

The New Energy State

The Recasting of Energy Economics and Governance around Renewable Energy Systems

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- 1. Background – the changing economics of energy**
 2. Offshore renewables as a “new” natural resource
 3. Lessons from offshore energy governance
 4. What is the role of the state? Five stylized roles
 5. Key criteria for a new offshore energy governance regime
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The economics of the electricity system is changing

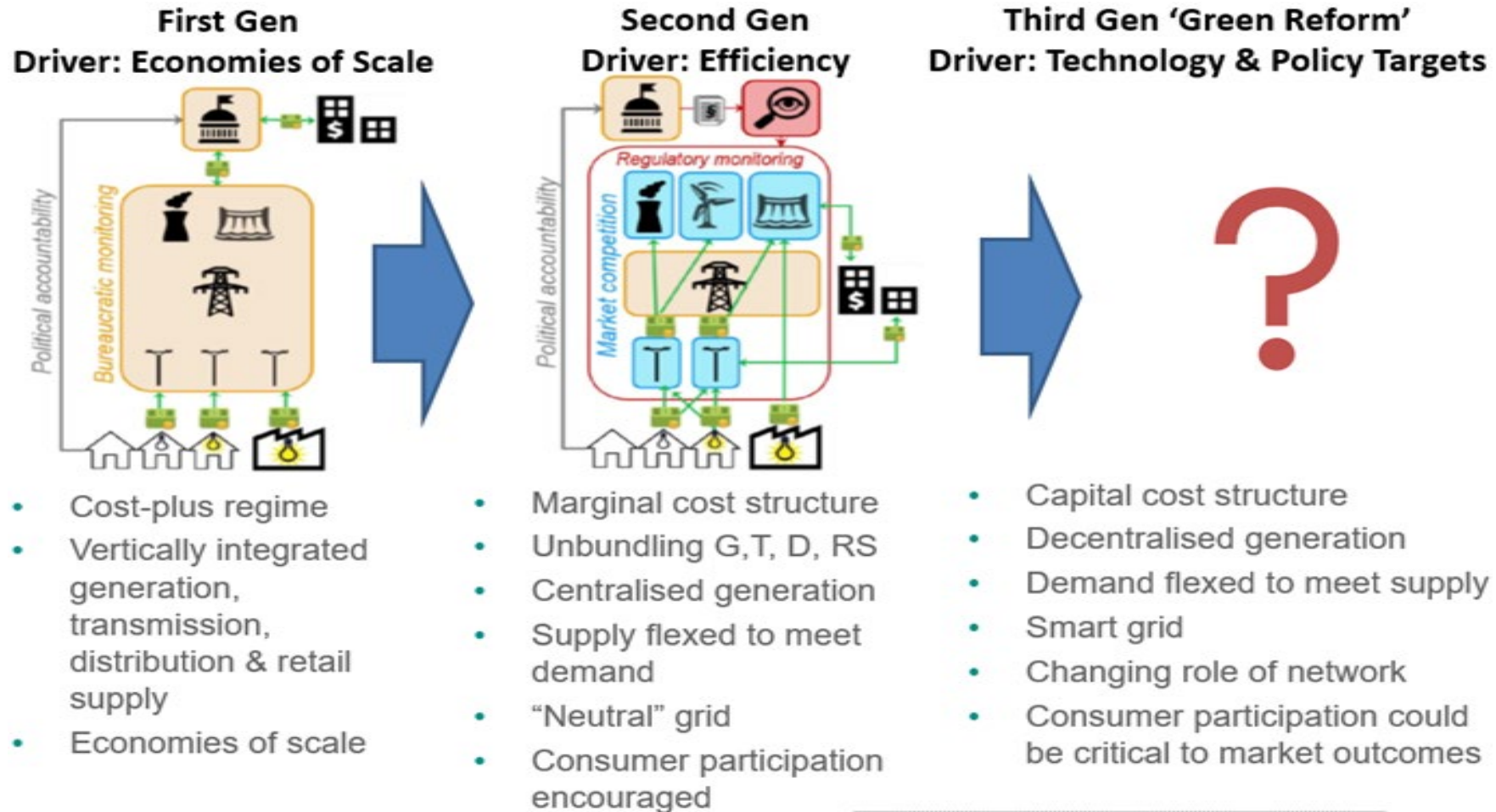


	NOW	FUTURE
Cost structure	Mainly marginal	Mainly capital
Generation structure	Mainly centralised	Decentralised
Pricing	kWh	?
Planning and operation	Flex supply to match demand	Flex demand to match supply
Control and dispatch	From centre	Throughout system (digitalisation)
Role of demand-side	Passive	Interactive
Role of grids	Neutral conduit	Smart player
Key Driver	Efficiency	Technology

Evolution of electricity governance regimes closely tied to economics



Power Sector Structures: From State to Market



Energy governance regimes historically shaped by economic characteristics of primary energy resource



- **Historically – ownership and provision of energy characterized in three ways**
 - ❑ **Global public good:** energy & infrastructure provision
 - ❑ **Pure public good (public service):** economies of scale, vertical integration, state ownership, cost-plus pricing
 - ❑ **Marketable public good:** rivalrous & non-excludable, provision through market
 - **In emerging paradigm of ‘green reforms’ – provision of energy characterized in new ways**
 - ❑ **Club good:** support of renewables a public good, provision through collective arrangements
 - ❑ **Common pool resources: energy islands** - a natural or man-made resource system that can make access to it costly, but not impossible to exclude other beneficiaries from its use
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Clear trends emerging in recent years (prior to recent energy price shocks)



- **Lease auctions for offshore seabed plots for windfarms have made headline news for attracting runaway bids**
 - ❑ E.g. UK Crown estate expected to generate £4bn over 10 yrs, much of the proceeds returned to UK Treasury under fiscal arrangements through which 25% of Estate's profits handed back
 - **Increasing number of zero-subsidy bids for offshore wind power tenders**
 - ❑ Germany (2017; 2018), Netherlands (2017; 2019), UK CfD auctions (2020); Denmark offshore wind tenders (2021)
 - ❑ Analyses suggest that offshore wind auctions in Europe have yielded levelized costs of electricity at the lower end of estimates for fossil fuel based generation (€50-55/MWh).
 - ❑ UK CfD round 3, winning strike prices were 18% below the forecasted market prices
 - ❑ Denmark Thor – record low strike price of 0.01DKK/kWh; cap of DKK 2.8 bn
 - ❑ Heralds an era of “subsidy-free” windfarms in some jurisdictions this decade
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Accompanied by new models and archetypes for offshore energy



Offshore Energy Islands

- ✓ **‘Energy Islands’** involve significant amounts of revenues earned from leasing land sites in ‘favourable’ locations (e.g. sea bed)
- ✓ **Traverse multiple jurisdictions** – electricity/energy produced from an energy island needs to be transported (via network & other infrastructure) to regional electricity markets /consumers
- ✓ **Synergies with regional industrial & maritime clusters (ports)**, as offshore renewables are seen as an integral part of the EU Green Deal
- ✓ **Governance:** the question of how the new configurations will be governed remains open
- ✓ **Considerations:** Ownership, operation, distribution of benefits, welfare, economic & political agreements



- *Covers the definition of an existing island, the construction of an artificial island, or an island based on a platform serving as a hub for electricity generation from surrounding offshore wind farms, that will be connected and distribute power between neighboring countries.*
- *Connection of various offshore technical equipment for electricity generation, e.g. facilities for energy storage, hydrogen or electrolysis plants, or other energy conversion technologies (e.g., Power to X)*

Source: Danish Government

Key questions

- **What are the implications of these developments for the future of governance and economic regimes of offshore energy as a natural resource?**
 - Recent developments in offshore wind energy as the only renewable resource to have birthed a new governance regime
 - Focus on EU countries – ~80% of global offshore wind capacity
- **Main implications**
 - Energy Islands – a reconfiguration of established energy (electricity) industry structures around changing economics and policies, in a repeat of historical trends
 - Present features of a natural resource in fixed supply; economic nature of the resource gradually transiting from sub-domain economics of renewable energy to economics of natural resources
 - To unlock their full economic value, offshore energy resources need to be viewed in conjunction with other related natural resources that are in fixed supply – such as land & siting locations
 - The paper provides some key criteria for the design of governance regimes for offshore energy

Outline



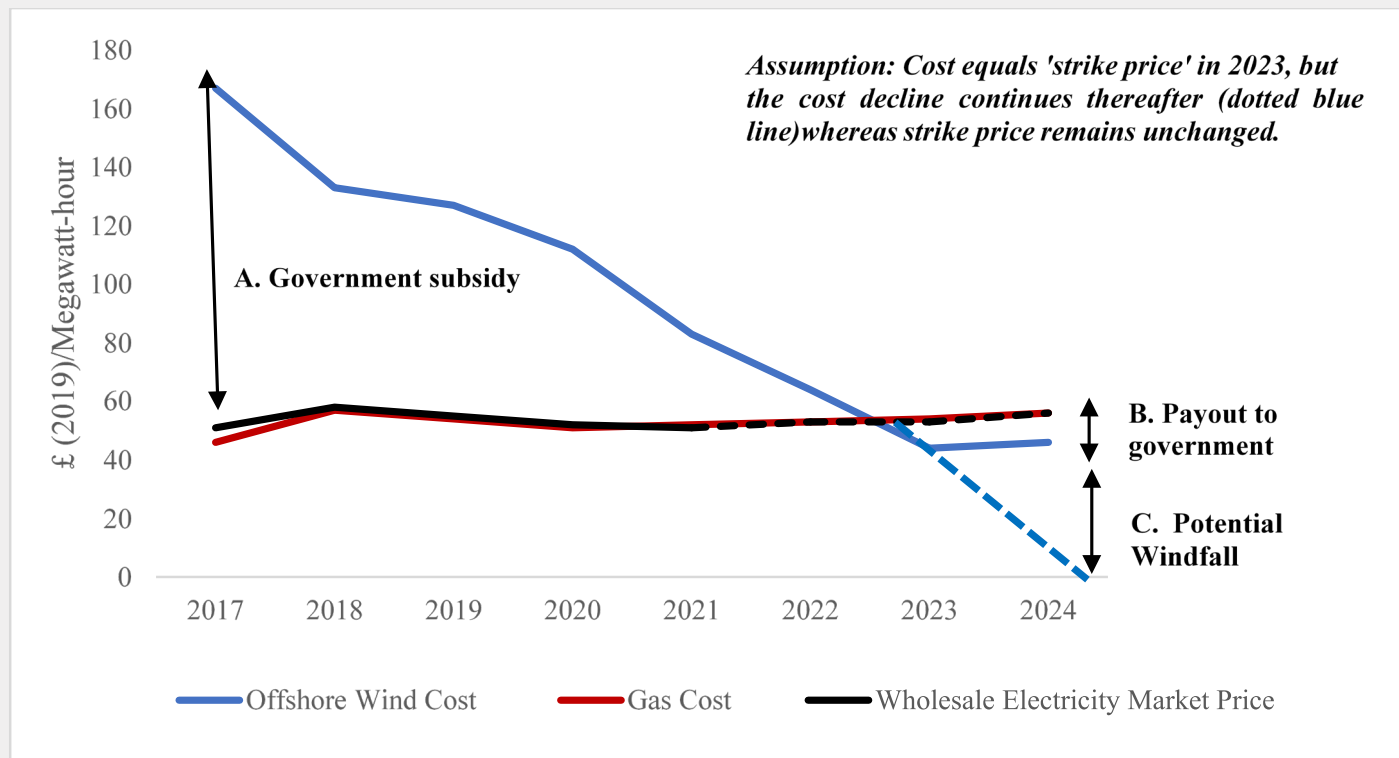
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Offshore renewables as a (new) natural resource



- **Development of offshore renewable energy** (primarily wind) incentivized through subsidy mechanisms which provided a form of revenue stabilization that has allowed projects to ‘get off the ground’
- **These mechanisms served** (i) technological progress and cost reduction through learning-by-doing, and (ii) increased renewable energy output and security of supply
- **As the cost of subsidizing offshore renewables declines** below a threshold level, potential for windfalls increases

Figure 1: Costs of UK generation and existing/projected wholesale electricity prices



Note: We assume the strike price tracks the trend of cost decline in the figure. Cost decline post-2020 is assumed to be linear for illustrative purposes only.

- **In economic terms, siting of offshore renewable energy is constrained by two factors:**
 - **Scarcity of prime sites** (e.g., favourable wind conditions, favourable water depth, relative proximity to large electricity markets, and connection to mainland).
 - **Public concerns** related to noise pollution, visual and biodiversity impacts, land utilization, and **other environmental concerns**
 - Offshore wind energy bundled with scarce natural resources (e.g. land & fixed infrastructure) - in addition to deriving its value solely from being a *renewable resource* (relative to non-renewable, polluting resources or hydrocarbons) presents some features of a *natural resource in fixed supply* - with the potential for earning rent
 - **Value of offshore renewable energy in this context**
 - The inexhaustible nature of renewable energy resources poses new challenges to the concepts of value and rent
 - Though the sun and the wind per se are not scarce, different locations have greater or lesser access to them; i.e. differential rent accrues to different locations
-

Offshore renewable windfalls and governance



- **As cost of subsidizing intermittent renewables is borne by consumers**, case for including provision on utilizing windfalls to spur development of offshore resources or spread its benefits to consumers, or local communities. (E.g. UK Wind Wealth Fund proposal)
 - **Illustrates need for a new governance regime**, separate to the existing incentives for offshore energy development, to capture and distribute any surplus that may be generated over the lifetime of a project
 - **Governments need to adopt a long-term vision** when designing governance regimes
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Experience from offshore energy governance



- **Jurisdictions with similar resource endowments have different outcomes**

- **An example: Norway vs UK offshore governance regime**
 - Norwegian state earned nearly two and a half times more revenue than the UK
 - Norway: proprietorial regime; combination of taxes and fees, State Direct Financial Interests, & dividend from the participation of state-owned petroleum companies.
 - UK: Liberal regime; revenues were obtained mainly from taxes and fees.

Table 1: Norway vs UK Oil and Gas Production and Revenues, 1971-2011

	Norway	UK
Oil Production (Bn. barrels of oil)	25.0	27.9
Gas Production (Bn. barrels oil equivalent)	15.1	14.9
Revenues (US\$ Bn., 2014 prices)	1,197	470
<i>Of which:</i>		
<i>Taxes and Fees</i>	805	470
<i>State Direct Financial Interest</i>	352	0
<i>Statoil Dividend</i>	40	0

A typology of offshore renewable regimes

	Policy Instruments	Role of the State: Functional Mission	Role of the State: Institutional Form
UNITED KINGDOM	<ul style="list-style-type: none"> Sea-bed lease auctions (exclusivity to construct, own, and operate project and receive feed-in revenues) managed by the Crown Estate, awarded on the basis of pre-qualification criteria and option fees. Two-sided CfD auctions for electricity output, contracted with the state-sponsored Low Carbon Contracts Company – based on difference between strike and market prices. Auctions for the operation of offshore transmission assets conducted by Ofgem. 	<ul style="list-style-type: none"> Acts through regulator Ofgem to maximize value from leasing network assets to offshore transmission operator. Appropriates part of revenues from sea-bed leasing through fiscal policy under which 25% of Crown Estate profits are returned to exchequer. Supports early project innovation through output subsidy. Other environmental institutions provide further oversight. 	<ul style="list-style-type: none"> Custodian of natural resources Management of fiscal flows
NETHERLANDS	<ul style="list-style-type: none"> Netherlands Enterprise Agency conducts all subsidy and permit tenders. Land lease reservation fee must be paid in addition to fixed fee until lease award is complete. One-sided CfD mechanism. Separate tenders for projects with/without subsidy – in former, a subsidy equal to difference between market price and cost price is paid by government for fixed period. Additional revenues from green certificates and sale of electricity. TSO (TenneT) is responsible for grid connection, and liable for delays/interruptions. 	<ul style="list-style-type: none"> Acts directly through agency awarding permits and tenders. Supports early project innovation through output subsidy, but for fixed period. Reduces risks for both private developers and for the government, through risk-sharing and site development. 	<ul style="list-style-type: none"> Landowner and custodian of natural resources Entrepreneurial support
NORWAY	<ul style="list-style-type: none"> Auctions with a prequalification process for the allocation of offshore land to ‘bottom-fixed’ wind; qualitative competition for licensing land for ‘floating’ wind (with goal of developing projects that contribute to technology development and cost reductions). Statnett appointed to operate the system; grid facilities to be planned, built and financed by companies holding a licence; grid customers on land are not required to cover the costs of a transmission network at sea. Income from wind power will be taxable for companies considered domiciled in Norway for tax purposes. 	<ul style="list-style-type: none"> Takes on a more active regulatory role e.g. differentiation of assets and land sites ex ante and ex post. Differentiation between offshore and onshore network and cost-sharing of grid connection ensures that offshore network customers face the real costs of building and operating offshore networks to the greatest extent possible; and grid rent is kept low. 	<ul style="list-style-type: none"> Landowner- Regulatory oversight from state. Management of fiscal flows in synergy with offshore hydrocarbon resource development.

A typology of offshore renewable regimes (2)

	Policy Instruments	Role of the State: Functional Mission	Role of the State: Institutional Form
GERMANY	<ul style="list-style-type: none"> Federal Maritime and Hydrographic Agency awards competitive tenders to bidder offering lowest tariffs. In German EEZ, no land rights need to be secured as area is not owned by anyone. A market premium payment on the basis of a CfD concept, and a feed-in tariff payment. Successful bidders entitled to grid connections; two private TSOs, TenneT (North Sea) and 50Hertz (Baltic Sea) responsible for financing, construction and operation of all grid onshore connection systems. 	<ul style="list-style-type: none"> Acts directly to award and incentivize projects in favourable sites or locations. Risks are borne by consumers – the developer is protected up to a significant percentage against lost revenues resulting from delays or grid interruptions; TSOs are also entitled to reimbursement of connection costs through consumer levies. 	<ul style="list-style-type: none"> Custodian of natural resources. Entrepreneurial support.
DENMARK	<ul style="list-style-type: none"> Licences issued by the Danish Ministry of Climate, Energy and Utilities obtained through open-door procedure or tender. Developers may need to negotiate with local landowners and commercial fishing community for onshore connection locations. Remuneration based on fixed tariff for electricity produced corresponding to a certain number of full-load hours after grid connection. Price supplements granted as variable premium covering difference between market and fixed price, not exceeding certain statutory amount – a two-sided CfD. Some developers granted guaranteed bonus. Energinet responsible for grid connection but developer must pay costs of construction. Energinet liable to compensation for delays. Energy islands: State has 50.1% stake in the overall project. Social and labour clauses included for local communities to benefit. 	<ul style="list-style-type: none"> Acts both directly and through extensions of the state to support projects. State is the custodian of land on behalf of citizens, with site development carried out by the bidder. Supports social welfare separately, through mandating the initiation of positive local spillovers related to labour markets and other social impact schemes. 	<ul style="list-style-type: none"> Landowner and custodian of natural resources. Entrepreneurial support.
BELGIUM	<ul style="list-style-type: none"> Federal structure complicates ownership, but all preparation for competitive bidding procedure is carried out by the government and the network operator in consultation with the Commission for Electricity and Gas Regulation. Support schemes consist of: (i) a system of green certificates and guarantees of origin issued in exchange for quantities of produced offshore renewable energy that can either be sold to the network operator at a minimum guaranteed price or on the market at a higher price; and (ii) a cable subsidy, which has to be included as part of the bid. TSO (Elia) is responsible for financing, construction and operation of grid connections. Cost for the submarine cable is shared between Elia and the developers/operators. 	<ul style="list-style-type: none"> The role of the State is diluted by the federal political structure, but state agencies cooperate to catalyze the conditions necessary for competitively bid tenders to succeed. The State's role is underpinned by Royal Decrees. 	<ul style="list-style-type: none"> Custodian of natural resources Regulatory oversight from state

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Five stylised roles of the State



1. The Landlord State

- State owns land upon which the resource is situated, and leases it to developers.
- Objective: generate as much ground rent as is possible over the lease period.
- Revenues flow into national budgets & used as state expenditure.

2. The Custodian State

- State is custodian of resources on behalf of citizens
- Objective: maximize the value of the resource for citizens through securing favourable contractual terms (e.g. state participation)

3. The Entrepreneur State

- State takes active role in development & monetization of the resource
 - Direct equity participation, joint operatorship, state-owned enterprise (e.g. energy producer or infra provider) operating at arms' length & subject to same regulatory rules as private sector
-

Five stylised roles of the State (2)



4. The Fiscal State

- 'Traditional' role of taxation of income and rents over & above normal return
- May revisit fiscal terms ex ante (e.g. windfall taxes) or ex post (e.g. higher corporate income tax)

5. The Regulatory State

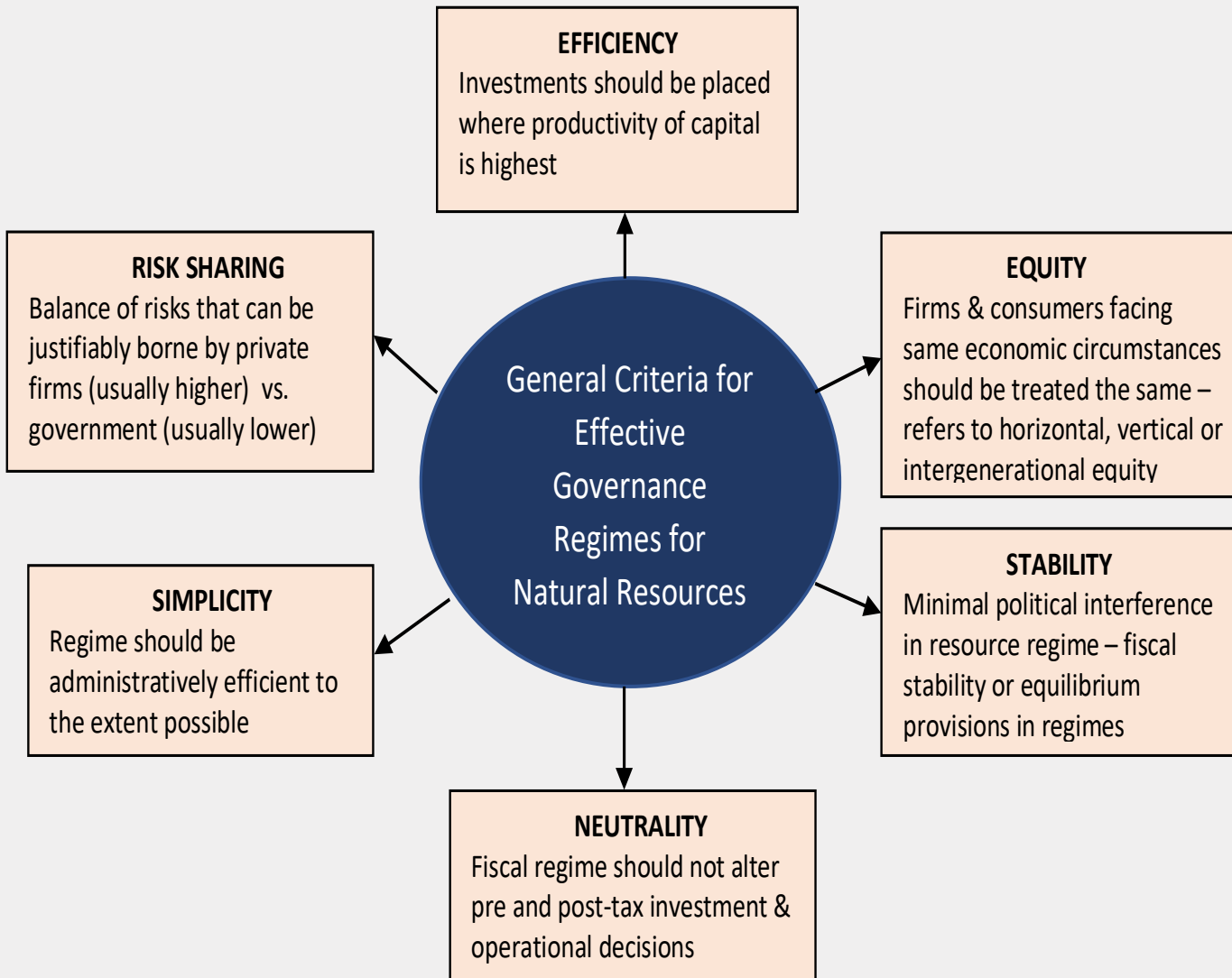
- Does not directly engage in provision of energy and other welfare goods & essential services
 - Intervenes to correct market failures
 - Provides conditions conducive to the competitive provision of energy goods & services through:
 - loosely coordinated sets of public agencies, and,
 - replacing pure public ownership of energy assets with a network of private (or public) developers or providers, regulated by specialized agencies operating at arms' length from the government under a transparent legislative framework
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Key criteria for offshore governance regimes




- **Neutrality vs simplicity.** The design of neutral regimes requires detailed information.
- **Neutrality vs revenue generation and efficiency.** E.g. of a neutral tax conceived for offshore hydrocarbons is the ‘Brown Tax’ i.e. governments paying out a subsidy to incentivize exploration, converted into a tax when production reached a particular level.
- **Equity vs simplicity and efficiency:** ‘equity’ or ‘fairness’ takes different meanings to different taxpayers. An equitable tax is not simple to administer – for e.g., a ‘progressive profit tax’ requires information on costs and profits.
- **Stability vs fiscal risk -** Fiscal systems resemble incomplete contracts and seldom remain unchanged for long periods.

Evaluation of trade-offs for new offshore energy governance regimes



	Landlord State	Fiscal State	Custodian State	Entrepreneur State	Regulatory State
Efficiency	Does not meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Meets criterion	Meets criterion
Risk-Sharing	Does not meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Meets criterion	Ambiguous – can be tailored to meet criterion
Simplicity	Meets criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion
Equity	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Meets criterion	Meets criterion
Stability	Ambiguous – can be tailored to meet criterion	Does not meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Meets criterion
Neutrality	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Ambiguous – can be tailored to meet criterion	Meets criterion	Ambiguous – can be tailored to meet criterion

 Does not meet criterion

 Ambiguous – can be tailored to meet criterion

 Meets criterion

Source: Compiled by Authors; subjective classification

Evaluation of trade-offs for new offshore energy governance regimes (2)



	Landlord State	Fiscal State	Custodian State	Entrepreneur State	Regulatory State
Efficiency	NOR, DEN	NOR, UK	UK, N, GER, DEN, BE	N, GER, DEN, NOR	NOR, BE
Risk-Sharing	NOR, DEN	NOR, UK	UK, N, GER, DEN, BE	N, GER, DEN, NOR	NOR, BE
Simplicity	NOR, DEN	NOR, UK	UK, N, GER, DEN, BE	N, GER, DEN, NOR	NOR, BE
Equity	NOR, DEN	NOR, UK	UK, N, GER, DEN, BE	N, GER, DEN, NOR	NOR, BE
Stability	NOR, DEN	NOR, UK	UK, N, GER, DEN, BE	N, GER, DEN, NOR	NOR, BE
Neutrality	NOR, DEN	NOR, UK	UK, N, GER, DEN, BE	N, GER, DEN, NOR	NOR, BE

■ Does not meet criterion

■ Ambiguous – can be tailored to meet criterion

■ Meets criterion

UK-United Kingdom N-Netherlands, GER-Germany, DEN-Denmark, NOR-Norway, BE-Belgium

Source: Compiled by Authors; subjective classification

Summary: broad implications of the New Energy State



1. Logic of collective action & the regulatory state

➤ Future regimes will differ from previous as products not traded on international markets but supplied to localized (regional or country) markets with specific characteristics and contexts. Economic & security of supply concerns.

2. Maximizing the economic value of renewable energy

➤ Regimes should unlock, maximize, & balance economic value of offshore renewable energy for stakeholders and citizens. E.g. through lower/less volatile electricity prices, or capturing value in other ways (e.g., through fiscal arrangements).

➤ Necessitates a clearer definition of “value” for offshore renewable energy

3. Incentivise investment in line with entrepreneurial & regulatory state

➤ Identify & allocate balance of risks between different parties; risk-takers receive sufficient incentives to carry projects to completion.

4. Supporting unprecedented innovation effort

➤ Government support plays important role at early stage – entrepreneurial state.

Thank you

CSEI Working Paper

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