

Appendix – Overview of Australian Wholesale Demand Response Mechanism (WDRM)

Outline

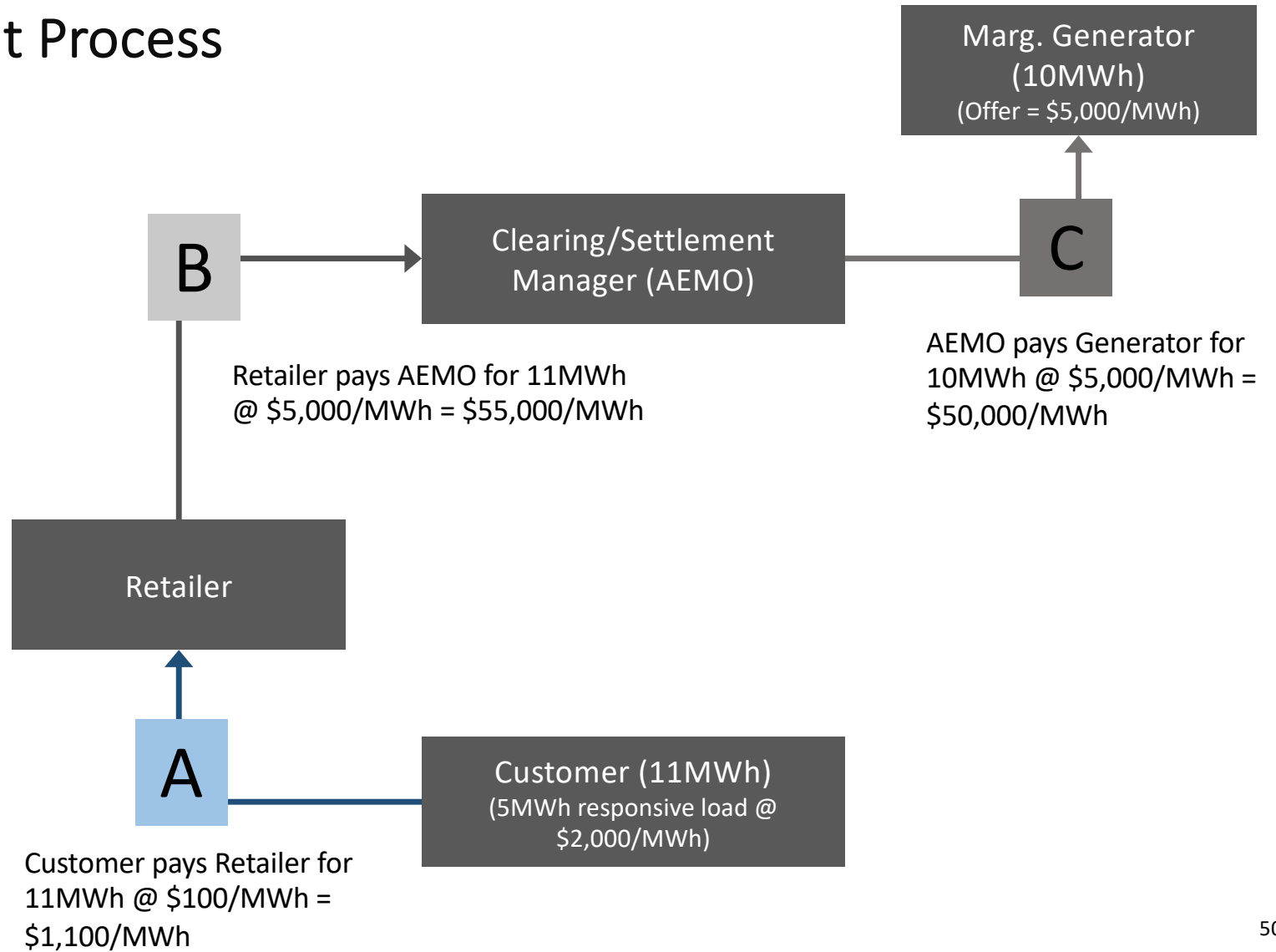
1. WDRM payment flows vs standard settlement processes
2. Worked example and outcomes
3. Comparison to other DSF-incentivising mechanisms
4. Insights, Risks
5. Advantages/Disadvantages

Standard Settlement Process

- A** Retail tariff x Metered consumption
- B** Metered quantity x Market Clearing Price
- C** Payment for generation

EXAMPLE PARAMETERS

Wholesale Price: \$5,000/MWh
 Consumer "baseline": 11MWh
 Consumer responsive: 5MWh
 Consumer Actual: 11MWh
 Retail Tariff: \$100/MWh



NEM's WDRM 'negawatt' design

- Introduces a new entity, the Demand Response Service Provider (DRSP) to be the customer's "agent"

B

- Introduces three amendments to the settlement process:

D

- Payment B (retailer wholesale settlement) is no longer based on the consumer's metered consumption, but on their **baseline consumption** (what they are assessed to have consumed in the counterfactual - no response – scenario)

E

- A new Payment D - the consumer's assessed **response quantity** (**baseline consumption** minus metered consumption) multiplied by the market clearing price. This is paid by AEMO to the DRSP

F

- A new Payment E – the consumer's **response quantity** multiplied by a "wholesale demand regional reimbursement rate" (WDRRR), which is collected by AEMO from the DRSP and paid to the retailer. This is intended to be a reimbursement to the retailer for the retail income it no longer earns from the customer, as a result of their response.

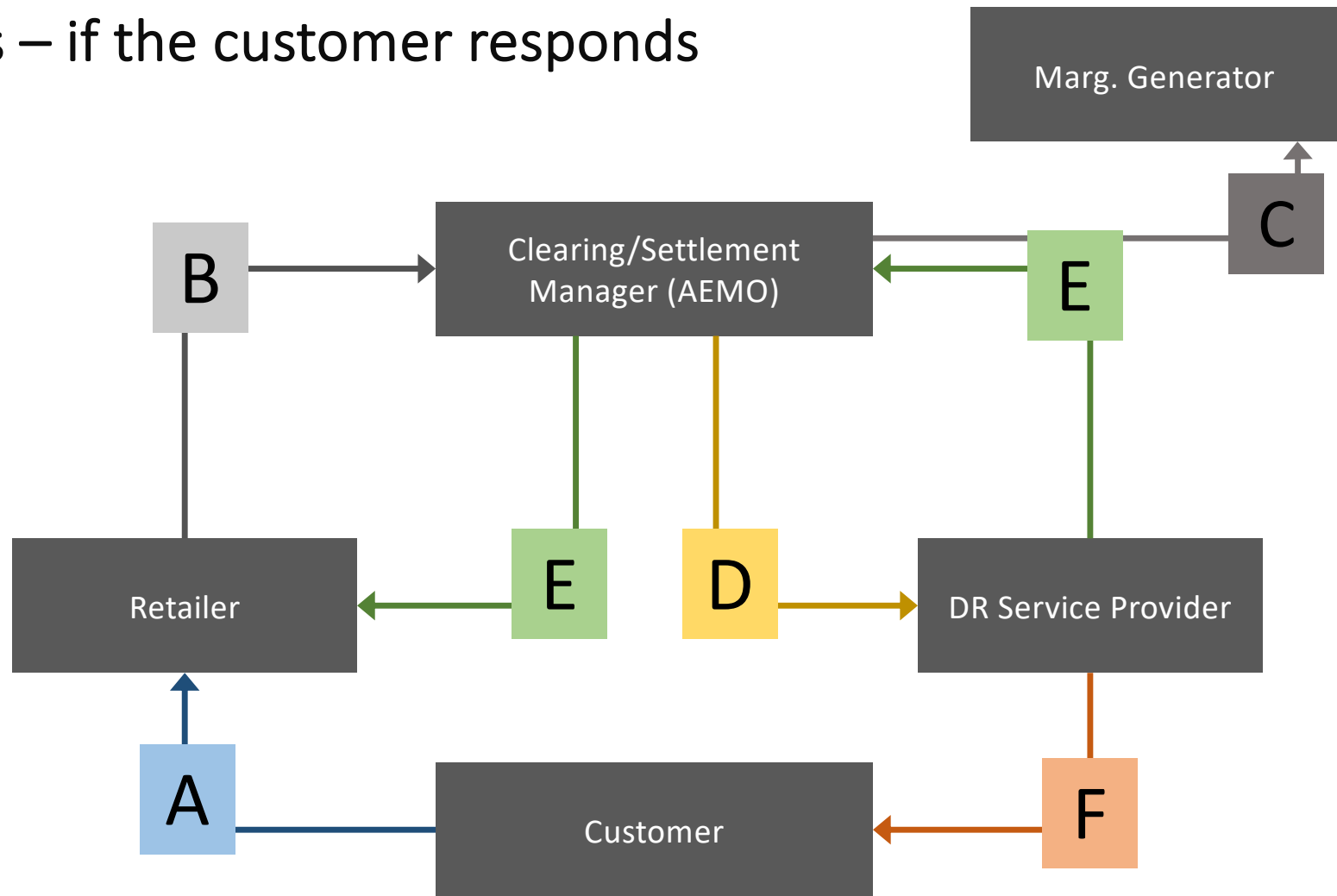
- **How the DRSP shares its net income (Payment D minus Payment E) with the customer (Payment F) is up to those two parties**

NEM's WDRM "negawatt" design

- **Requiring DRSP intermediary to meet most of the dispatch requirements a generator would – clear that they wanted price discovery.**
- **Restricted to large commercial and industrial loads.**
- **Excludes any customers on spot contracts.**

WDRM payments – if the customer responds

- A** Retail tariff x Metered consumption
- B** **Baseline** quantity x Market Clearing Price
- C** Payment for Metered generation
- D** Market Clearing Price x quantity reduced
- E** Approx. retail tariff x quantity reduced from baseline
- F** Payment for response



WDRM payment – if the customer responds

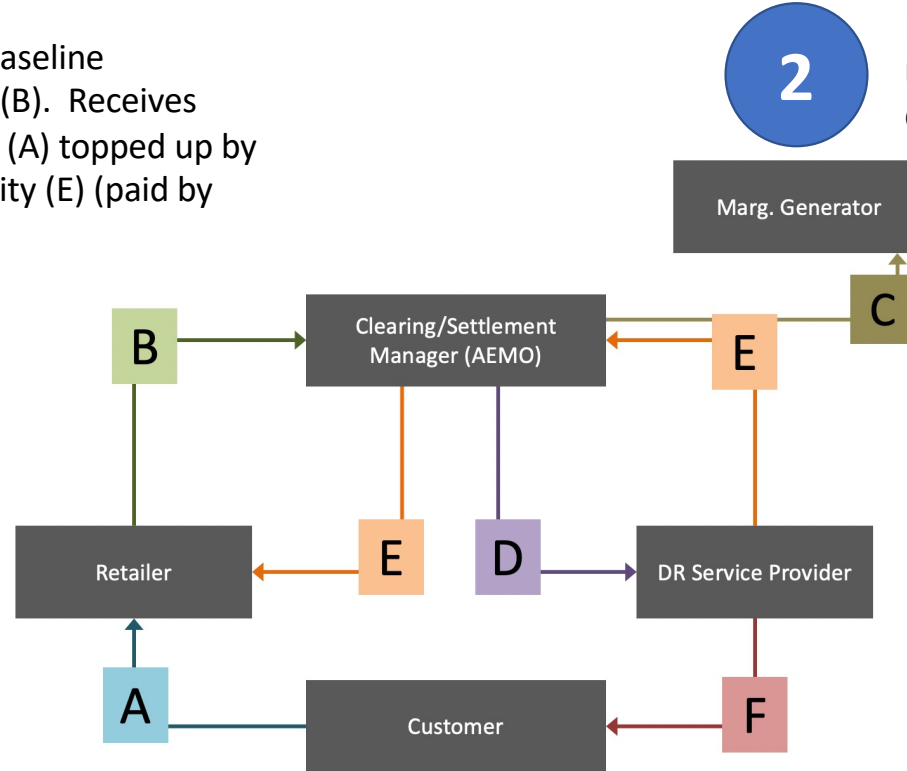
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Retailer pays market for full baseline consumption at market price (B). Receives retail revenue from customer (A) topped up by WDRRR x the response quantity (E) (paid by DRSP via AEMO).

2

Marginal generator dispatch is reduced, due to reduction in demand

- A** Retail tariff x Metered consumption
- B** Baseline quantity x Market Clearing Price
- C** Payment for Metered generation
- D** Market Clearing Price x quantity reduced
- E** Approx. retail tariff x quantity reduced from baseline
- F** Payment for response



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The DRSP receives the market price x response amount, and from this revenue pays AEMO the WDRRR x the response quantity (E), and a share to the customer (F)

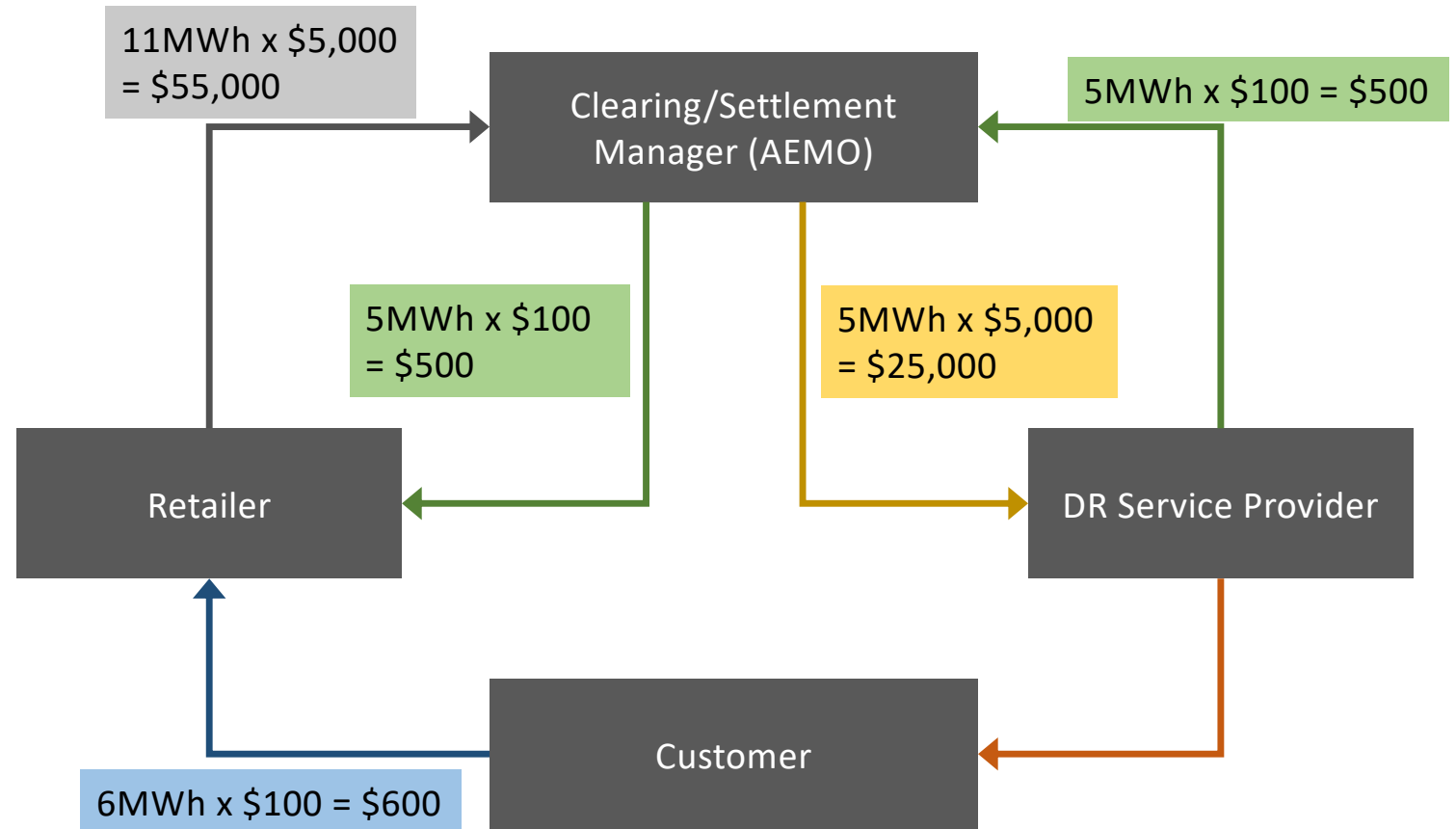
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Customer responds, reducing consumption to a level below the baseline. Pays retailer for (lower) metered consumption.

WDRM payments – example

Wholesale Price: \$5,000/MWh
 Consumer baseline: 11MWh
 Consumer response: -5MWh
 Consumer Actual: 6MWh
 Retail Tariff: \$100/MWh

- A** Retail tariff x Metered consumption
- B** Baseline quantity x Market Clearing Price
- C** Payment for Metered generation
- D** Market Clearing Price x quantity reduced
- E** Approx. retail tariff x quantity reduced from baseline
- F** Payment for response



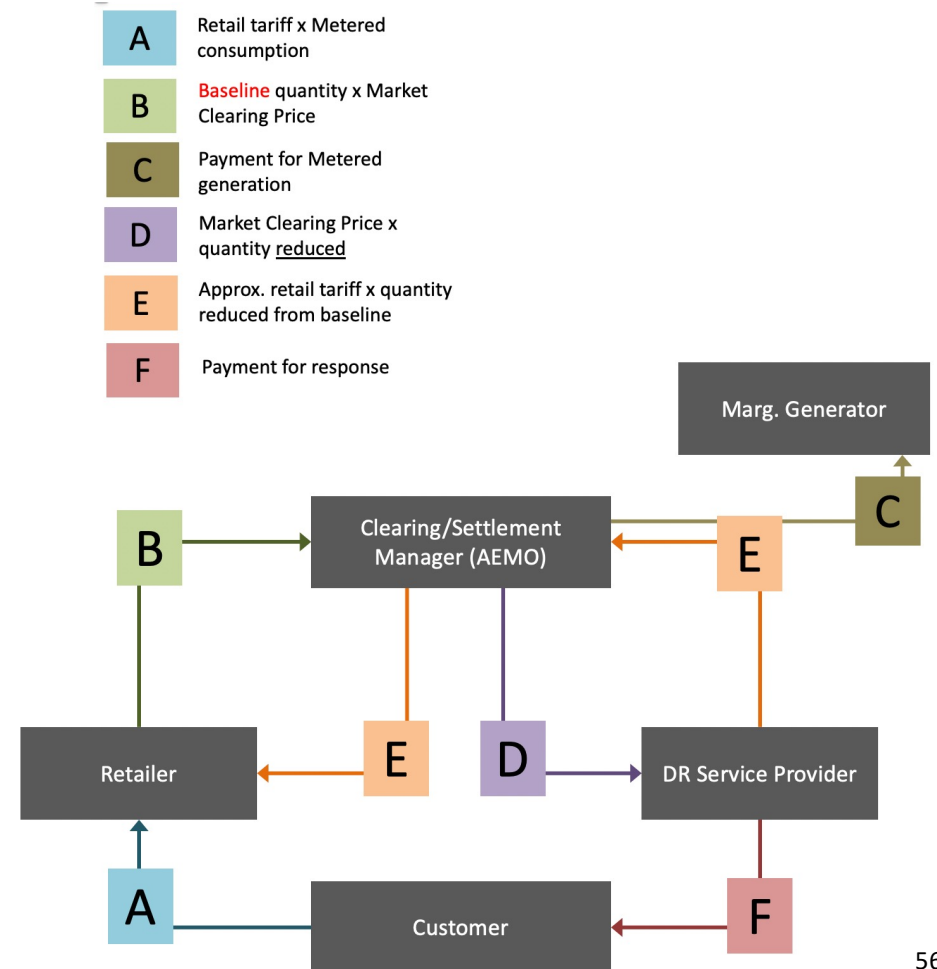
Outcomes of the WDRM - Retailer

In the FPVV “counterfactual”, with no negawatt scheme, the customer would not have responded to the \$5,000 price (as their FPVV tariff was lower than their willingness to respond).

The retailer would therefore have had to purchase the no-response quantity (11MWh in our example) at the market price of \$5,000/MWh.

Under the WDRM scheme, the combination of payments A, B and E, leave the retailer approximately “whole” vis the counterfactual, in terms of its gross margin. It is “approximate” because there is

- (a) no guarantee that the baseline quantity used in deriving B and E is exactly what the customer would have consumed, and
- (b) there is no guarantee that the WDRRR used in payment E exactly matches the retail tariff the customer is on.



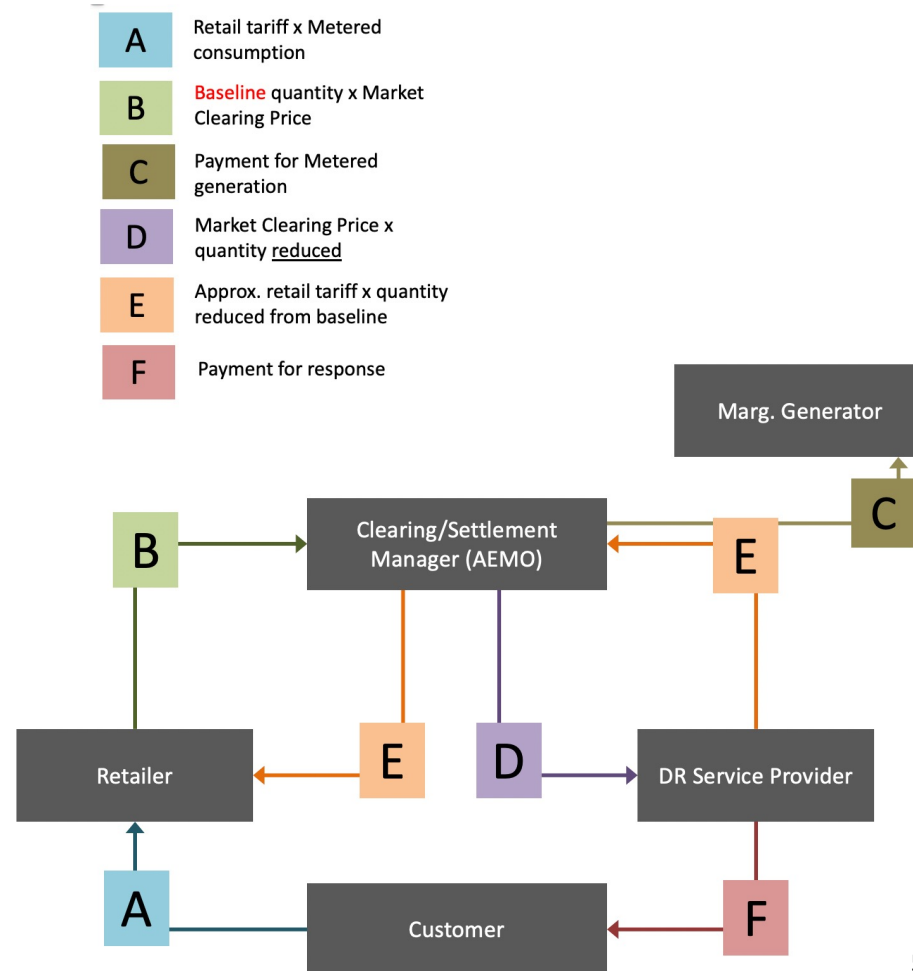
Outcomes of the WDRM – Customer, DRSP and Generator

In the FPVV “counterfactual” the customer would have continued to consume all load, despite the wholesale price being higher than its economic value (\$2,000/MWh in our example), because it is only paying its FPVV tariff for it (\$100/MWh).

Under the WDRM, the customer reduces the component of its load worth \$2,000/MWh (i.e., reducing income), reducing its retail costs by only \$100/MW, but also receiving a share of the \$5,000/MWh (net of the WDORR) received by the DRSP.

The DRSP, in turn, earns the net of this payment to the customer, its WDORR payment to AEMO, and the wholesale income from the consumer’s response.

The generator reduces its output (and thus gross margin incl fuel costs) by the response quantity, assuming this is an accurate reflection of the counterfactual.



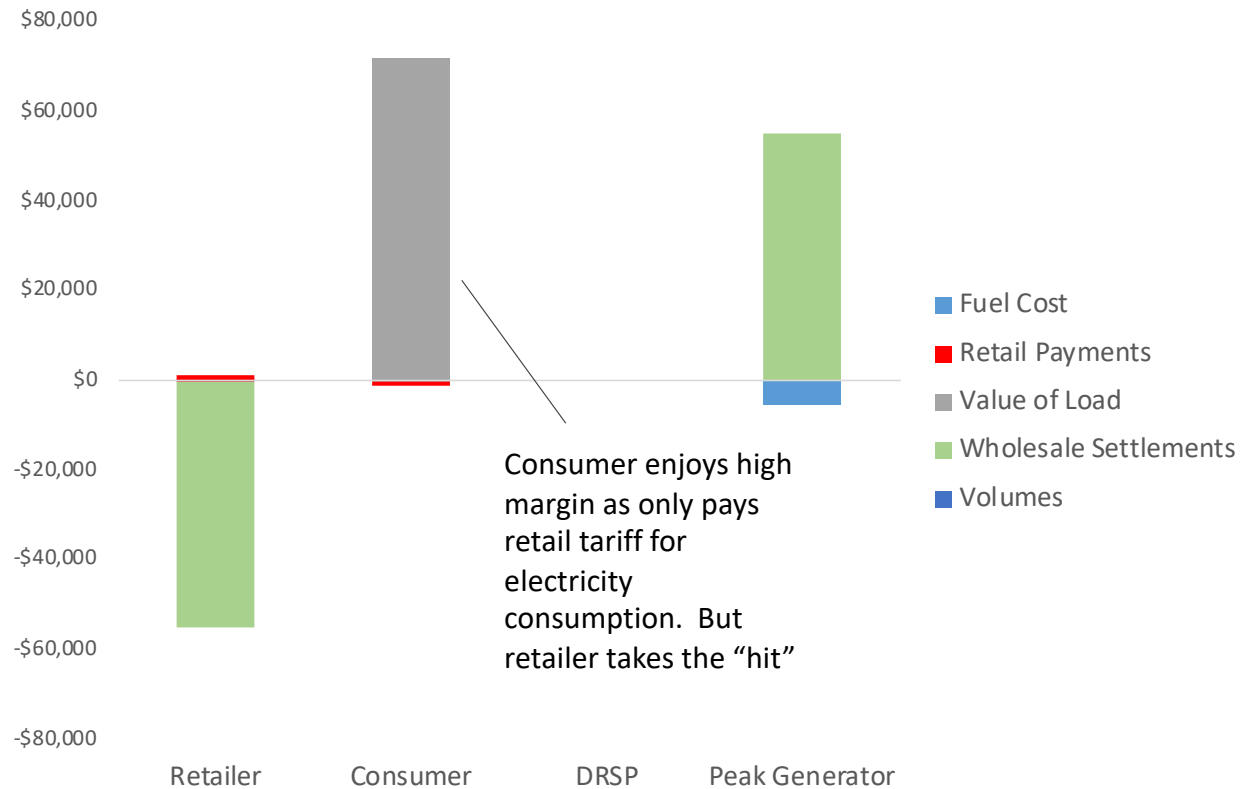
The Status Quo - FPVV

Wholesale Price: \$5,000/MWh
Consumer Actual: 11MWh
Consumer response: 0MWh
Retail Tariff: \$100/MWh

Consumer value of load:
6MW @ \$20,000/MWh
5MW @ \$2,000/MWh

FPVV - Energy Margin

Incl. Value of consumption



Comparison of WDRM to other tariff structures

- **We now illustrate how the payments and outcomes under the WDRM compare to three other mechanisms :**
 - A fully dynamic (spot) pricing retail tariff
 - A lower priced FPVV-like tariff which grants the retailer right to control customer's demand in high price situations
 - A contract for differences between the retailer and the customer (at the same price as the FPVV retail tariff)
- **We evaluate these in the period where a high wholesale price (\$5,000/MWh) is observed. Obviously, these contract forms also have different implications for other periods where wholesale prices are lower – we discuss that later.**

Changes in margin

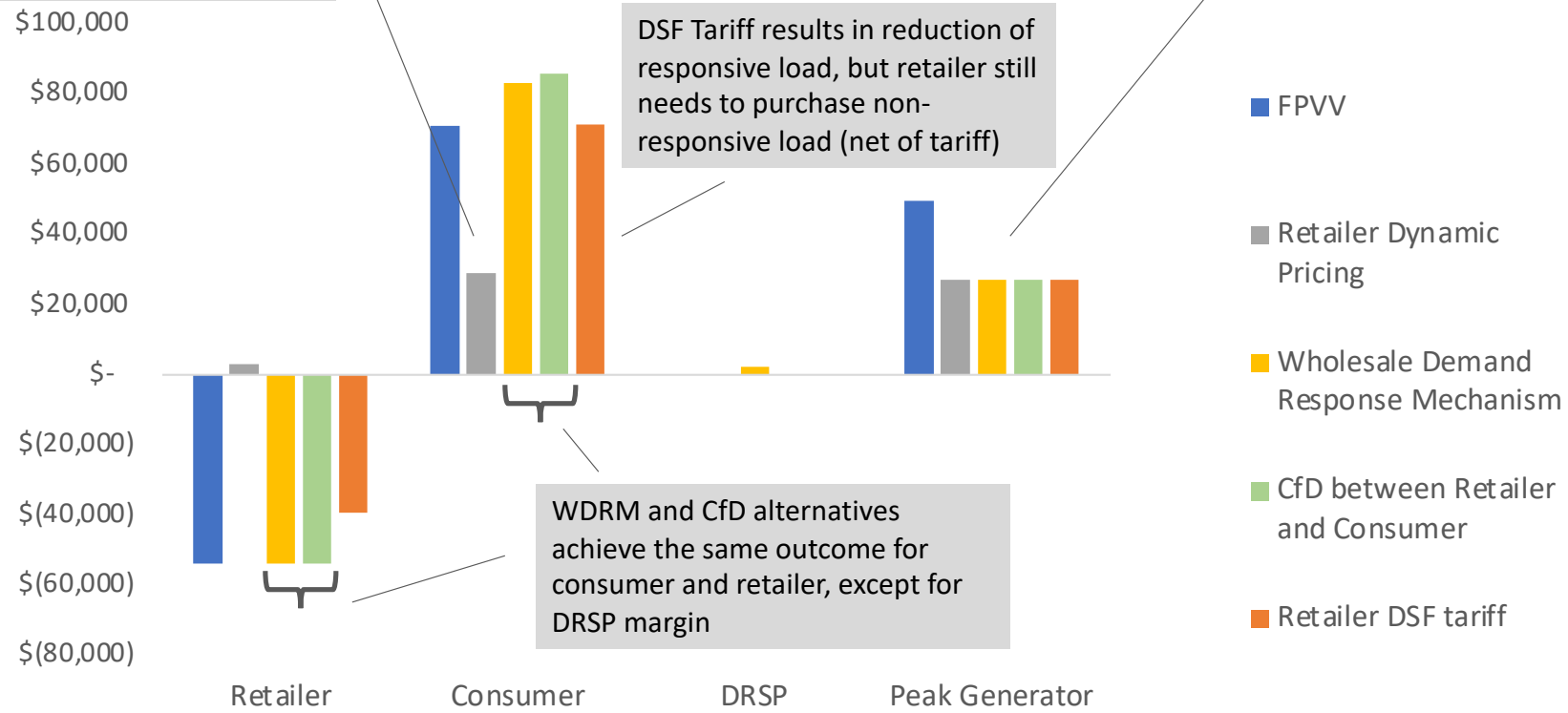
Dynamic pricing reduces consumer consumption (and thus margin) back to its "efficient" level; "consumer surplus" (sum over retailer and consumer) higher though.

Energy Margin

Alternative Pricing Arrangements

DSF Tariff results in reduction of responsive load, but retailer still needs to purchase non-responsive load (net of tariff)

All alternatives trigger a response from the customer, reducing generation output



WDRM and CfD alternatives achieve the same outcome for consumer and retailer, except for DRSP margin

Insights

- **FPVV makes retailer feel the pain but results in loss of overall market efficiency where Value of Load < market price**
- **Dynamic pricing, retail DSF, WDRM, CfD all increase consumer surplus (reduce producer surplus) relative to FPVV, as they have triggered “efficient” demand response from a net benefit perspective), and just shift the CS differently between customer and intermediaries:**
 - Dynamic pricing relieves retailer of the pain, customer no longer consumes “cheap” (FPVV) power
 - DSF tariff relieves retailer of the pain for the responsive component of demand
 - Which begs the question of why retailers do not seek these arrangements?
 - WDRM and CfD preserves retailer pain and “rewards” customer for same response...but CfD is not and apples-with-apples comparison (see later)

Why don't retailers incentivise DSF?

- The net WDRM payment (wholesale price minus WDRRR) approximates the retailer's maximum willingness to pay the consumer to reduce load, if it were to construct such an arrangement with the customer. In essence, this is equivalent to the retailer becoming the DRSP.
- However, this arrangement provides an uncertain series of payments for the customer – may prefer the DSF tariff structure where the retailer WTP is “annuitized” into a lower FPVV tariff in return for a right to control in certain circumstances – analogous to reserve market.
- Also allows retailer to find a better commercial outcome if it could entice response at a payment P where $VoL < P < \text{wholesale price}$

While payments very similar, WDRM is not equivalent to a CfD

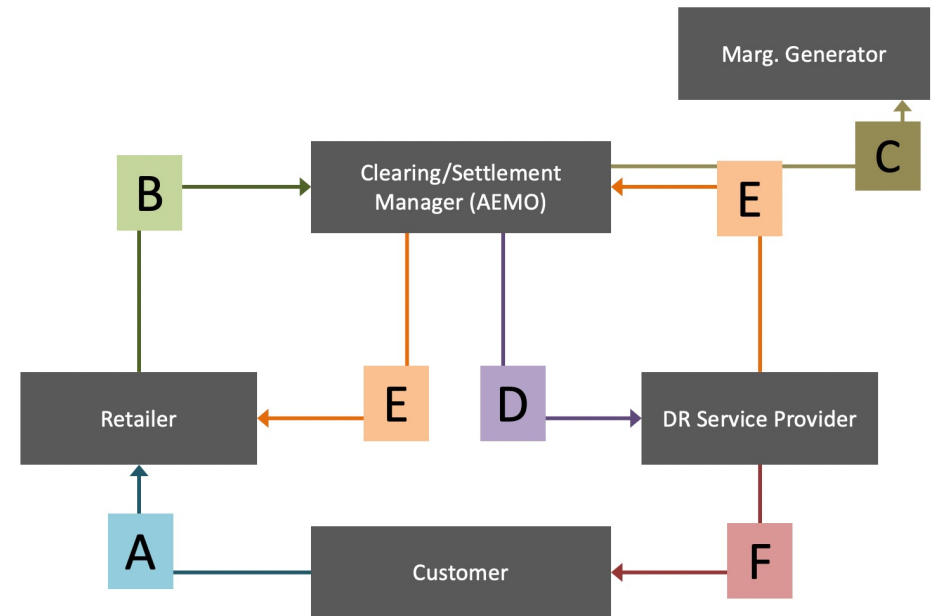
- **Insights re: WDRM and CfD equivalence ignores:**

- CfD reflects a commitment to purchase a known (fixed) quantity of power at an agreed price, irrespective of the wholesale price.
- The CfD preserves incentives for efficient response, including increased demand at very low prices.
- This is not the basis of the WDRM – in all periods other than high price events it is an FPVV.
- Philosophically, the WDRM presumes that the customer has “agreed” to purchase the full (fictitious) baseline amount – again, not the basis of an FPVV contract. Numerous market design experts (e.g., Joskow, Borenstein) have found this to be a major challenge with negawatt arrangements

Risks?

- **Baseline estimation:**

- The baseline (counterfactual) quantity is estimated as part of the scheme, and will be prone to error in most situations except very stable load profiles.
- Over-estimation of the baseline inflates payments B and E, but since the price applied to B is significantly greater than the WDRRR (for payment E), the retailer faces the risk it is over-paying for response
- Underestimation favours the retailer, but under-rewards the DRSP (and thus consumer)



What does this show us?

- Under a WDRM without a price change, there is no net change in market settlements but:
 - Increases CS and reduces PS; essentially a wealth transfer from generator to consumer/agents
 - The alternatives just represent different allocations of CS amongst intermediaries
- There would be a gain to the market if the DR reduced clearing price (FERC's CBA, Singapore)
- Replicates the CfD outcome when it is in effect (i.e., not for low prices)
- Leaves the retailer no worse off as long as WDRRR is \geq to retail tariff and baseline is \leq counterfactual.
- Retailer would avoid these risks if it offered its own demand response scheme.

Arguments in favour

- **Our objective is to see efficient wholesale-induced DSF; the FPVV contract is a major impediment**
- We have not seen widespread emergence of tariffs which encourage dynamic response; Flick experience shows limitations of customer facing full dynamic pricing
- A negawatt/WDRM scheme:
 - strengthens dynamic incentives to respond without harming market efficiency
 - Supports price discovery while leaving customer (mostly) on a stable tariff
 - Is offered and dispatched, so improves visibility to System Operator
 - Essentially a wealth transfer between generators and (responding) consumers; retailers left somewhat indifferent (although exposed to parameter risk)
 - Specifically creates a role for an intermediary (CSP, DRSP) - accelerate uptake?
 - May stimulate incumbents to develop DSF tariffs

Arguments against

- The notion of paying someone to not consume is not found anywhere else; (but is an artefact of the existence of FPVV contracts – it’s a hack on a hack)
- Baselineing is problematic practically (measurement) and philosophically (presumes the customer has “pre-bought” a right to the higher demand, and therefore can sell it back per CfD arrangement)
- WDRM limited to large commercial and industrial (perhaps for good reason, i.e., baselineing) – little direct benefit to mass market.
- Limited evidence (so far...) that it has spurred significant uptake of DSF in energy-only markets;
- US and Australian regulators believe it is temporary only....but may be problematic to remove.