STAKEHOLDER CONSULTATION WORKSHOP

On

Designing a BCS-Style Framework for India

Session 3 : International Case Studies

Topics

1. **Introduction and background**
2. **A European journey**
3. **Australia**
4. **Some conclusions**

Introduction and background

Options considered for enabling RE participation through BCS

Options	Settlement Details
Option-1: Single strike price for entire contract tenure	▪ A fixed strike price is paid to RE generators for the full duration of the contract. ▪ Settlement is done every 15 minutes via Pay-in/out if the market price differs from strike price.
Option-2: Strike price range	▪ RE generators are assured a minimum and maximum price per MWh of output. ▪ They are exposed to market prices within this band. ▪ If market prices fall outside the range, 15-minute Pay-in/Pay-out settlements are triggered.
Option-3: Revenue support during high prices	▪ RE generators quote a fixed strike price for the entire contract term. ▪ If market price exceeds the strike price, generators retain the gains. ▪ If market price falls below the strike price, the shortfall is compensated. ▪ Settlements are conducted every 15 minutes basis on price deviations but revenue support is limited upon monthly adjustments.
Option-4: Weekly Average Market Price Top-Up	▪ RE generators participate fully in the market. ▪ If the weekly average price earned is lower than the weekly market average, a top-up is provided. ▪ If the generator earns more than the weekly average market price, a portion of the excess may need to be refunded. ▪ Generator may be allowed to retain part of the excess revenue as incentive.

Examples of these are found in the case studies

Objectives of the case studies

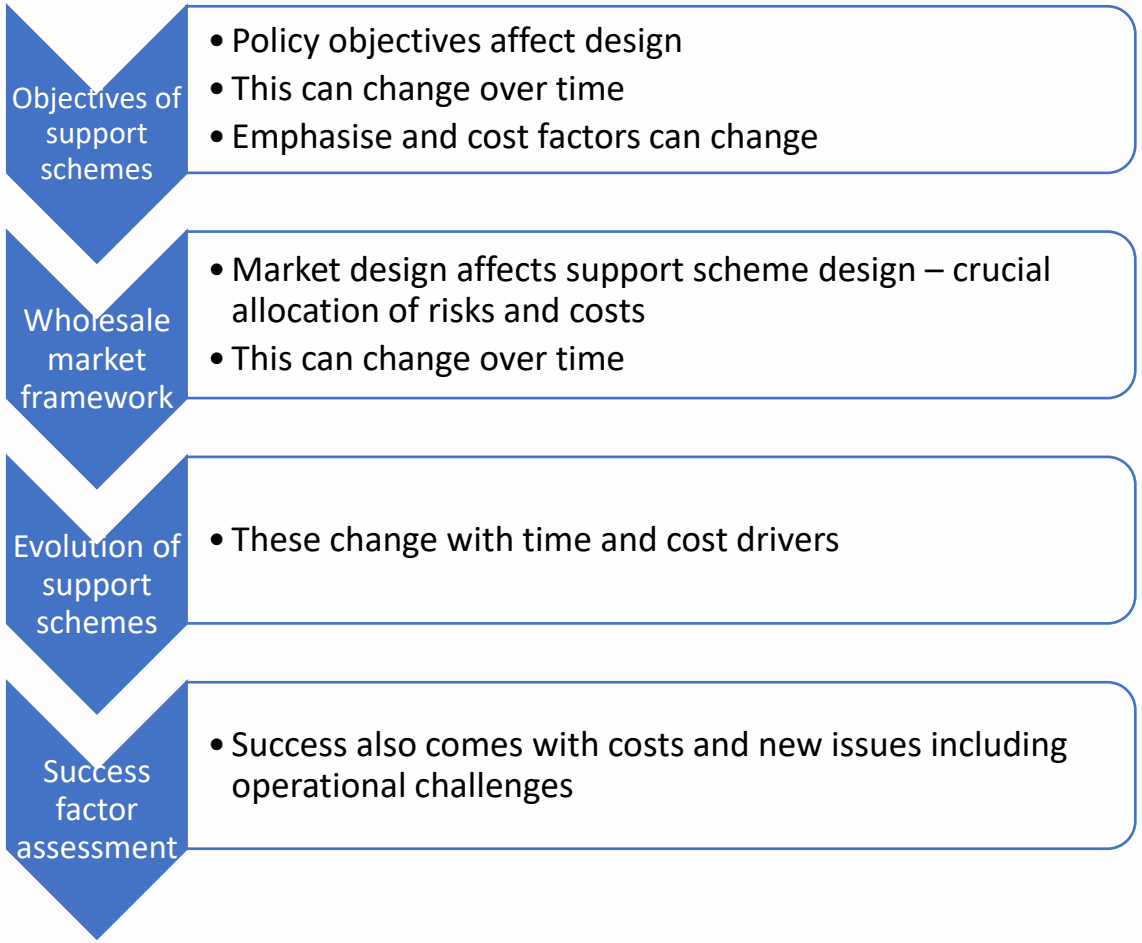
India policy objectives:

- Overcome defects in legacy arrangements (silo effect inefficiencies)
- Need for contractual support for low-cost renewables
- Liquidity in national spot markets – benchmark pricing

The baseline assessment scope:

- Review commercial mechanisms in India
- BCS as an option for guarantees to efficient renewables investment
- Assess market opportunities
- **International benchmarking – renewables support alternatives**
- Risks benefits and impacts (of BCS-style arrangements)

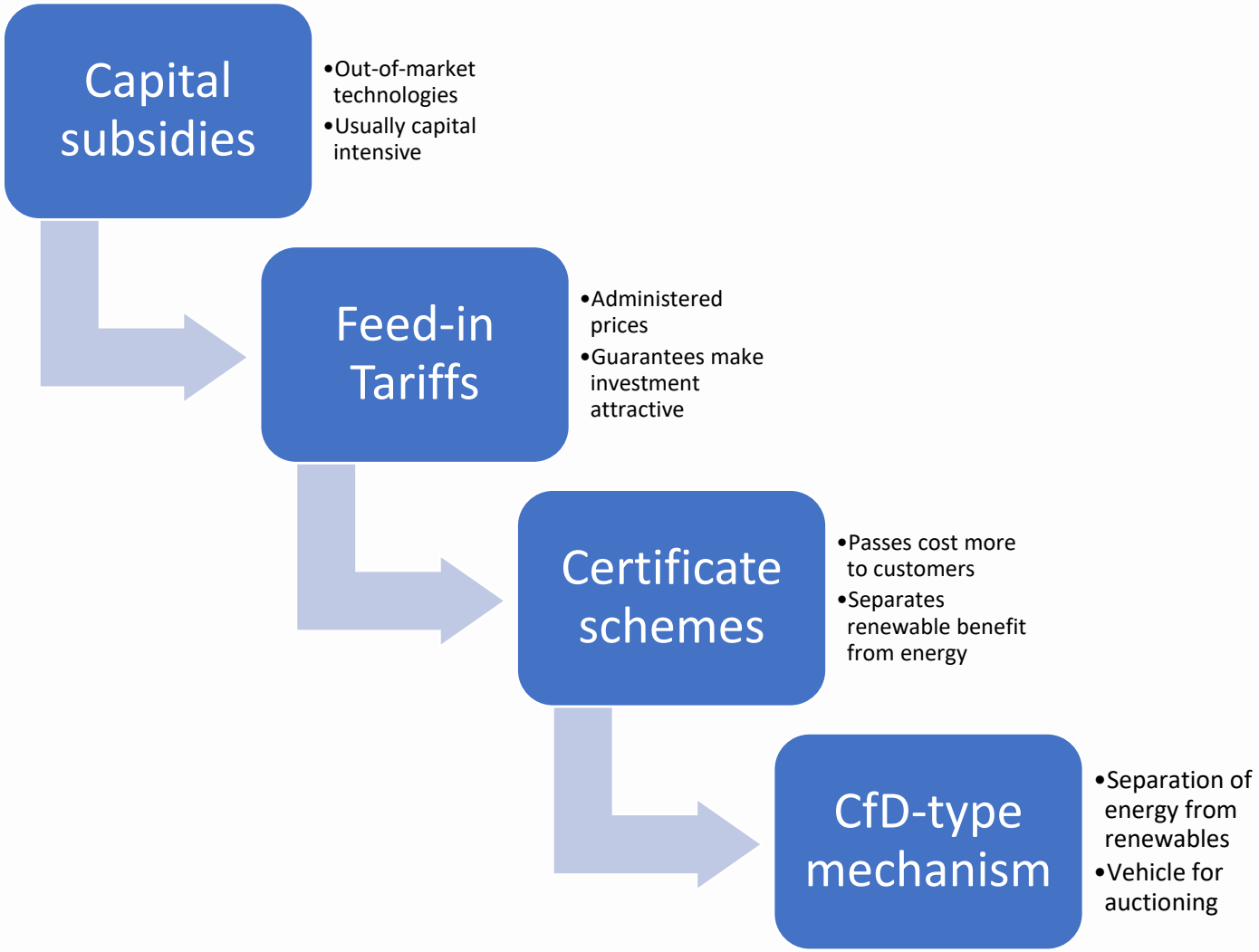
International benchmarking



Europe offers examples of 10 different BCS variants

Options	Description
1 Two-way, symmetric CfDs (intermittent)	These are seen in the UK and allow intermittent producers (e.g solar and wind) to capture the differential when the reference price falls below the strike price, but also the buyer to 'clawback' the differential when the reference price rises above. A fixed strike price is established at competitive auction and indexed in line with the CPI. The reference price is set hourly as the weighted average of the two day-ahead auctions.
2 Two-way symmetric CfDs (baseload)	These arrangements are designed for baseload generators (e.g biomass, geothermal and nuclear) and have a reference price which is set six-monthly on the average of the forward market price, instead of the DAM price.
3 One-way, contract-for-premium CfDs	These are seen in Germany and do not require producers to pay-back when the reference price rises above the strike price. These also do not payback during periods of negative pricing.
4 Partially symmetric CfDs	These types of CfDs are used in Spain and led to famously low strike prices in 2021 auctions. They are comparably short compared to the 15-year duration of Conventional CfDs, coming in at 12 years, and deviate in one key way. Producers are obligated to provide the offtaker with a certain amount of electricity at the bid price (which in the Spanish case was low and unprofitable for generators) but any remaining above this amount could be sold at market.
5 Cap and floor CfDs	These types of arrangements have been used for example by Ofgem in incentivising long duration energy storage (LDES). They stipulate a floor which guarantees the recovery of project costs (including a return) and a cap which prevents developers from making excessive profits.
6 Capability-based CfDs	This arrangement has been led by Denmark after the failure of 2024 auctions to procure developments because of 'untenable commercial risk.' These untether actual electricity output from capacity to deliver, rewarding what the project could have produced, not what it did produce.
7 Hybrid CfDs	These arrangements have been developed in response to the implications of high penetration of intermittent generation in power systems. They seek to reward delivery of firm supply, thereby incentivising 'hybrid' projects where intermittent generation and energy storage might be co-located to provide dispatchable services.
8 Carbon Contracts for Difference (CCFDs)	This arrangement is aimed at supporting industrial decarbonisation by supporting companies to invest into low-carbon sources of energy, and in particular, hydrogen. It involves the uplift of the EU ETS carbon price up to a bilaterally agreed strike price in order than investors might hedge risk against the fluctuation of the carbon price.
9 Locational CfDs	These types of contracts were introduced at the Scandinavian electricity exchange, Nordpool, in 2000. There can be substantial price variations across space as well as time due to transmission congestion. CfDs allow market participants to manage the risks of these locational pricing spreads, and act in both directions so can be positive, negative or zero.
10 Financial CfDs	These arrangements are completely independent from generation (similar to capability based CfDs) and additionally may address weather-related volume and liquidity issues for generators. Generators redeem a fixed hourly remuneration from the government which is determined upfront by auction. They are then obligated to pay back hourly the differential between this price and the reference price, which equals the full hypothetical market revenue of the reference generator (minus any operational costs).

Common theme for renewable support mechanisms



Common issues

- **Who pays?**
  - Government or buyers
- **Allocation of risks at each stage of development**
  - Investor/ buyer?
- **Balancing risk**
- **Efficient investment incentives**
- **Efficient operation of the renewables**
- **Cost and price control**

International case studies – market environment

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Great Britain

- Bilateral Contract Market with balance responsibility
- (formerly gross pool)
- Now developed day ahead market
- Capacity market separate

Germany

- EU Target model with bilateral contracts, balance responsibility and day ahead and intraday markets
- No capacity market

Greece

- EU Target Model (fairly recent implementation)
- Dispatch optimisation added in
- Separate arrangements for the islands

Australia

- Coverage is Eastern and Southern Australia
- 5-minute spot market
- Thin network so islanding common

Policy objectives for renewables – a common theme

Net zero	• International commitments • Avoidance of carbon pricing penalties
Diversity of supply and self-sufficiency	• Reduced dependence on fossil fuels and coal in particular • Reduced imports (fossil fuels and electricity)
Encourage renewables development	• Support to encourage private sector investment
Reduce cost	• Consumer cost from now cheap renewables • incentives to encourage efficient investment and operation

Case study results

European countries

A European journey – UK evolution

1990-1998

- Non-Fossil Fuel Obligation
- Buyer obligation to contract at a premium price over pool price
- Generators bid for contracts at auction

2002-2014

- Renewable Obligation Certificate (ROC)
- Certificate awarded to generators per MWh generated
- Supplier Obligation to acquire certificates against an obligation to redeem certificates as % of MWh sold or pay a buy out penalty

2014-

- CfD contracts auctioned by technology
  - No caps or collars to pay out
- Pay-as-clear auction outcomes
- Central counterparty for CfD contracts
- Fully firm access for generators

Evolution driven by changing environment and objectives

- Small beginnings: not worried about impacts
- Need for more incentives but still reliant on markets

Choice of supplier obligation

- No effective central DAM in 2002
- Market incentives on investment

CfD allows move to controllable net cost

- Balance responsibility but return to defined strike price

UK ROC scheme: defects in design

Long-term price risk	• Certificate price subject to collapse if too many certificates issued • Needed mechanism to increase obligation to prevent this • Reliant on energy price for revenue certainty for generator • Buyout price design made this variable
Short-term price risk	• Energy price volatility affecting revenue stream of generator • This is a cashflow issue more than a revenue issue
Technology selection	• Designed as technology neutral initially – later adjustment to award multiples of certificates to favoured technologies
Customer cost	• Inframarginal rent retained by generators regardless of initial costs – this is different from thermal generation because most renewable technologies are zero variable cost • Partial mitigation of customer cost in that long-term inverse correlation between energy price and certificate price through fall in renewables investment when energy prices drop

UK BCS scheme: main features

BCS type	Counterparty	Auction parameters	Payment flows	Limits on BCS contract	Firmness of energy sales

• Contract for Difference
• Reference price from day ahead market hourly price
• Contracts awarded at pay-as-clear technology specific auctions
	• Low Carbon Contract Company
	• Non-profit regulated TSO company
		• Government designs auctions and sets parameters
		  • Pre-qualification registration and rules
		  • Auction budgets
		  • Technology tranches
		  • Reserve price caps
		  • Descending clock design
		• Regulator as arbiter and disputes manager
			These occur within a day or two of physical delivery
			1. Generator nominates volume to power exchange and receives the clearing price that day (PX buyers pay out for the energy)
			2. Generator meter reading leads to CfD payment adjustment paid to/by LCCC
			3. Energy imbalances calculated and paid out
			4. LCCC collates payments and charges suppliers
				• No price limits
				• Payout even when reference price goes negative
				• BCS contract does not pay out on energy offered for sale but not taken
					• Fully firm
					• Constraints on market fully responsibility of TSO
					• System balancer compensates for curtailment through the balancing market but only for the energy

A European journey – Germany evolution

1990-2014

- Feed-in Tariffs
- Must-buy obligation on network operators at Government-dictated cost
- Tariffs for generators set by Government
- Degression of tariffs from 2004
- Storage added in 2012

2014-2016

- Feed-in 'Premium' – generators exposed to market energy prices
- Network obligation to buy remained
- Cost continued increased through increase in renewables penetration

2016-

- 1-way CfD contracts auctioned by technology
  - CfD only paid premiums (but paid zero when reference price zero)
- Pay-as-bid auction outcomes
- Central counterparty for CfD contracts – taxpayers paid (not consumers)

Evolution driven by changing environment and objectives

- Small beginnings: not worried about impacts
- FiTs became attractive in 2006 – change in affordability of scheme

Choice of Feed-in Premiums about cost control

- Reliant on good premium to provide investment incentive
- But rising costs remain

CfD allows move to controllable net cost

- Balance responsibility but return to defined strike price

German Feed-in Scheme: defects in design

Long-term price risk	• Fully covered • Lowers cost to generator financing but reliant on administered calculation of rate • Degression of calculated prices after 2006 but no recalculation to reflect falling costs
Short-term price risk	• Fully covered
Technology selection	• Not covered • Prices available for a range of technologies but no budget control on extent of investment
Customer cost	• Inframarginal rent retained by generators regardless of initial costs – this is different from thermal generation because most renewable technologies are zero variable cost • No cap on generation so no effective cap on customer cost • Degression did little to track falling technology costs

A European journey – Greece evolution

1994-2006
2006-2016

- Feed-in Tariffs emphasising smaller schemes
- Many isolated islands
- New law in 2006 increased investor incentives
- Gradual expansion for more eligible technologies
- Tariffs for generators set by Government
- Retroactive cuts in payment in 2012 due to scheme deficits

2016-

- Feed-in 'Premium' – larger scale projects
- Auctioned by technology
- Payment mechanism works a bit like a 1-way CfD with the premium calculated monthly

2021-

- Gradual replacement of FiT Premium arrangements
- Technology specific volume capped auction
- Sealed bid pay-as-bid auctions
- 2-way CfD
- Central counterparty for CfD contracts (HENEX)

Evolution driven by changing environment and objectives

- Small beginnings: not worried about impacts
- Government-mandated incentives to generators
- No cap on projects connection

Choice of Feed-in Premiums about cost control

- For larger projects
- But rising costs remain

CfD allows move to controllable net cost

- Balance responsibility but return to defined strike price
- Remove

Case study results

Outside Europe

Australia – Support evolution

2008 -

- Feed-in Tariffs for small schemes
- State-level schemes
- Popular with widespread deployment, especially South Australia rooftop solar
- High prices offered

2022-

- National BCS (called CIS Mechanism for renewables and storage)
- Auctioned by technology
- Floor and ceiling strike prices

Drive for renewables deployment

- Feed-in tariffs encouraging small-scale deployments
- Displacement of fossil fuel generation

BCS (CIS) scheme for largescale deployments

- Same rationale as small-scale
- Costs feed through to electricity prices

Australian BCS scheme: main features

BCS type	Counterparty	Auction parameters	Limits on BCS contract	Firmness of energy sales
• Contract for Difference • Upper and lower strike prices • Contracts awarded at pay-as-bid technology specific auctions	• National government as counterparty • AusEnergy Ltd administers scheme	• Single stage auction process • State-level adjustments to meet local needs for renewables so separate tenders • Separate tenders for dispatchable capacity (including BESS) • Pay-as-bid tenders • Selection based on both price and quality (financial value, deliverability)	• Individual contracts • Energy settled at market price but top-up or rebate paid to or by generator when energy price outside the tolerance band	• No compensation for curtailment

Conclusions

Lessons for India

BCS advantages

Lowers cost of investor financing	• Guaranteed return – risk on buyer • Protection against short-term price volatility • Risk can be socialised across customers
Cost control	• Cap on auction volume contracted • Auction price caps
Technology selection	• Can promote new technologies and diversity • Policy control on technology selection • Assist with system management development
Operational efficiency	• Balancing costs retained by generator = efficient forecasting incentive

Issues with BCS

Problems of success

- Cost of maintaining thermal generation for security of supply and ancillary service provision due to displacement be VRE (including lower capacity factors affecting viability)
- Reduction in rotating mass from inverter-connections of VRE – inertia issue
- 'Duck'-curve effect from significant solar as part of excess VRE generation when demand is low
- Reconfiguration of transmission system due renewables no longer in previous generation locations

Problems associated with BCS mechanisms

- Long-term and short-term price risk affecting viability of counterparty
- Cost to customers (same problem as support through FiTs)
- Curtailment payment mechanisms
- Excess energy in the DAM (lack of liquidity in that market)
  - Can be partly mitigated by generators selling some energy outside of the PX under bilateral contract (but still bound by payments under the PX reference price

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