

Why long-term contracts are key design features of future electricity markets

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**The short-term energy-only
markets work very well
for dispatch**

...not so much for investment

We need to add strong long-term signals

Academic literature converged into common notion that 'hybrid' markets combining short-term and long-term price products are necessary in the new investment environment

FOUNDATION FOR INVESTMENTS IN ELECTRICITY MARKETS

Last century

SPREADS

- 80-90% of lifetime cost are variable fuel prices
- Majority of energy investments by state / state-owned companies
- High shares of equity
- No political investment / build-out targets

This century

FINANCING

- 85-90% of lifetime cost are upfront investment
- 73% of global energy investments today rely on commercial financing
- Debt financing a cornerstone of clean energy projects
- Huge investment gap to NZE scenario

Political targets for fossil phase-out & low cost energy supply require massive low-cost investment in renewables

- 1) Mismatch between cost and income structure impedes (low-cost) financing for renewables: long-term contracts are necessary**
- 2) Limited demand-side participation in long-term contracting & lack of emerging long-term products**

States must take a more proactive role

Viable options for long-term contracting

(in connection with energy-only markets)

1) Forwards

2) Power-Purchase Agreements (PPA)

3) Contracts-for-Difference (CfD)

Building blocks approach for long-term contracting

Longer term products (10+ years)
More complex products
Ensure liquidity for all products

Strengthening the
Forwards market

Boosting the
PPA market

Product diversification
Securisation
Simplified access across regions
Standardisation



Contracts-for-Difference
Contracts-for-Difference as safety net

Smart designs that do not unduly
distort market operations

**CfDs increasingly solve a "missing market" problem,
rather than a "missing money" problem**

How should the safety net look like?

Not as previously

Either

Price Stabilisation

Or

Exposure to price risk

Long-term
price
volatility

Short-
term price
volatility

Extreme
price
events

But as state-of-the-art

Both

Price Stabilisation

And

Exposure to price risk

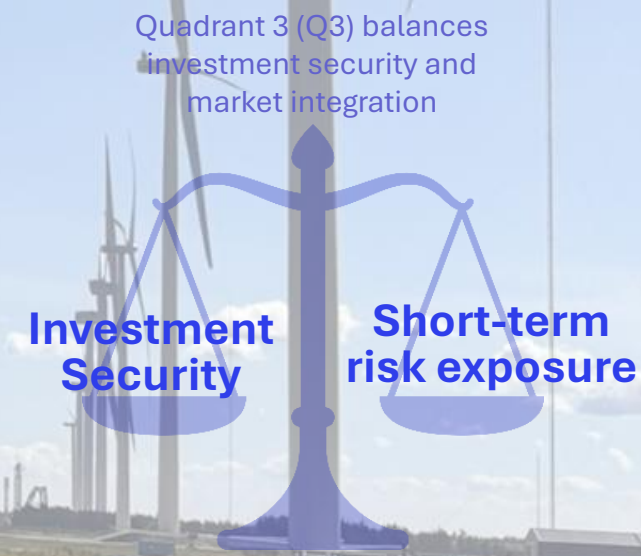
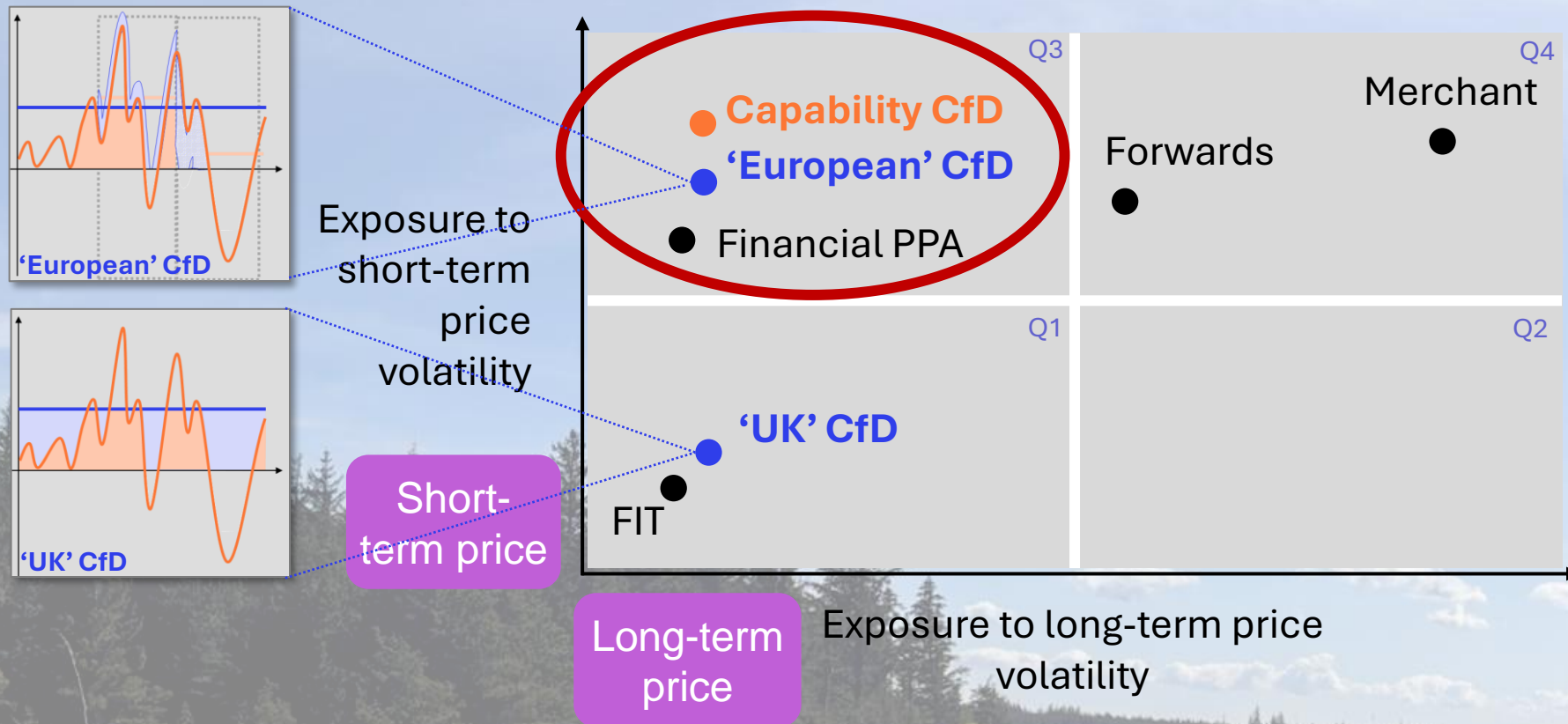
Stable
long-term
price

Variable
short-
term price

Differentiating short-term and long-term price risk

Two options:

- 1) Decoupling reference prices from spot variation through longer-term reference prices
- 2) Decoupling applicable volume from actual production



Conclusions

- **Keep the short-term markets – add strong long-term contracting**
- **Proactive building block approach:
Strengthen Forwards markets
Boost PPA markets
Provide CfD safety net**
- **Make use of smart contract design (‘financial engineering’) –
differentiating price risk types and exposing to short-term risk only**

THANK YOU

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References

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DTU



European CfD Implementations

Table 1: CfD schemes implemented in European countries

Country	Duration (Years)	Reference period	Referencing method	Other features
DK	20	Annual	Uniform	Limited clawback / net payment cap
FR	20	Monthly	Volume-weighted	Premium for curtailment during negative prices
GR	20	Monthly	Technology-specific	-
HU	up to 25	Monthly	Technology-specific	-
IE	20	Hourly	n/a	Compensation for unrealised available energy
IT	up to 30	Hourly	n/a	-
PL	15	Daily	Volume-weighted	-
PO	15	Hourly	n/a	-
ES	up to 20	Hourly	n/a	Adjustment factor for remuneration at market price / Electricity market is regarded
UK	15	Hourly	n/a	-

Notable European CfD Designs:

- Denmark: Thor (offshore wind)
 - Annual, baseload reference price
 - Dynamic clawback
- Spain:
 - Mixed-market reference index (day-ahead / intraday)
- France: Normandy (offshore wind)
 - Capacity-based element:
 - Compensation for each hour of pausing production during negative prices (beyond 40 hours annually) = $0.7 \cdot \text{strike price} \cdot \text{capacity}$
- Belgium: Princess Elisabeth (offshore wind)
 - Capability-based (AAP)

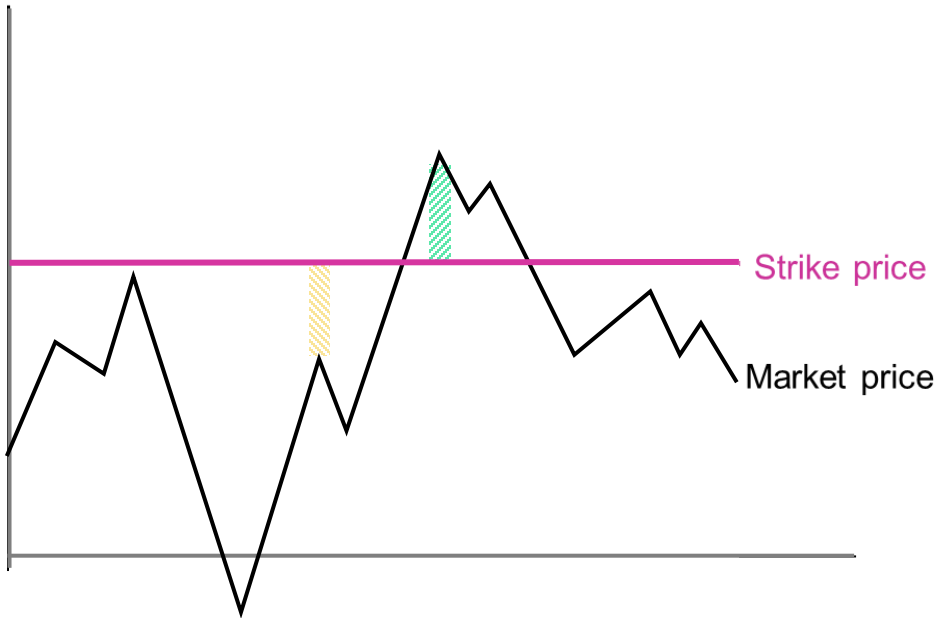
Source: Lena Kitzing, Anne Held, Malte Gephart, Fabian Wagner, Vasilios Anatolitis, Corinna Klessmann, Contracts-for-Difference to support renewable energy technologies: Considerations for design and implementation, Research Report, RSC/FSR March 2024, Robert Schuman Centre, Florence School of Regulation, European University Institute, <https://fsr.eui.eu/publications/?handle=1814/76700>

How are we exposing renewables to short-term price variations via Contracts-for-Difference?



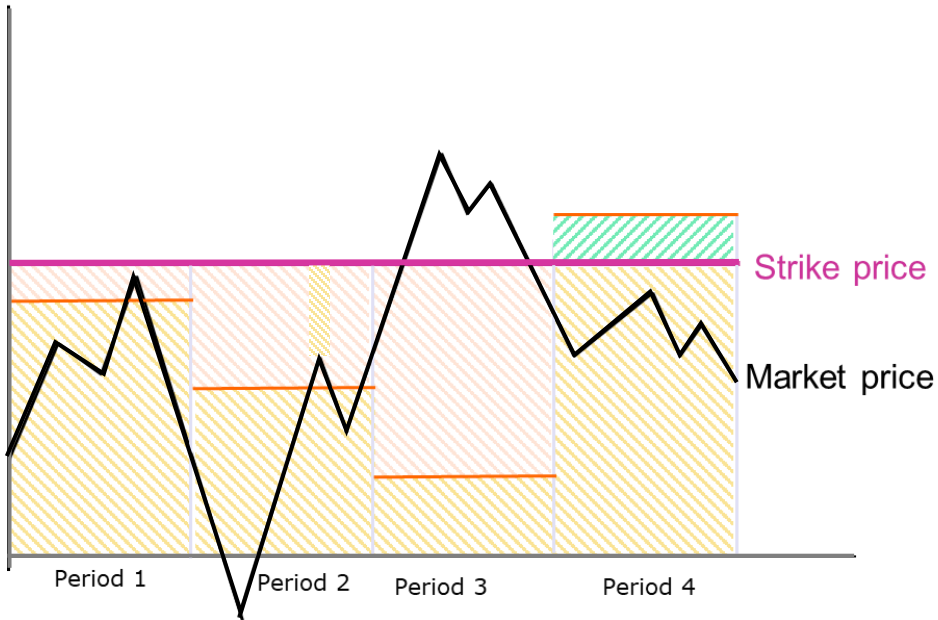
iea wind

'UK' CfD



- **Early CfD Model (no averaging of prices):**
 - Premium calculated based on the difference between hourly captured spot-price and CfD strike price.
 - No incentive for increasing market value of production as lower captured prices offset by higher subsidy ('produce-and-forget')

How are we exposing renewables to short-term price variations via Contracts-for-Difference?



Hybrid CfD Model (averaged reference prices):

- Premium calculated based on difference between average spot price and CfD strike price over defined period – average price can be determined technology-weighted or flat (baseload)
- **Stabilisation of long-term revenues while exposure to short-term price volatility**
- Incentive for increasing market value through plant locating, layouting and operational decisions
- Increased price and volume risk for developer due to political decisions affecting market values and negative prices

*'European'
CfD*