Benchmarking Sweden and the Netherlands

Concrete company and policy examples of best practices and lessons learned

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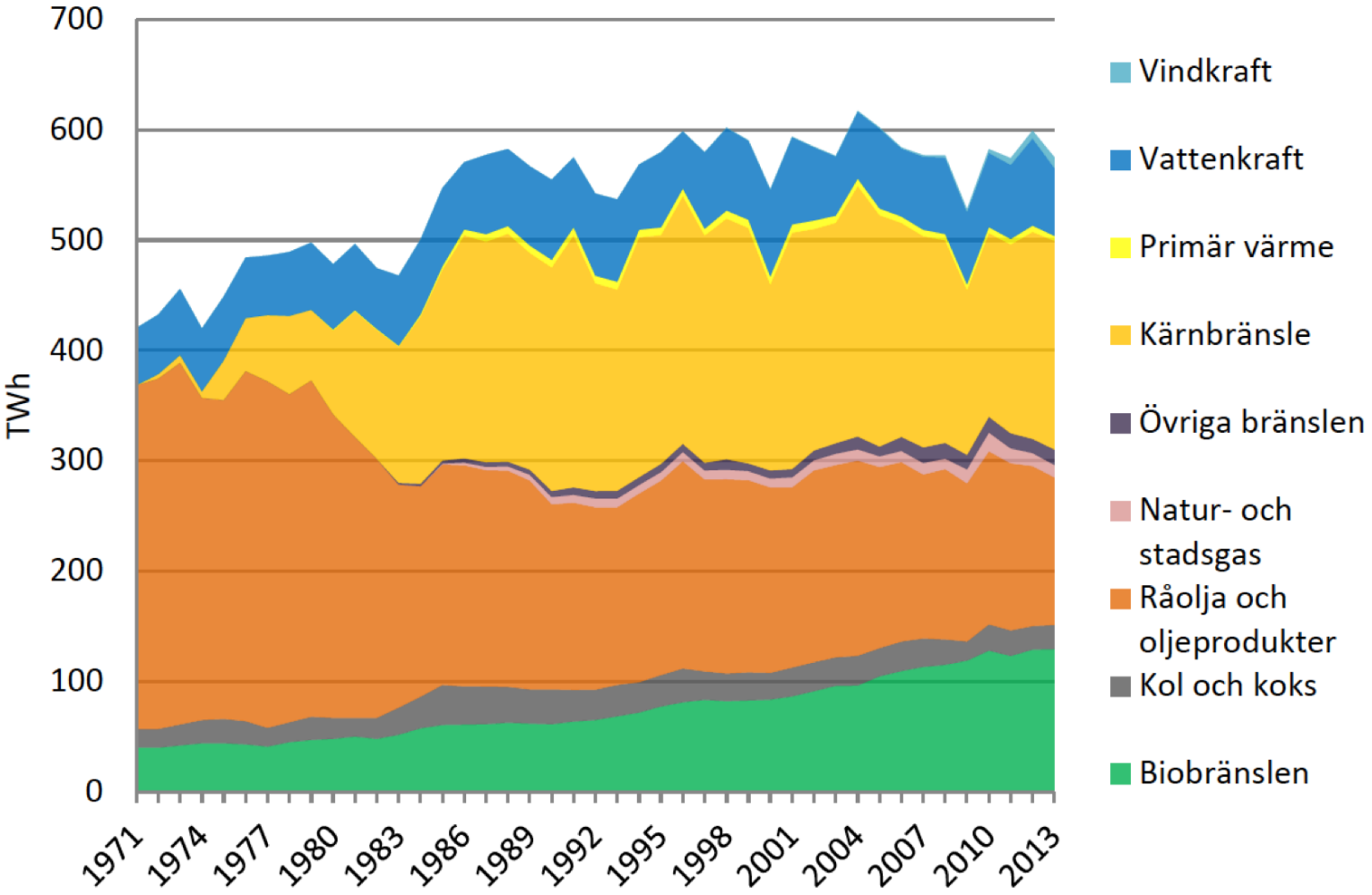
Sweden: two generations of transition



Källa: Energimyndigheten och SCB.

Three principle phases:

1. Reduce oil dependence
2. Oil independence in transport
3. Fossil free economy (emerging)

Bioeconomy transition is increasingly aligned with 'oil transition'.

Drivers for urgency – trade balance surpluses dropping year on year ….

1. Paper: US$7 billion (Down by -30.6% since 2011) (1st place exporter TB)
2. Wood: $2.1 billion (Down by -9.1%) (4th place exporter)
3. Woodpulp: $2.1 billion (Down by -6.9%) (4th place exporter)

Transition towards biobased economy in Sweden

- De-carbonisation of the economy. Visions: leave oil-dependency, fossil free
  - Climate and oil dependency
  - Attention on fuels for transport – the hardest nut to crack
- Emerging biobased economy but still no national strategy
  - Research and innovation strategy for bioeconomy (FORMAS, VINNOVA, Energy Agency)
  - National forest programme “Our Green Gold” (Ministry of Enterprise and Industry)
  - Investigation of the Bioeconomy sector (Statistics Sweden and The Swedish Agency for Economic and Regional Growth)
  - Call for a National bioeconomy strategy from sector organizations (agro, forest, chemistry)
- Several ministries involved
  - Enterprise and industry, Rural affairs, Agriculture,
- Multiple funding agencies
  - FORMAS, VINNOVA, ENERGIMYNDIGHETEN, MISTRA, regional bodies.

1. Swedish duality bio-transitions (past and present)

	Netherlands	Comment	Sweden	Comment
Transition	Fossil based to biobased	Biobased economy in the Netherlands is mainly about breaking away from fossil resources and towards biobased resources.	Multiple transitions	Sweden covers a large area and different enviro-socio-technical systems (e.g. markedly different economies in Norrland to V. Götaland) 1 replacement of fossil-based raw materials with biobased raw materials (raw materials, nutrient and fertilizer 2 optimization of systems, new and improved biomass properties 3 extension to other ecosystems for biomass production. 4 Smarter products and smarter use of raw materials (refinement of biomass products, bi-products and waste as raw materials, biorefineries and more).
			Bulk → speciality	Paper & pulp and energy industries: low-cost, high-efficiency bulk production with incremental shift to high-quality specialty products.
			Fossil → bio	Breaking oil dependence programme since 1970s – in recent times has had focus on 'recalcitrant' portion of the fossil economy (transportation fuels). Fossil to bio-transitions with fuel focus are by definition large scale.
Drivers	Chemical sector + government	Driven mostly by the chemistry sector together with the government.	Bioeconomy core functions & innovation expectation	**Expectation of success *Fast follower strategies not first movers (?)*** Linked to emerging broad belief of reality of the future bioeconomy and the certainty of involvement because of comparative (broad resource based advantage). Sweden has a mixed system. Reflected by division of bioeconomy strategies. - Innovation – mixed and open to key emergent niches - Energy (fossil fuel transition) - Rural affairs (mainly forestry, food etc. to emerge) - Industry/Enerterprise (mainly forestry)
Urgency	Rather high	Urgency is rather high - among small niche companies - among core chemical and refining industries	Average and tempered but escalating	**Linked to emerging broad belief of reality of the future bioeconomy – see above.** **Linked to broader national portfolio of production.** **BUT value of exports NOT increasing.** Although the bioeconomy flagship (forest sector) essentially represents the export surplus, it is NOT always among the top 10 export products (import/export). The economy is broader and deeper in other sectors. Urgency also diluted by focus on key fossil component of economy. *"60 000 people and has a net export value of close to 100 billion SEK …. now facing a transformation, where significant resources are invested in developing the next generation of products from trees. …. further accelerated by the global ambition to move towards a greater usage of renewable materials."*
Phase	pre-develop-ment		Pre take-off	PRECURSORS OF TAKEOFF INCREASINGLY IN PLACE · Advanced R&D institutes and academia , with established practices for international cooperation · Wide ranging set of pilot- and demonstration plants · (Forest) industry clusters with presence of all players in the value chain · Extensive materials research capabilities · Research and business climate that fosters industry collaboration and technology transfer

2. Duality in geographical scope

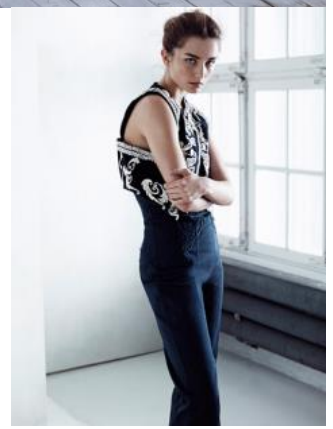
	Netherlands	Comment	Sweden	Comment
Regime	economic top-sectors	Regime characterised by the economic topsector policy and niches	Eroding silo structure	SCA, StoraEnso, BillerudKorsnäs, Södra and Holmen do not always speak the same language. Forest owners and forest companies have diverging expectations.
			Regional clusters supporting niches	**Västra Götaland.** Embedded, well funded. Supported. Green Chemicals, biobased products. Regime actors! **Övik.** 2013, the Swedish Industrial Research Institute (SP) 60% of Processum; Swedish government's science partner initiative; 17 FTE, 23.5MSEK/yr turnover; 21 member companies. **Paper province:** An industrial cluster in Värmland, Northern Dalsland and Örebro counties. Activities focus upon cooperation with marketing, competence building, project development and regional growth. The organisation is owned and driven by 90 member companies that span in scale from multinational to local suppliers – and span the entire forest value chain.
Niches	Systematic experiment-ation	Systematic experimentation with radical innovative experiments aligned with overall long-term vision. Setting up breeding grounds for radical innovation is of crucial importance.	Incumbent-related	Lacking a shared vision and a joint agenda that connects long-term change to short term action. Swedish bioeconomy transitions within the large forest sector could be more open to government and frontrunner activities. However, scale and success expectations, may be combined with 'avoid first mover' view.
			True niches – multi connected?	Regional clusters important. Opportunistic stepwise reconfiguration strategies have been more successful than substitution strategies. Substitution strategies have been pursued by non-incumbents with regional support. Alternatives to the regime are developed, focused on radical innovation and connected through regional clusters systematic long-term vision and pathway development. The niches, where the alternatives to the regime are developed, are connected at the regional level but not at the national.
Vision	Co-created vision for 2050	coherent vision that was co-created between the government, front runners and progressive industrial partners. It has high ambitions and concerns the long term (2050).	Ad hoc vision national (2030)	**2012 Sweden adopted the "Swedish Research and Innovation Strategy for a Bio-based Economy"** **NO NATIONAL BIOECONOMY STRATEGY** All short term. But over a generation of work has led to this point. Two generations of bioeconomy shift. Can we bring in the argument that there is 'evidence based' expectation that innovation spin offs will accrue from incremental change. Market guidance via carbon tax for example has supported a fundamental shift in the energy sector. Each major component change-out in this system, has yielded innovation spin-offs and changed expectation thresholds.
			Co-created regional (2030)	
Govern-ance	Transition governance	Transition governance, focussing on co-creation, and searching, learning and experimenting based on shared understanding of the persistent problems and a long-term vision that informs short term action. Focus on smaller frontrunners	Traditional but multi-platform	National: A mish-mash of agencies and agendas. Coalescing into a governance format. A point of departure from long term guiding vision (reduce oil dependence) – new opportunities for the green economy. Economy is considered COMPARATIVELY green. Leveraging comparative advantage.

3. Sector based but more sectors ’taking form’

	Netherlands	Comment	Sweden	Comment
Scale	Regional approach	Focus on promoting radical innovation through cooperation between change –oriented vested players	Emerging national approach Regional approach	Two generations of national agenda of reducing oil dependency (institutional inertia) Regional approach is clear – but not comparable to definition of regional in Dutch context. Closer to markets than Finland? Regions receive central funding - North Sweden - Östergötaland - Västragötaland - Värmland
Approach	Conceptual, network based Practical, sector based	more bottom-up and regional approach based on networking and vision development - conceptual (ideas and possibilities only?) - practical sector based seen in Rotterdam refinery fuel and chemicals visions.	Practical, sector based	· Emerging clusers (e.g. Övik, Paper Province, V. Götaland) · Rural economy = Forestry focus but Agriculture as a bioeconomy actor now emerging. · Materials science = increasingly visible Stepwise and modular reconfiguration of value chain components in fuel chains has had some success. Attempts at radical systemic change (substitution) of fossil value chains have been attempted but have failed thus far. Openings seem to be with modular. Scale of investments put forward 1-5 billion SEK. Modular bioeconomy additions in bulk liquid fuel segments increase scope for biochemical etc.
Focus	Radical innovation		incremental innovation	Incremental innovation Stepwise reconfiguration Negative experiences with attempts at systemic XXX
Govern-ment role	Facilitator	The Dutch government acts as a facilitator, significant networking behind the scenes, while changes.	Stimulator – director (national) Stimulator – facilitator (regional)	Stimulator-director – reduction of oil dependence Facilitator stimulator - stimulation and support of bioeconomy (materials, chemicals, …)

Company examples: materials and chemicals

- Fuels/bulk chemicals, dissolving pulp, specialty pulp, resins, ligno sulphate, preserved wood, water-repellent treatment of textiles.
  - Södra
  - Domsjö
  - SunPine
  - Organowood
  - OrganoClick
- Textile brands expect competitive "novel viscose" in the near future.
- And a lot of research – not least in textile fibres



Company examples: wood-based buildings

- High-rise in massive wood frames
- Modular and elements
- The industrial building is expanding
  - Martinsons – Folkhem
  - Moelven
  - Lindbäcks
  - BoKlok

CE in textiles – a lot of activities

- Voluntary collection and Sorting plant
- Chemical recycling
- The Brands
  - Collection of used textiles
  - Textiles from recycled material
  - Lease/lend
  - Repair and care
  - 2nd hand sale
  - Design

Examples: Circular building in Sweden

- Material databases practice (what and where, how much)
- Experiments on re-use of components after renovation
- Trade in used building material
- Temporary modular wooden buildings and pavilions
- Add-on wood construction on existing buildings

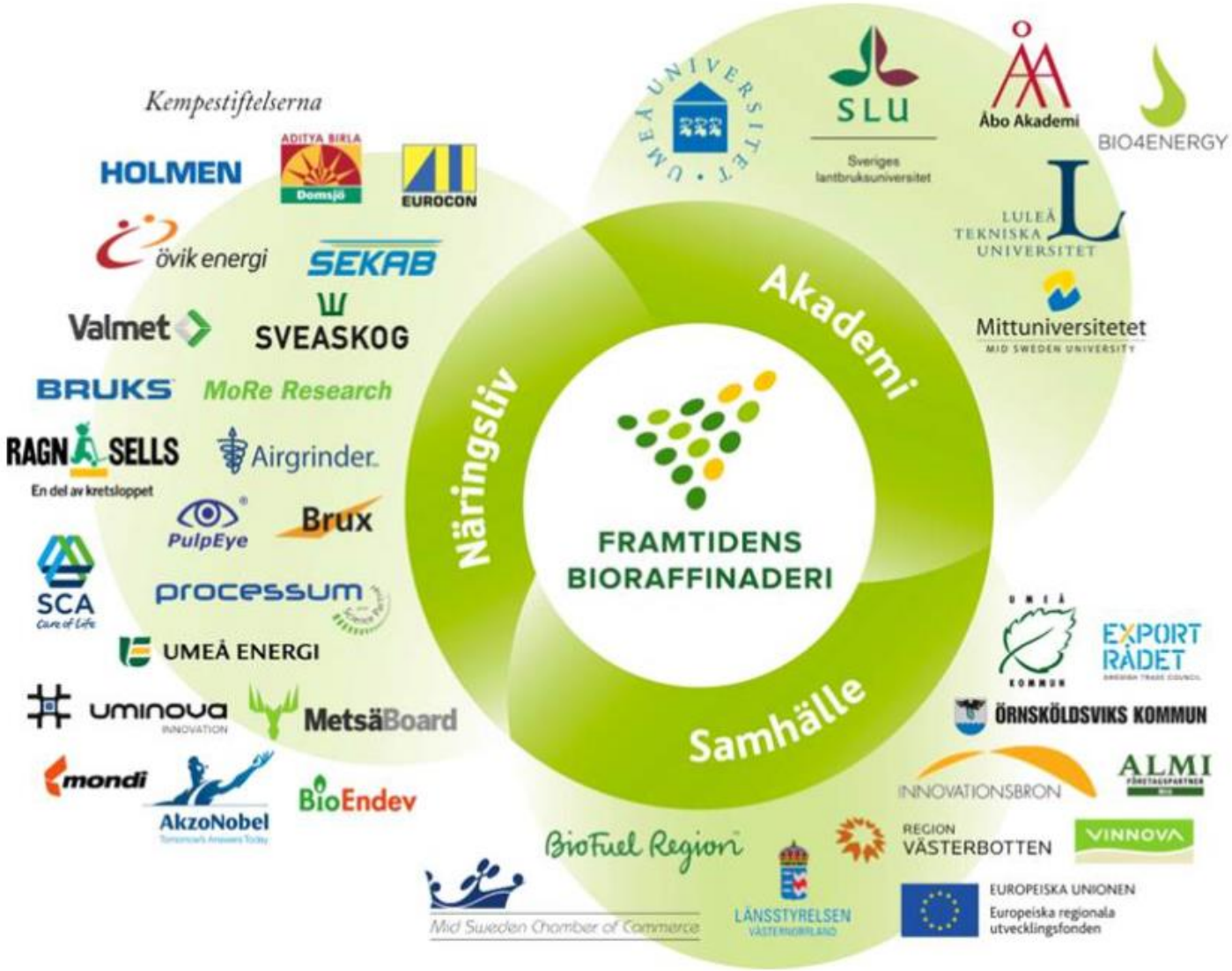



Kiitos! Tack! Thank you!

Potential Bioeconomy base industries

- Gasification (CH_4, MethOH) advance fuel platform
- Substitution vs. stepwise reconfiguration
- Preem/SunPine
- Stenungsund cluster (AGA, AkzoNobel, Borealis, Ineos, Perstorp) Sustainable Chemistry 2030
- ”Närodlad plast” (SP + value chain actors)
- Many research projects demonstrate possibilities – not much towards commercialisation.

Regional cluster – Övik.



Highest dollar Swedish Exports

1. Machines, engines, pumps: US$21.8 billion (15.6% of total exports)
2. Vehicles: $15.7 billion (11.2%)
3. Electronic equipment: $15.2 billion (10.8%)
4. Oil: $8.6 billion (6.2%)
5. Paper: $8.4 billion (6%)
6. Pharmaceuticals: $7.3 billion (5.2%)
7. Iron and steel: $5.6 billion (4%)
8. Plastics: $5 billion (3.5%)
9. Medical, technical equipment: $3.9 billion (2.8%)
10. Wood: $3.8 billion (2.7%)

But .. NONE of these increased in value during the 5-year period starting in 2011. Leading the decliners were Swedish iron and steel exports which declined in value by -38% from 2011 to 2015. Electronic equipment fell -37%; oil (down -36.7%) and paper (down -30.9%).

Ref: http://www.worldstopexports.com/swedens-top-10-exports/

Swedish positive net exports

1. Paper: US$7 billion (Down by -30.6% since 2011)
2. Machines, engines, pumps: $4.3 billion (Down by -24%)
3. Pharmaceuticals: $3.5 billion (Down by -5%)
4. Wood: $2.1 billion (Down by -9.1%)
5. Woodpulp: $2.1 billion (Down by -6.9%)
6. Iron and steel: $2.1 billion (Down by -28.9%)
7. Ores, slag, ash: $1.4 billion (Down by -52.9%)
8. Gems, precious metals, coins: $829.3 million (Down by -24.8%)
9. Base metal tools, cutlery: $599.6 million (Down by -28.1%)
10. Copper: $431.7 million (Up by 17.2%)

Sweden has highly positive net exports in the international trade of pulp and paper. In turn, these cashflows indicate Sweden's strong competitive advantages under the paper product category. But … the marked declines help explain the growing interest in product diversification in the incumbent sector.

Policy inputs from interviews: materials and chemicals

- Barriers:
  - Forest industry needs to collaborate with new market actors
  - Substantial investments: cost and risk of being “First mover”
  - Competition with fossil sector
    – uncertainty regarding energy, climate and industry policies
  - Perceived environmental benefits, however LCA analyses provide differing results (how much better, what constitutes the improvement)

Policy input from interviews: Wood building

- Barriers:
  - Risk perceptions: fire, acoustics
  - Competing with established knowledge base – “why change a functioning concept”
  - Building permits on aesthetics: perceptions of “standard/modules”
  - Perceived climate benefits, however LCA analyses provide differing results (how much better, what constitutes the improvement)
  - No price on CO_2 and embodied carbon

Circular economy

Circular Economy – Swedish Policy

- Environmental Quality objectives
- National waste strategy
- Approx. 60 different policy instruments – fragmented
- Government inquiry – also stimulating green markets
- Weak connection to bioeconomy per se.

- R&D funding (MISTRA, FORMAS, VINNOVA, S-EPA)

Examples of relevant policies for CE

- EPR discussions for textiles
- Infrastructure for textile collection
- Municipalities and producers make use of construction waste
- Quality grading of construction waste
- Log/database for used material in buildings (what? Where? How much?)
- Public procurement

Policy input from interviews: textiles

- Main barriers:
  - Large recycling actors generally not interested unless legislation
  - Cheap transport: used textiles go abroad for cheaper sorting
  - Automated sorting techniques – under development
  - Legal uncertainties regarding definition of waste vs. materials for re-use
  - Uncertainties regarding role of actors in case of EPR for textiles
  - Innovation funds largely absorbed by research institutions, start-up companies struggle in the early phases

Policy input from interviews: CE in buildings

- Main barriers:
  - Uncertainties regarding CE implications in the traditional building
  - Long life-times of buildings – how will the re-use system look like in one hundred years?
  - Complex building materials – need for radical new design and material concepts to be reusable
  - Standards and responsibilities for used material

Suggestions for policy intervention

- Common themes:
  - Comprehensive environmental assessments beyond renewable raw material/CE of a transition
  - Funding from Vinnova and other agencies is important for innovation projects, but could consider more focus on commercialization and involvement of existing industrial actors
- Bio-based materials and chemicals:
  - The state/government involvement in capital intensive industrial projects to share financial risks
  - Predictable rules of the game
  - Assess current waste-related policies to keep products, components, and materials at highest utility and value in a CE
- Textiles:
  - Many different projects provide good platform for future activities. Need for intervention if we want industrial application in the Nordic Region. What would automation mean?
  - Improved collection scheme and sorting. EPR may be useful.
- Wood-based construction:
  - Acknowledge need for different materials. Continue on robust LCA for material comparisons.
  - Dissemination of knowledge and experiences through demonstrations and education
  - Role for public procurement
  - Innovation in refinement projects and industrial production processes
  - Address embodies carbon as construction phase gain importance over user phase