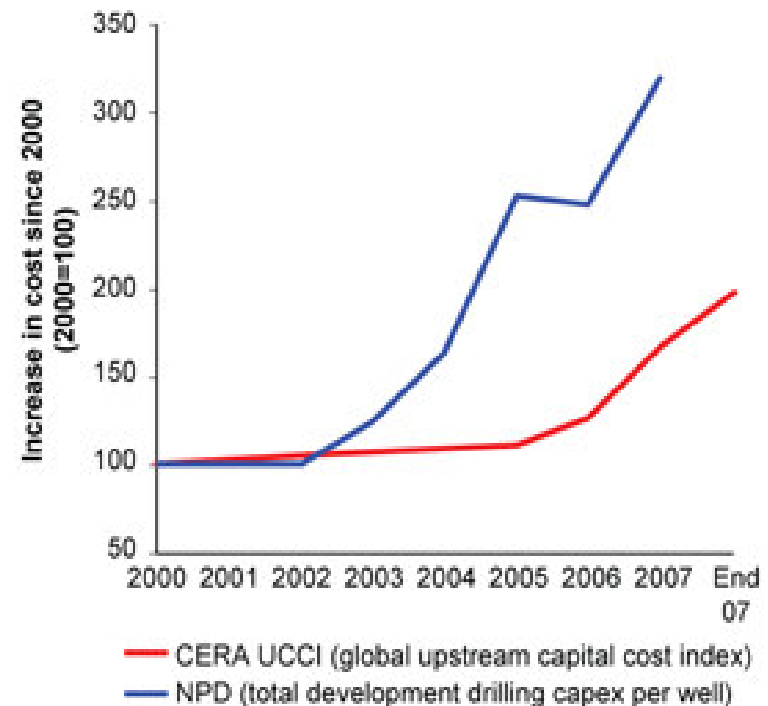
Despite rebuking the European Union's climate and energy package for its high cost, ANSA said Italy could approve the plan if it includes a clause allowing for its revision following a cost-efficiency report to be produced in 2009.

together with Poland and Germany, Italy has voiced concern about the strain of the EU's climate-change goals on industry.

Effects of recession and lower oil price on energy markets

- Demand forecasts are coming down, actual change will be slow, but then larger than expected
- There has already been much investment in new oil & gas capacity, supply likely to be maintained
- Some new oil & gas investment will be postponed, but much will go on
- Investments in alternative energy likely to take a deeper fall
- Costs in oil & gas industry will come back down as capacity constraints relax
- Net effect as always uncertain but rapid price rebound seems unlikely

Index of nominal capital costs: Norway development drilling and CERA UCCI



Post-recession: Time for reconciliation?

- ⇒ End of Bush reign will improve global political climate
- ⇒ Lower oil price, reduced US military spending will help redress global financial imbalances
- ⇒ Obama will bring US closer to Europe, Russia, China; common effort to stabilize Middle East?
- ⇒ Africa will need increased attention. Food crisis must be solved. Obama right man at right time?
- ⇒ Climate paradigm will survive, but in modified shape.
- ⇒ Obama will bring US into climate processes, but with strong emphasize on cost efficiency and broad global partnership. China and India will have to share burdens, which means ambitions will have to come down.
- ⇒ Eventually reduced resource nationalism, host nations will need and accept the industry's technology.
- ⇒ But many pitfalls: Possible US protectionism, backfire after withdrawal from Iraq, adverse regime changes during recession, etc.

The long run: Fossils or renewables?

- ⇒ Climate science will diversify and improve as US, Russia, China, India are pulled into closer partnership
- ⇒ US will ensure that the other countries will not see climate policies as a means to financial benefit
- ⇒ Three possible scenarios as science improves and reality unfolds:
 - ⇒ IPCC theories hold; problem is huge; cost efficiency paramount
 - ⇒ Natural variations dominate, solar influence goes into cooling mode, climate paradigms wither, energy and food supply paramount
 - ⇒ Natural variations dominate, but continue in warming mode; most dangerous situation since world is likely to confuse causes and continue to spend on the wrong medicine. Cost efficient policies still least harmful.

What's the sensible climate policy?

- ⇒ A sensible policy minimizes damage in all scenarios
- ⇒ Cost efficiency means uniform framework conditions for all energy production technologies
- ⇒ Let all CO₂ emissions and absorptions (including forests, ocean etc) meet the same price
- ⇒ Adjust price by adjusting reduction targets as climate science and experience improves
- ⇒ No selective subsidies to or specific production targets for renewables; allow the oil & gas industry and renewables industry to compete on equal terms to see which is best to overcome respective challenges.
- ⇒ Also best policy for competition *between* renewables, gross mistakes possible if the wrong technologies are chosen
- ⇒ Generous R&D funding to be distributed on merit, not preconceived beliefs
- ⇒ Most likely outcome: Oil & gas industry will meet the test. Renewables will contribute to growth in long-term energy demand, unlikely to cut much into base load from fossils.

Will the world be sensible?

- Certainly not immediately: EU is preparing renewables directive; Obama promises USD 150 bn of investment; still policies to require biofuel mix-in.
- Worst case: Programs will be implemented, but rapid up-scaling will turn out impossible, and programs will be reversed.
- More likely case: Programs will be delayed and down-scaled, attention will turn to cap-and-trade.
- Sooner or later, it will be recognized that oil, gas, and coal have major advantages even under climate paradigms (area, labour, energy & financial efficiency) and that CCS etc – to the extent it is necessary – is just another step up the technology ladder (albeit a high step)

Will Norway be sensible?

- Norway is a tougher case; environmentalists have managed to dominate the mindset of the political and social elite
- It is quite possible that Norway manages to destroy its oil & gas industry before it realizes that the world will continue with oil & gas for a very long time.
- Green paradigms challenge directly the industry's immediate need for access to more acreage
- “Good riddance” syndrome reduces political attention to other policy issues:
 - Diversity and competition
 - Foreign policy aspects in the north
 - Fiscal issues
 - Innovation

The strange thing is that voters do not obey the elite:

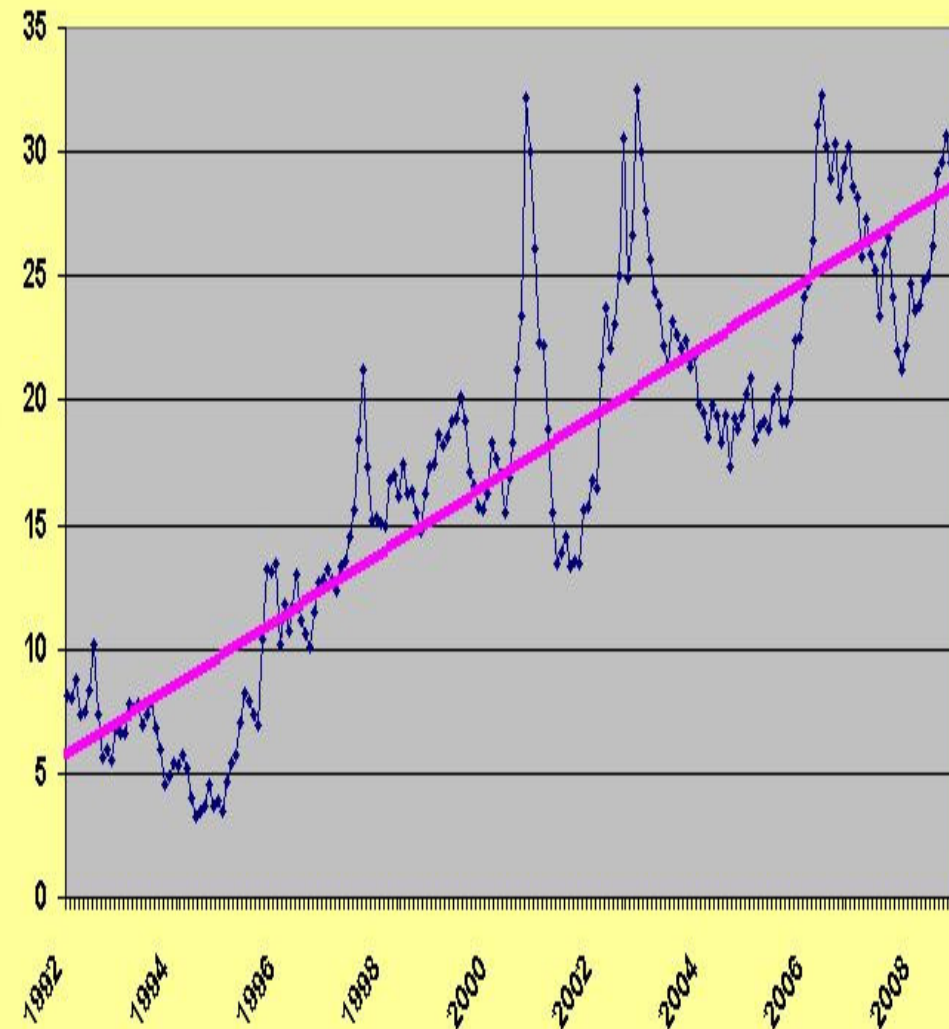
GREEN PARTIES

Average of all opinion surveys with trend across period



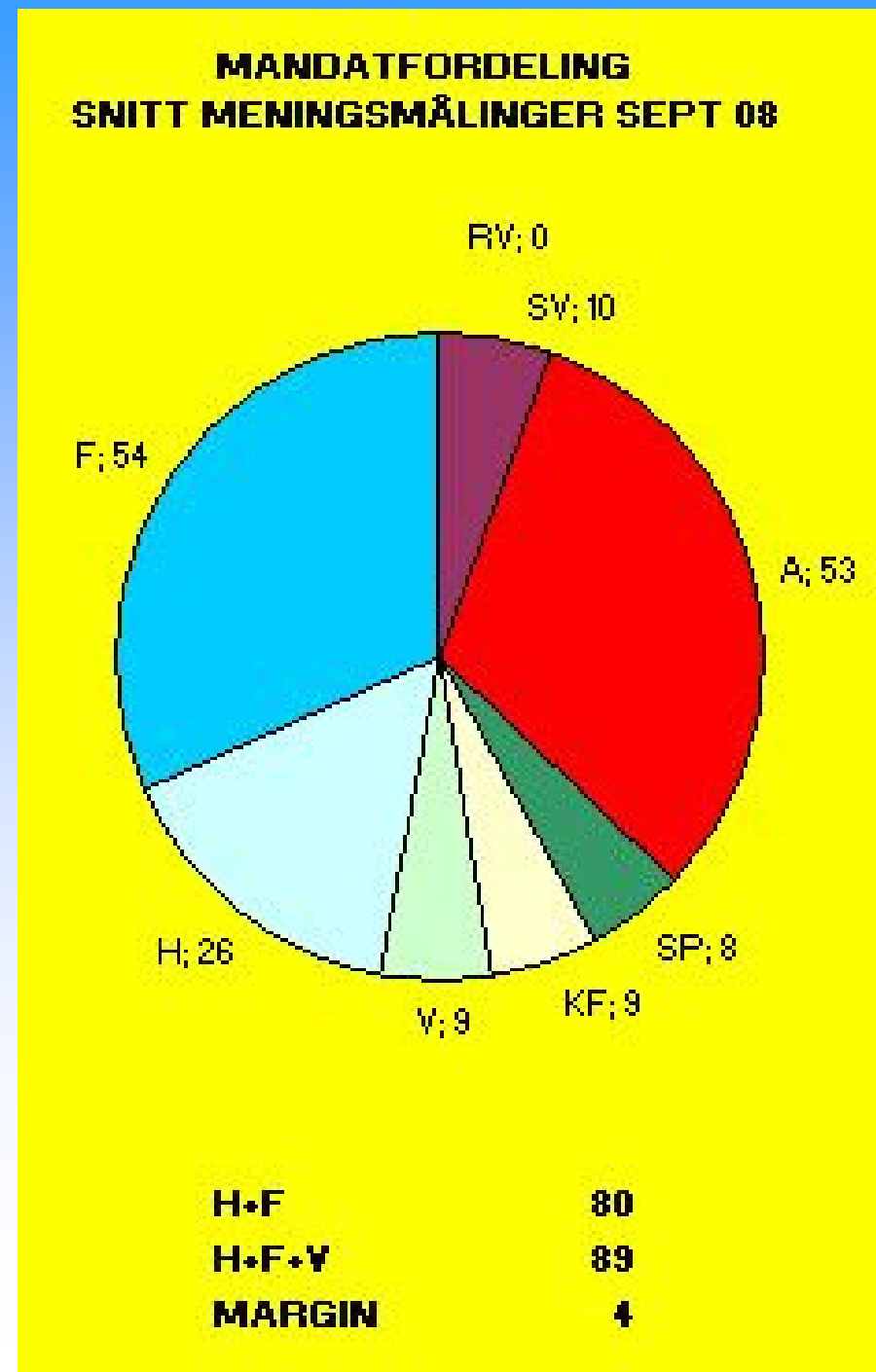
PROGRESS PARTY

Average of all opinion surveys with trend across period



Political change is coming

- Opinion survey Sept 08
- Con/Progress needed only one other party for majority
- Con/Progress government?
- After finance crises:
Stronger Labour, weaker Progress Party, still no red-green majority
- With two centrist parties in the balance; pure Labour government most likely
- Good chance of avoiding green parties in government



The PM is preparing for change

➤ Same message at ONS and other occasions:

TORS DAG 2. OKTOBER 2008 | DAGENS NÆRINGS LIV

30 NYHETER

Markedets mann: Høyere pris på CO₂-utslipp og kvotehandel er veien til investeringer i fornybar energi, mener statsminister Jens Stoltenberg.

Tror markedet «ordner opp»

Most important climate policy: Global CO₂ price. Norway's contributions:

1. Gas to replace coal. 2. Export of energy efficient technology. 3. CCS.

The fourth point sometimes mentioned is protection of rain forests. Stoltenberg systematically avoids mentioning subsidies for renewables, referring to the carbon price strategy as the most powerful policy. Questioned, he usually says Norway has sufficiently good support policies for renewables. In the speech referred to above, he simply said he didn't oppose support, primarily for R&D.

Last chance?

- We can expect a pure Labour government to do what it believes is politically possible to preserve and develop the Norwegian petroleum industry.
- The same is the case for a Conservative/Progress Party government, or a pure government of either
- More doubtful in case of a “new Bondevik” government, but it will be better than the red-green, and it will meet a pro-industry majority in Parliament
- But no government operates in a political vacuum. What it believes is politically possible may not be what it really wants.
- In particular, the paradigms of the elite (media, organizations, celebrities) are hard to change.
- “Normal people” and mid-level resource persons are much more open for growth/technology paradigms.
- It may be the last chance to turn the tide.

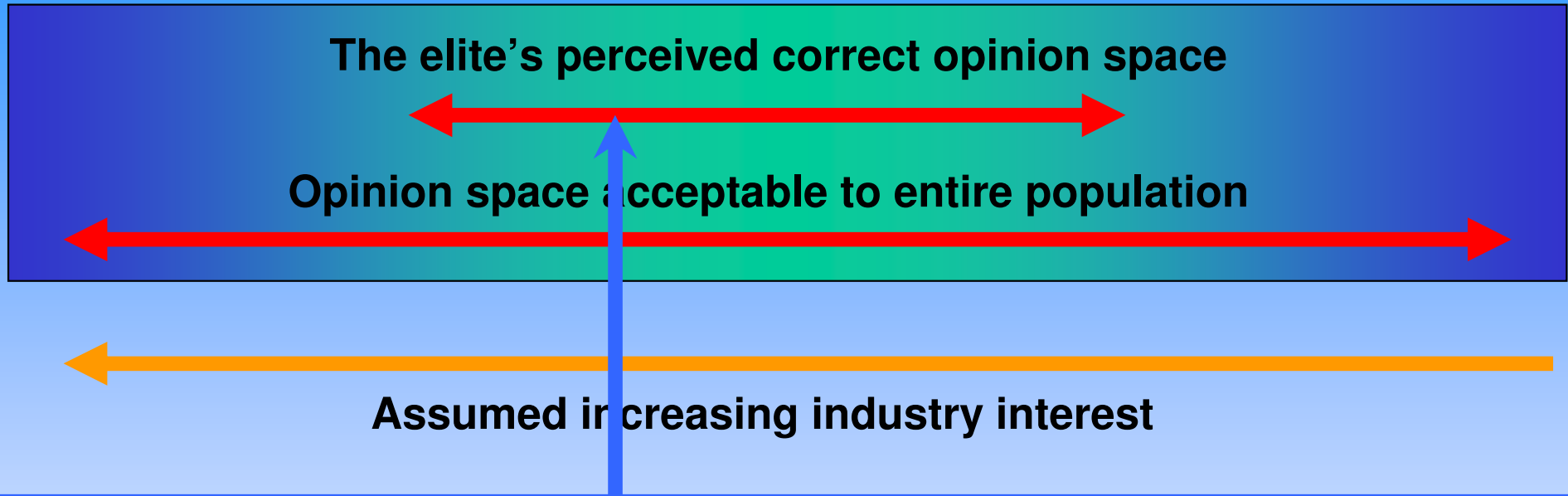
What is industry's role?

- Classical perception: Industry is not moral or immoral, simply amoral: Maximize profit within legal limits.
- Modern CSR perception: Industry should reflect opinions of “stakeholders” and “do more” than required to promote society’s desired goals. Assumed to improve profits because of improved “reputation”.
- But in reality, just the same old amorality as long as opinions are defined externally.
- Problem: Most external opinions are not fixed, but a function of reality perception, knowledge, debate, political power, and media power.
- True consensus opinions are mostly limited to normal decency, very little to boast about.
- Is industry responsible if it withholds opinions and knowledge that it believes truly would benefit society, because it conflicts with current “stakeholder” paradigms?
- Wouldn't true CSR be to accept short-term risk to “reputation” to achieve more rational long-term policies, when needed?

The functionality of politics

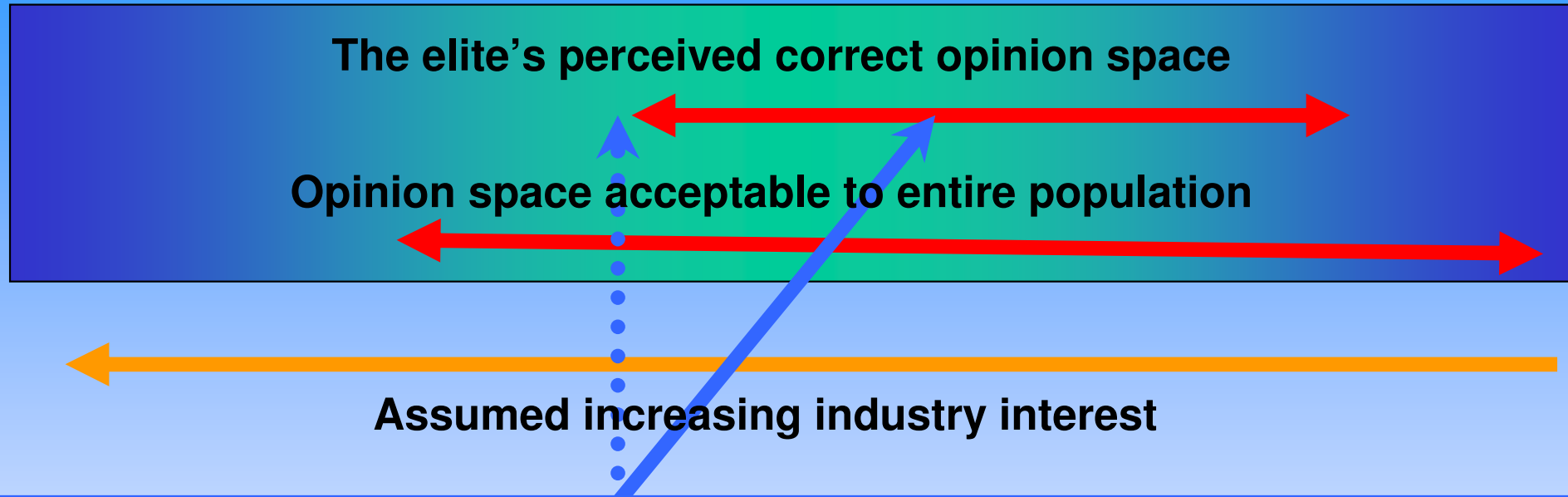
- In modern society, politics is much more about leveraging various pressure groups and relative positioning than about using knowledge to find the objectively best policies to promote values.
- If industry chooses a CSR strategy parroting other pressure groups, it abdicates from its expected role of standing up for its own interests, letting other groups define the action space.
- Political parties define their profiles more by means than by values (since these are pretty uniform), making them very reluctant to modify means in face of evolving knowledge.
- This makes it very important for society that those who hold knowledge relevant to policy-making also make it available.
- Akademia has knowledge, but doesn't refine it into policy suggestions and has poor access to politicians and media.

The fallacy of chasing the elite



What happens if industry adjust to the elite?

The entire opinion space moves!



Will CSR require that the industry follows?

No politician, journalist, or “enlightened” pundit can be “holier than the pope”. Politicians like to mitigate special interests and cannot be seen as representing any. By adjusting its own profile to appear more “friendly”, industry forces even its friends to become less friendly. This is not the kind of help that Stoltenberg needs if he is to correct the red-green mistakes in a pure Labour government.

The overriding issue at stake

- The overriding issue is about whether Norway has a moral duty to reduce and as soon as possible close down its petroleum activities.
- While this still is a minority view, it is gaining strength, and reducing the political will to interfere with what many believe is a natural decline.
- In reality, the decline is far from inevitable, but avoiding it requires positive and often hard decisions.
- The “moderate” view may become to let the decline proceed without either accelerating or delaying it, since renewables is “the wave of the future” anyway.
- This is a matter of ideas and paradigms, and the industry has no idea about how it is to handle it.

It impacts several other issues:

- ⇒ The most direct impact is on *access to acreage*.
- ⇒ Without increased access to acreage, the NCS will continue to mature rapidly
- ⇒ New discoveries will be small and development projects will not be large enough to sustain development and first use of new technology.
- ⇒ Without moving into Barents North, the NCS will not offer training grounds for the kind of technology that will be in demand in the international parts of the Arctic
- ⇒ The supply industry will lose the NCS as the laboratory that has made it excellent
- ⇒ Kon-Kraft report on internationalization confirms that the strong increase in exports have depended on innovation made at home.
- ⇒ Outlook for 2010 Management Plan revision has become bleaker also because the industry has failed in its relations to the fishing industry and lost allies in Northern Norway.

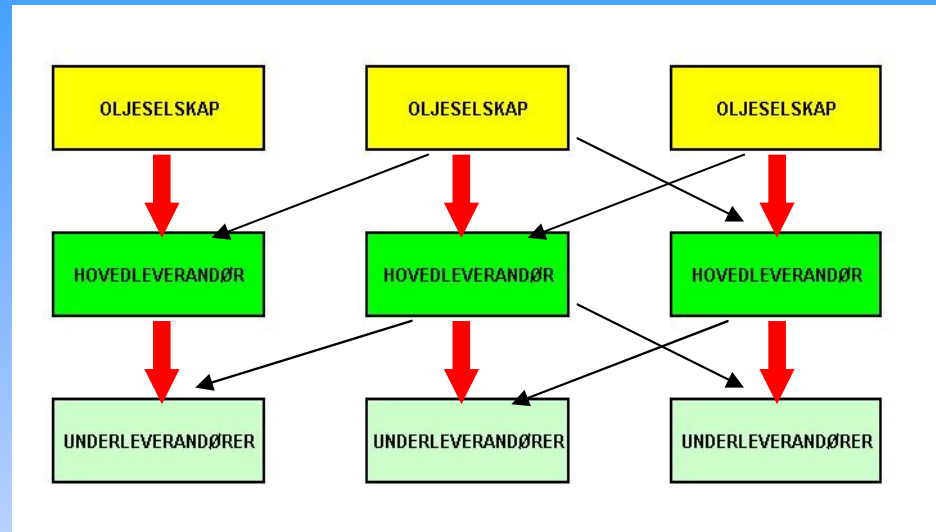
Diversity and competition

- The perception that politicians would let NCS go into decline was probably part of Hydro's decision to let go of its oil & gas division.
- The perception that the NCS would go into decline was among the reasons why politicians accepted reduced diversity as a necessary cost for international expansion. Some also believed that innovation has lost importance.
- The merger cannot be reversed, but these perceptions need to change to make politicians adopt new strategies for improved diversity.
- This is possible but require that the state co-operates with StatoilHydro management to use its ownership position flexibly for an accelerated internationalization combined with non-core NCS divestment.
- Diversity matter is also related to access to acreage: We need to strengthen the NCS position of majors and independents.

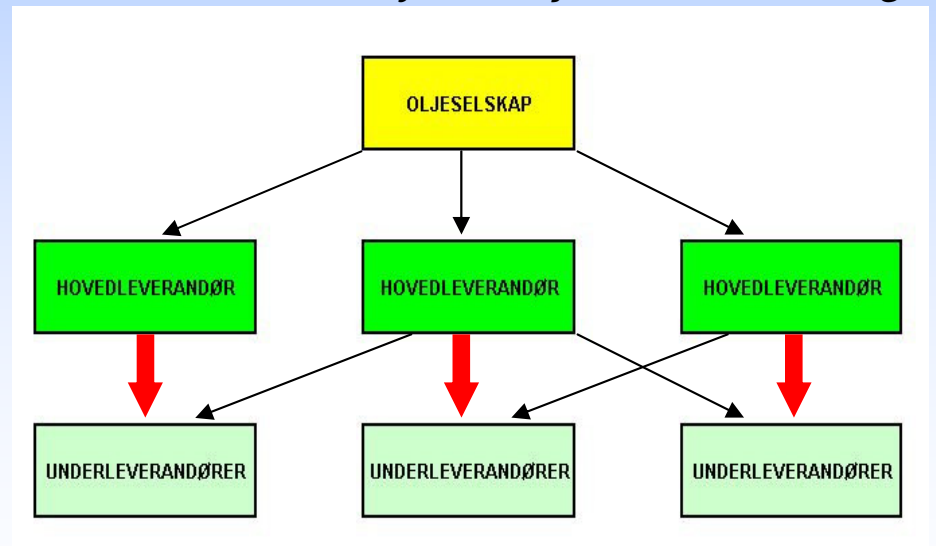
Why is increased diversity important?

- A well-functioning cluster should have competing vertical supply chains.
- This maintains competition while allowing for close oil company/supplier alliances (↓).
- As a single dominating customer, SH must choose between less supplier competition and fewer/weaker alliances (↓).
- Suppliers will experience more arm's length relationships if SH chooses competition, as it is likely to do.
- Some suppliers have already said they find it more difficult to get SH involvement in technology development.
- This will be a significant step back to pre-NORSOK relationships.

Ideal model for cluster innovation.



Probable StatoilHydro adjustment to merger:



MODERN INNOVATION THEORY: INNOVATION IN SUPPLY CHAINS (*BETWEEN FIRMS*) IS BECOMING MORE IMPORTANT

Some theorists describe a three-dimensional innovation space.

Traditional innovation metrics is focused on “inner space”. Conventional wisdom and easier to measure from statistics. More happens in staffs.

“OUTER SPACE” IS BECOMING MORE IMPORTANT!

The three large Norwegian clusters innovate everywhere, but relatively more in “outer space” than classical hi-tech, other European industries, and non-clusters. Much “tacit knowledge” (unformalized) that is hard to measure. More happens in lines than in staffs.

VALUE CHAIN

WHERE THE INNOVATION TAKES PLACE

SINGLE-FIRM

PURE TECHNO

PRODUCT

WHAT KIND OF INNOVATION

ORGANIZATION,
SERVICE,
LOGISTICS

WHERE THE INNOVATION IS EMBEDDED

PROCESS

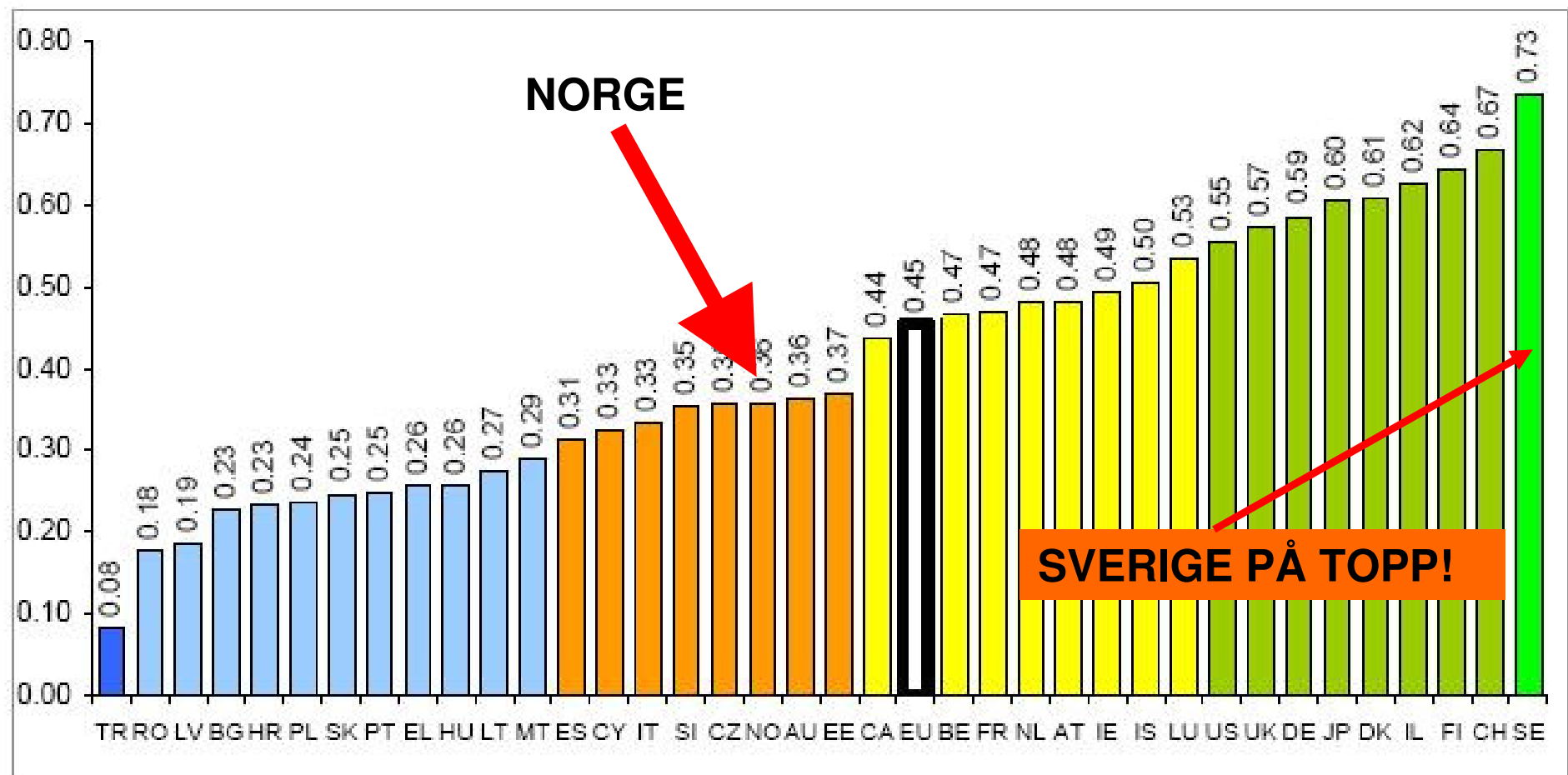


Tacit knowledge and innovation “on the job” in the line rather than in dedicated staffs is excellently illustrated in Aker’s Nutcracker movie.

Aker is a huge knowledge base and a powerful innovator, but little can be measured by traditional metrics.

Metrics that only captures the "inner space" is the main reason why Norway scores poorly:

FIGURE 1: THE 2007 SUMMARY INNOVATION INDEX (SII)



UKEFORUM

TOM BOLSTAD leder i Bedriftsforbundet - KRISTIN CLEMET Civita - ARVID HALLÉN Norsk Forskningsråd - STEIN LIER-HANSEN Norsk Industri - PER MORTEN HOFF IKT Norge - VIBEKE H. MADSEN HSH-leder - GUNN OVESEN adm.dir. i Innovasjon Norge - SIGRUN VÅGENG NHO-direktør

DENNE UKEN:



Er vi godt nok skodd for å møte utfordringene som står foran oss med endringer i den globale økonomien, spør **Gunn Ovesen**.

*Gunn Ovesen er administrerende direktør i Innovasjon Norge.
E-post: gunn.ovesen@invanor.no*

CEO Gunn Ovesen (Innovasjon Norway) in Ukeavisen 29 August, 2008. (She has good answers!)

Norge - en innovativ gåte

Norsk næringsliv går godt. Veldig godt. Det skapes hele tiden nye, spennende produkter og tjenester her i landet. Norske selskaper er helt i teten på en rekke områder. Olje og gass, solceller, mobile teletjenester, oppdrett av fisk, digitale

kartløsninger, feranser - du finner n verdenselite

Men er det godt nok skuddingene som endringer i økonomien? Gjør å bygge de plassene bak gå til? Noen

i Norge, at vi legger altfor mye vekt på tradisjonelle næringer og ikke satser nok der den virkelige innovasjonen foregår.

Jeg vil hevde at Norge er et land fullt av virkelig

tredve årene? De kaller det «den norske gåten.»

I mange, om ikke de fleste internasjonale sammenligninger fremstår vi som en skikkelig sinke når det gjelder FoU og innovasjon. Bildet blir enda mer forvirrende når vi vet at Norge

kunder, gjennom forbedring av eksisterende produkter, og så videre.

Sannheten er at denne typen «ikke-teknologiske» innovasjoner er like verdifull. Bedrifter lærer og forbedrer seg på mange flere måter enn gjennom viten-

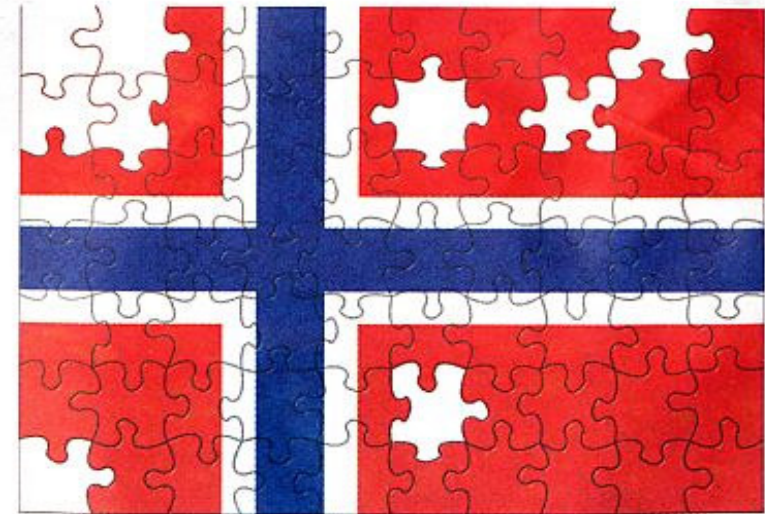
OECD 2007 about “the Norwegian conundrum”: Why has Norway such a high productivity growth when the country scores so poorly on innovation metrics?

til å tro.

Den tradisjonelle forestillingen som ligger under de

internasjonale målingene av innovasjon, er at innovasjon er knyttet til tunge

som bidrar til å øke investeringene i forskning og utvikling dramatisk - Nokia, Ericsson, Volvo og ABB. Norge og Island har en bransjestruktur med mye tradisjonelle, råvarebaserte industrier som investerer lite i FoU i forhold til omsetning, og disse telles ikke med hos OECD



Jeg vil hevde at Norge er et land fullt av virkelig nyskaping og innovasjon. Vi må bare se etter den på de riktige stedene.

lingsevne og -vilje. Dessuten er bedriftene åpne for andre læringsformer og det er god integrasjon mellom bedrifter og kunnskapsinstitusjoner.

Et eksempel på dette er drøghjelpen fra olje og gass-sektoren de siste 25 årene. Virksomheten innenfor olje og gass har resul-

betydning for samhandling og åpenhet - og som igjen er forutsetninger for innovasjon.

Vi må ikke glemme at Norge har en internasjonalt orientert og sterkt konkurranseutsatt økonomi. Økonomien vår er åpen. Det gir sterkt innovasjonspress. Politikken beskytter ikke enkelt-

«Norge er et land med sterk, leverdyktig

Why is this relevant to politics?

- ⇒ Because most politicians and many civil servants (such as the MoF) are not aware of the innovative capabilities of the Norwegian petroleum cluster. Many think “exporting commodities” is of low value.
- ⇒ This means they don't recognize what they stand to lose if they do not make timely decisions on access to acreage, diversity, fiscal matters, petroleum directed R&D and so on
- ⇒ - and generally if they do not show stewardship in the general struggle of paradigms relating to petroleum, energy, environment, and value creation.
- ⇒ For the industry, it is all a matter of protecting the knowledge base that also is the fountain of international competitiveness.
- ⇒ To do this, we must document it clearly, with all the above ramifications about the industry's value to Norway as well as the world.
- ⇒ *There is a job to do, and it cannot be left to politicians alone.*