Transmission Pricing Methodology

Proposed application of the residual charge to battery storage

Battery storage information session, 10 November 2021

Tēnā koutou katoa

Our purpose today

To present, at a high level, key components of the proposed TPM

To allow stakeholders to question & clarify – to assist making your submissions complete and the highest value

Discussion at this stakeholder event does not replace your written submissions

- We're going to talk through:
  - context
  - what we mean by battery storage
  - our recommendation
  - and the alternatives considered
    - with allotted timeframes for each
- We welcome all feedback and questions section by section
  - for online sessions, please raise your (Teams) hand or use the chat function
- We can use a parking lot if need be, so revisit at end

Agenda

Agenda

1. Recap on TPM
2. The residual charge
3. What do we mean by battery storage?
4. Why are we consulting on a proposal?
5. Options considered:
   - Our proposal: allocation based on final consumption
   - Other options considered
6. The proposed Code
7. Consultation dates and anticipated next steps

Recap on TPM and proposals for the residual charge

The Authority's statutory objective

To promote competition in reliable supply by and the efficient operation of the electricity industry for the long-term benefit of consumers

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How the proposed TPM fits together

Main charge components are calculated...

- A connection charge
- A benefit-based charge, for 7 large historical investments, and post 2019 investments
- A residual charge
- Additional components

then adjustments are made...

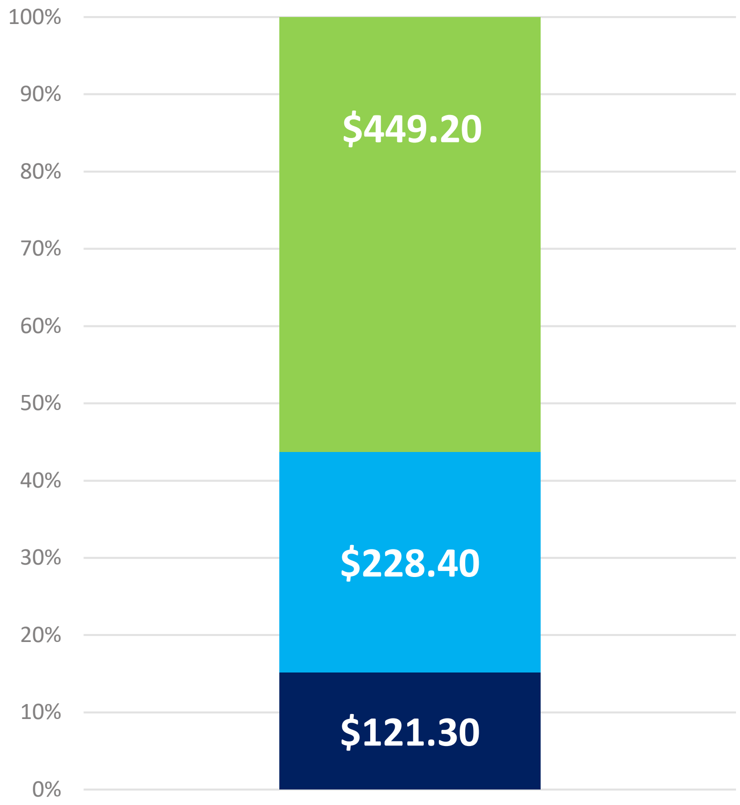
- Main adjustments
- A prudent discount for some (on application)
- A transitional cap for load customers whose electricity bill would increase by > 3.5%

resulting in transmission charges

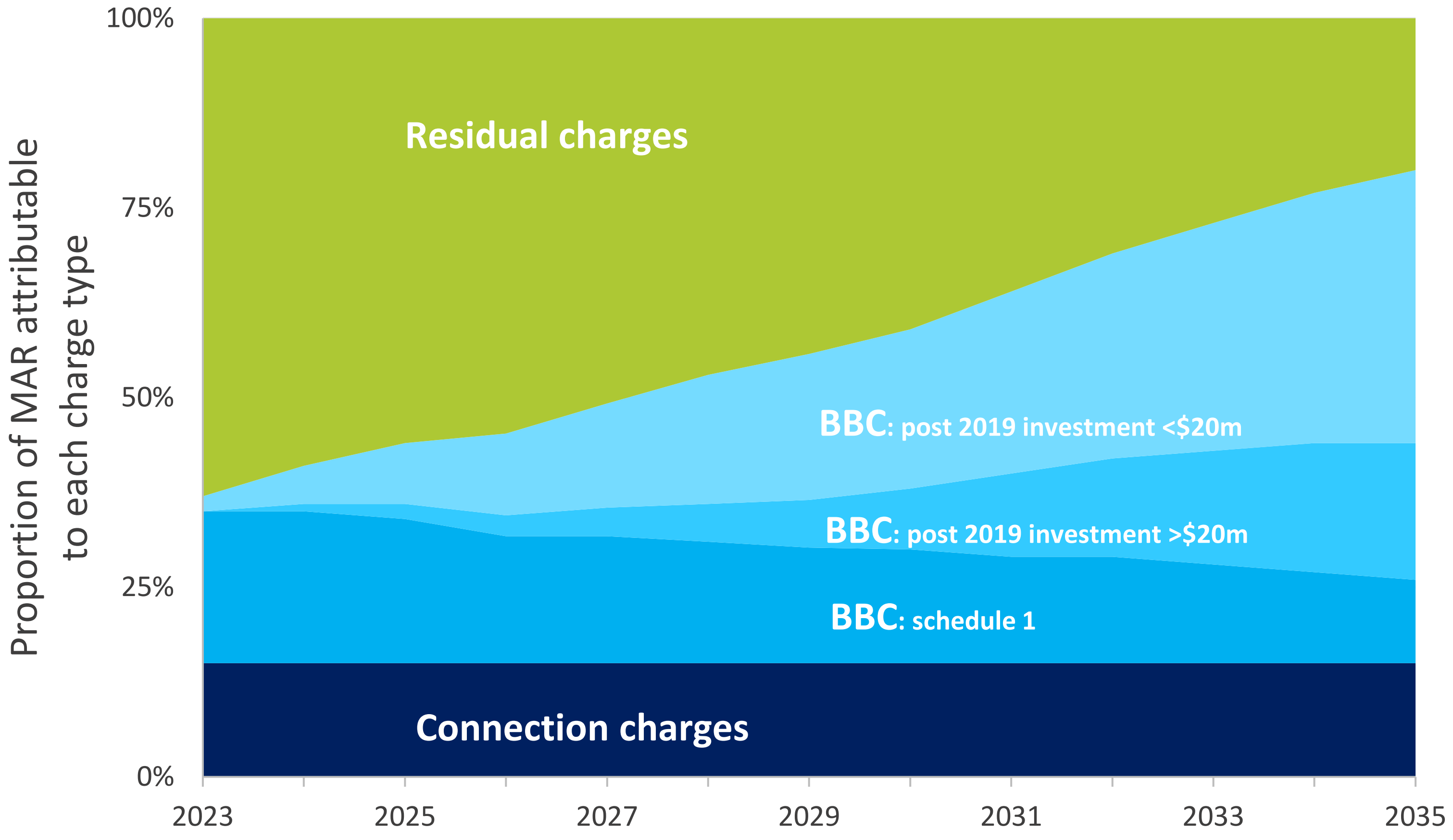
- for each designated transmission customer (generators, large industrials, and distribution networks).

A shrinking residual charge – 2021/22 and over time

Transpower's MAR, across the charge types:



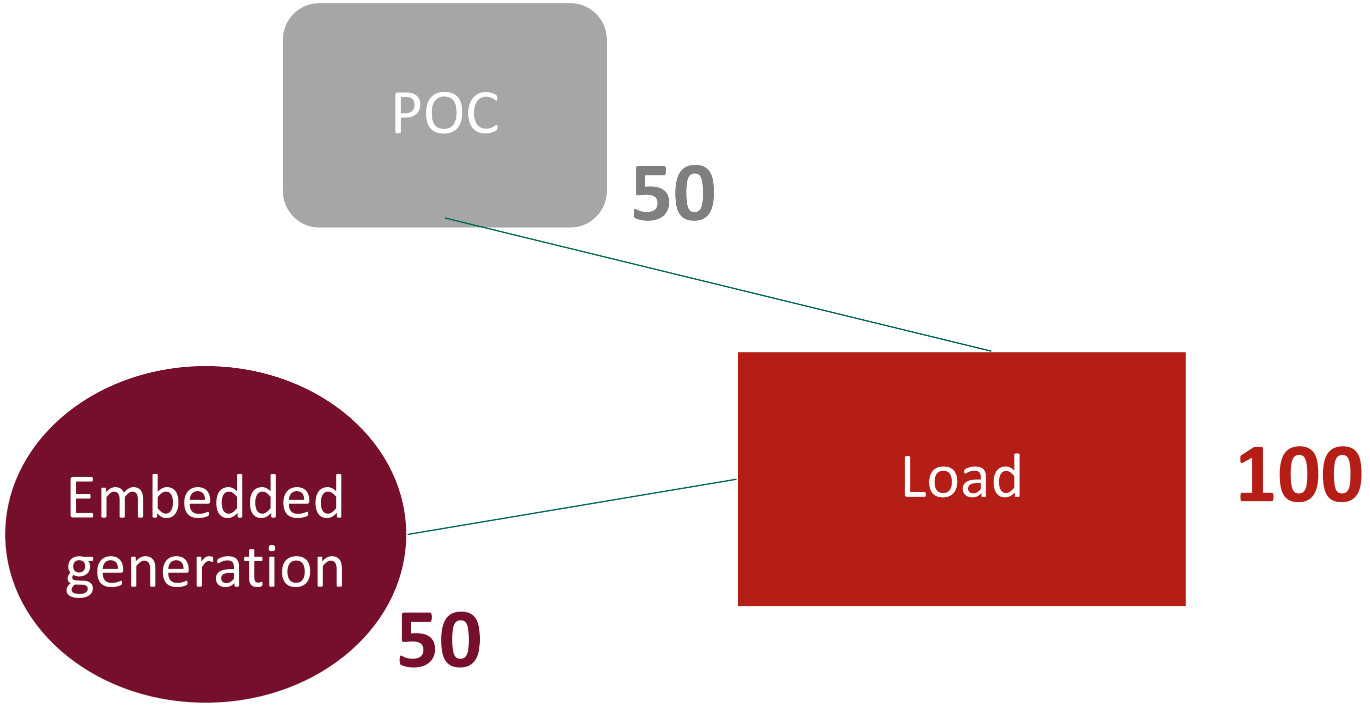
The proportion of each charge type, over time:



Residual charge

Deliberately non distortionary:

- gross energy: includes all energy
- not just grid offtake
- grid-connected generators with load will pay



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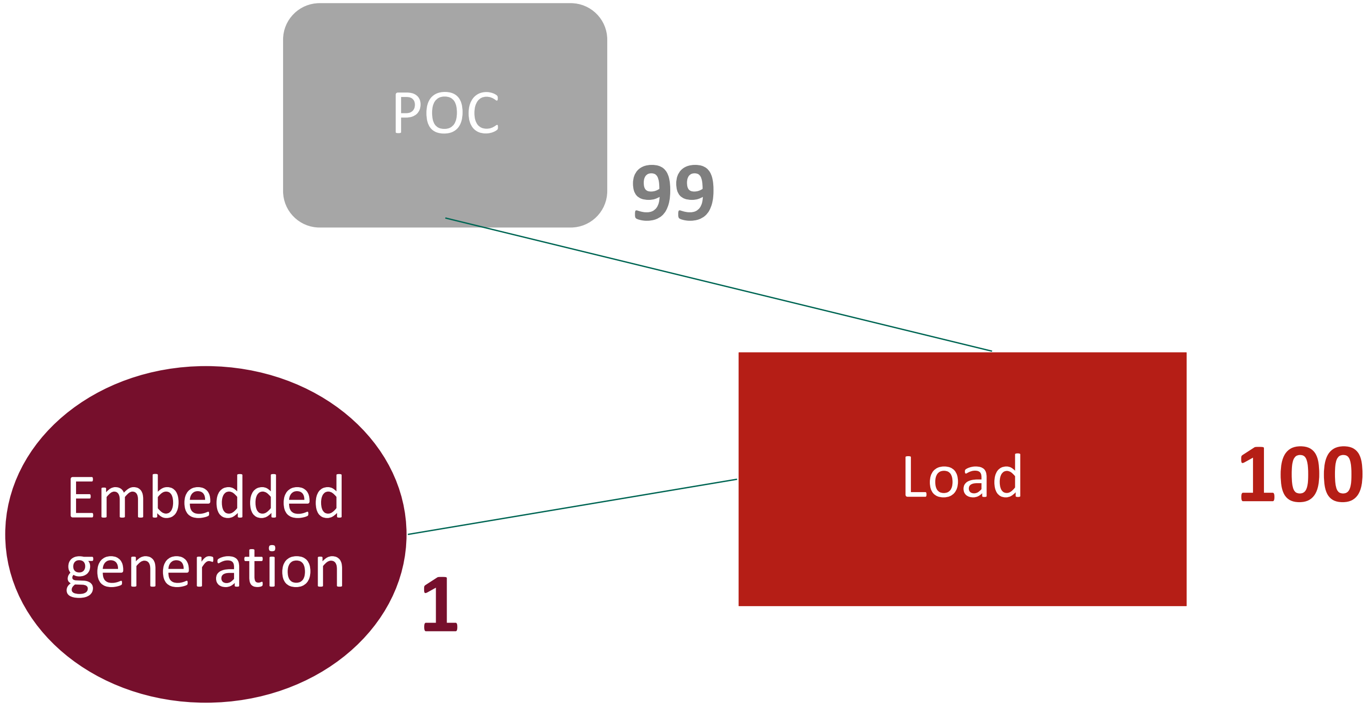

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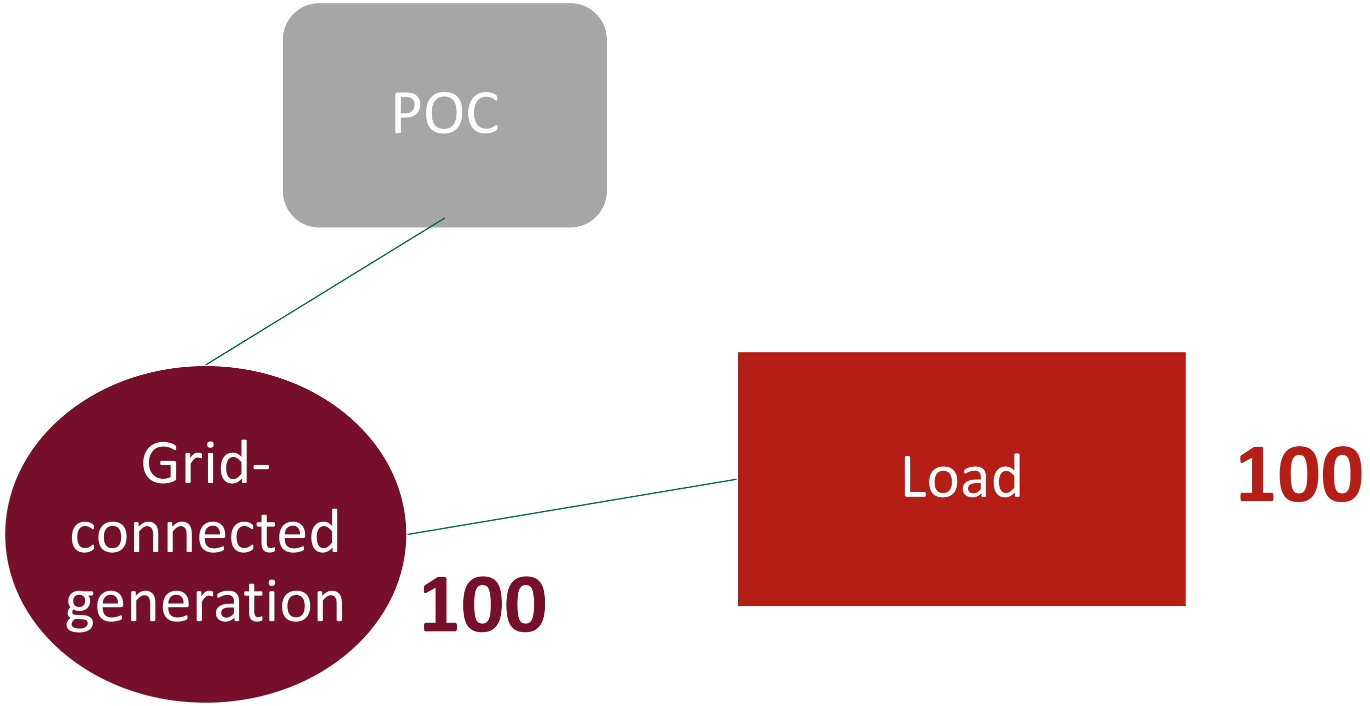
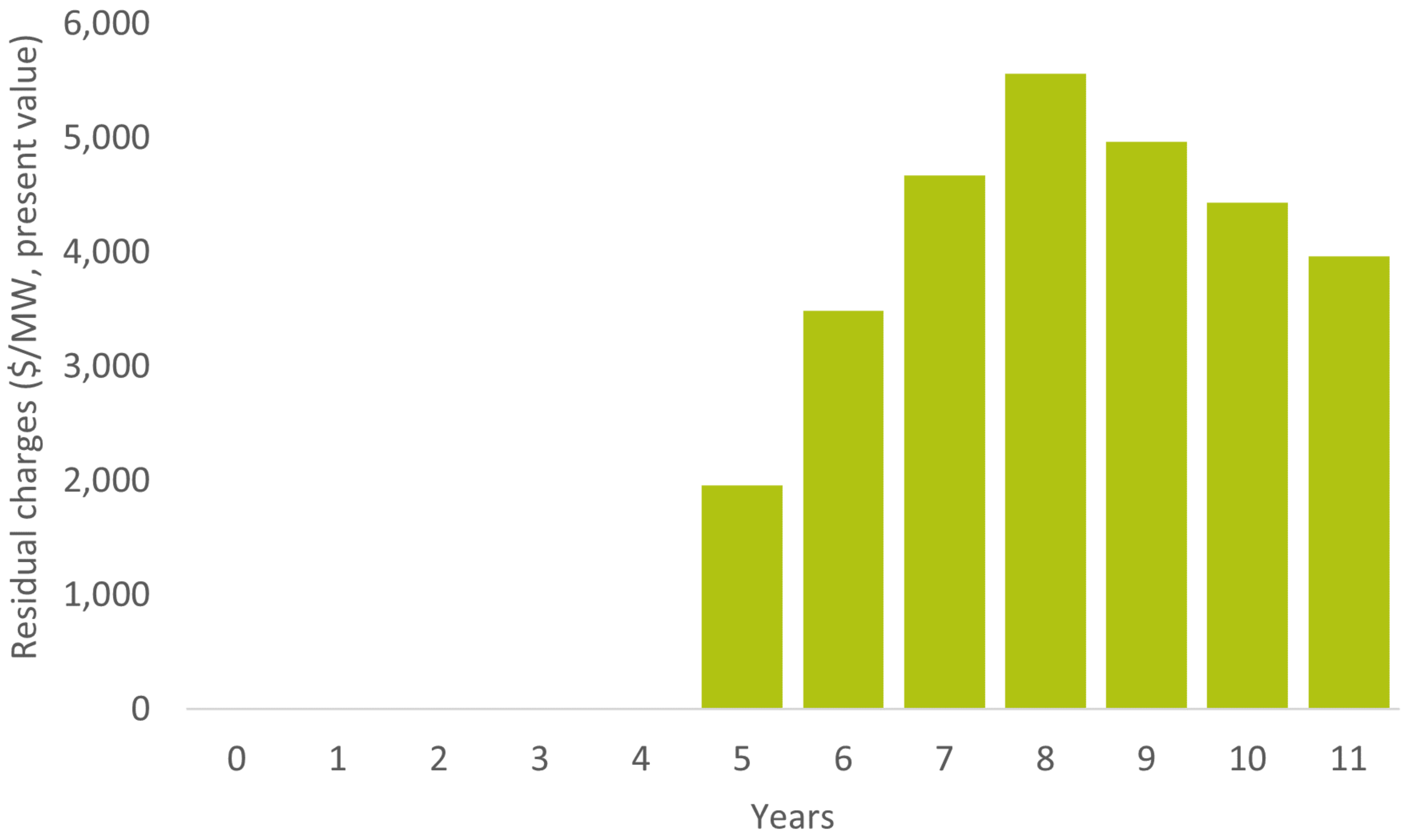


Residual charge allocations are designs with a lag

Deliberately non distortionary:

- allocations update with a lag
- then gradually ramp up
- for new entrants as well as existing customers



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What do we mean by battery storage?

What's included in battery storage?

It is a deliberately broad definition and intends to include a range of methods and equipment for storing electricity

- We propose the term 'battery storage' covers:

  a. Electro-chemical storage, eg, lithium-ion and redox flow batteries.

  b. Electrical storage, eg, capacitors.

  c. Mechanical storage, eg, compressed air energy storage, flywheels and pumped hydro storage systems.

  d. Chemical storage, eg, hydrogen.

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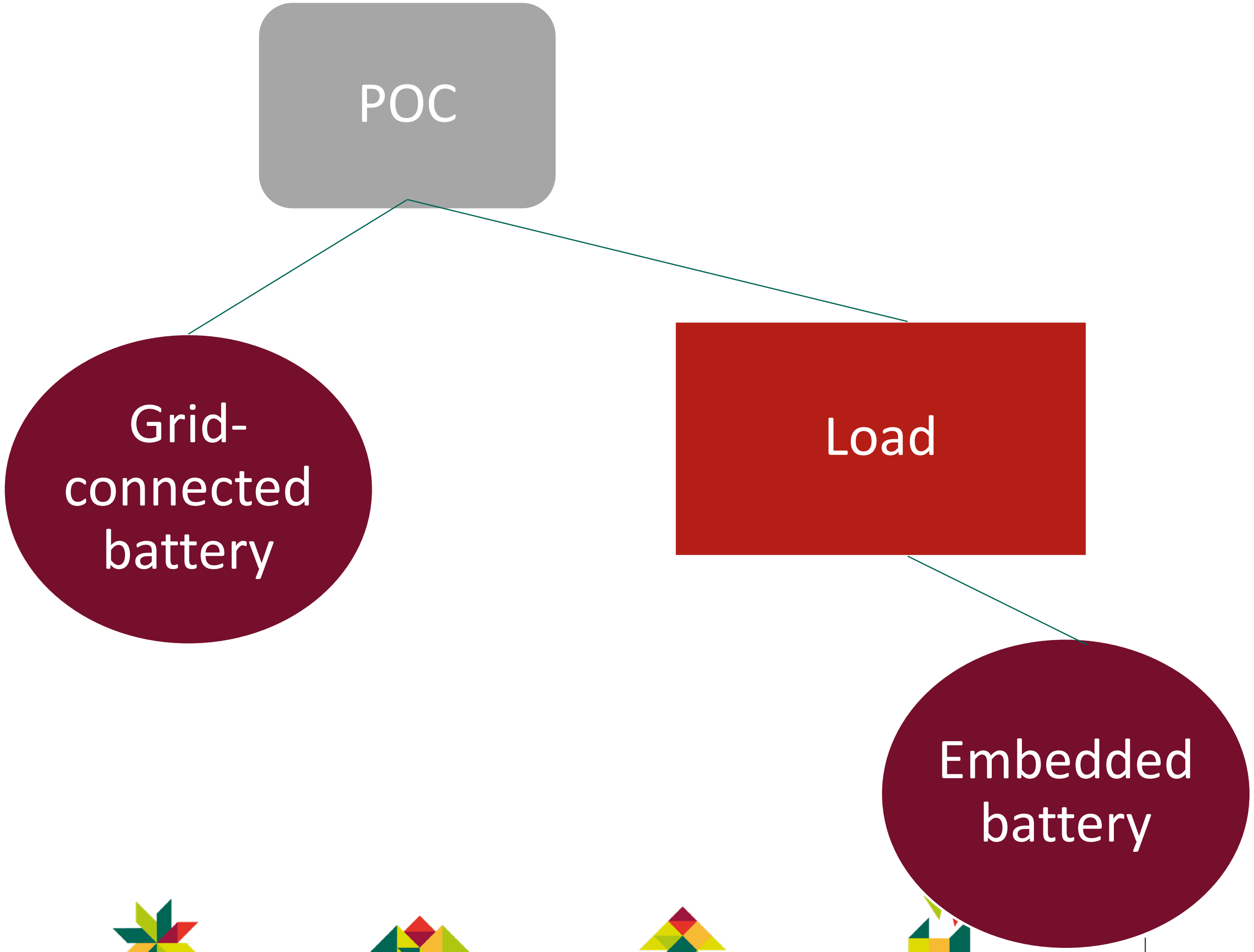
Why have we considered this matter?

5 mins

How the residual charge applies to battery storage

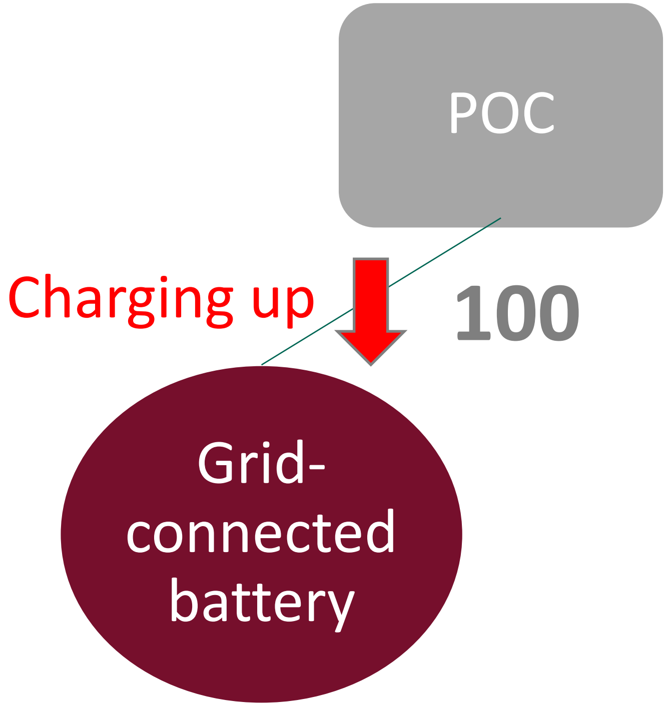
- Policy issue – Authority led
- Applies to embedded storage and grid-connected



How the residual charge applies to battery storage

Problem (if not addressed):

- batteries would be allocated the residual charge for all electricity used while charging up

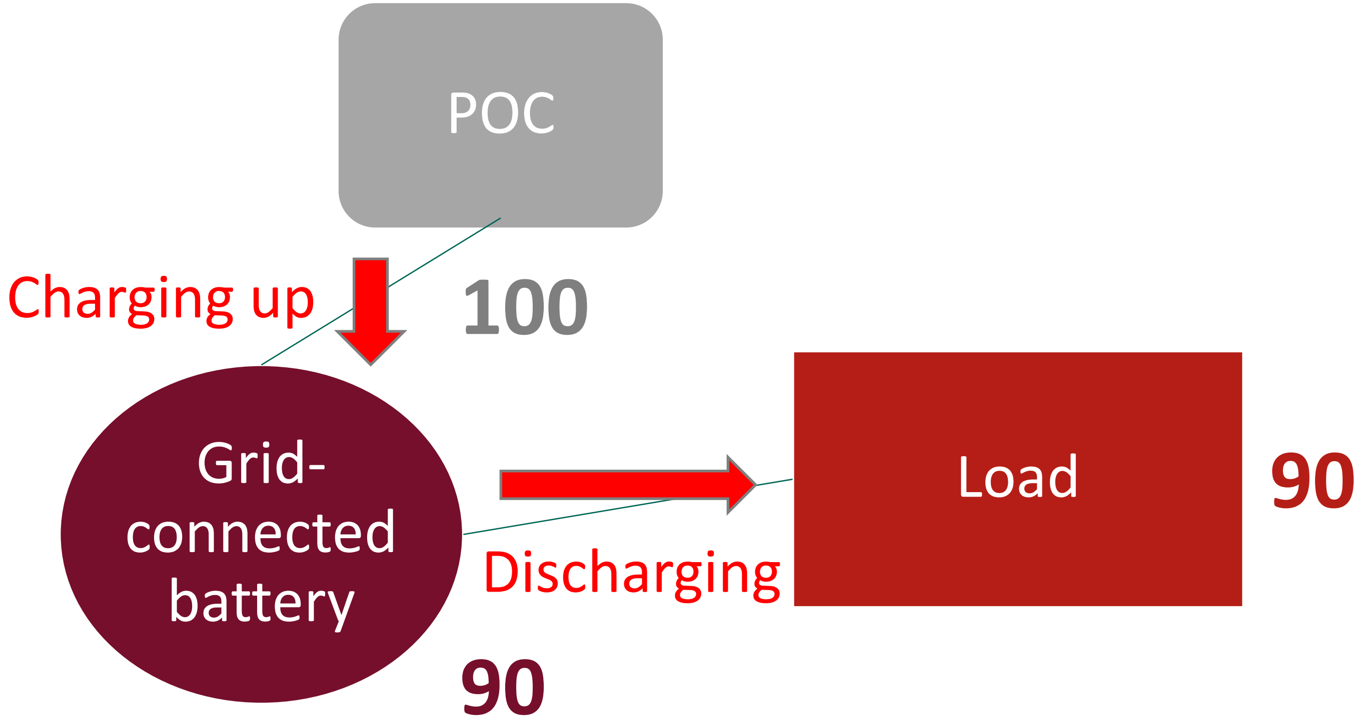


How the residual charge applies to battery storage

10 minutes

Problem (if not addressed):

- batteries would be allocated the residual charge for all electricity used while charging up
- **the same energy then attracts the residual charge again**, after discharge, when used by end customers (load)



Why?

Double counting

- Double counting

  (for purpose of residual charge allocation)

  of electricity used for charging up,

  then again when used for consumption

- Such double counting would create an extra cost for battery storage that would not be faced by other generators

- So would result in a competitive disadvantage if not addressed.

Aims for residual charge's treatment of battery storage

To support competition, reliability and efficiency, the residual charge should apply to battery storage in a way that is efficient and least distortionary, such that it:

is competitively neutral

- across all types of generation, including storage

ensures all load attracts the residual charge on the same basis

- regardless of where/what/who is supplying its electricity

  so minimises distortions and promotes efficient operation of the industry

is scale neutral

- no biases towards or against larger scale storage

is future proof as new storage technologies develop

- given the market for storage is immature and storage technology is rapidly developing.

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Options

Options considered

We considered **three** main approaches to address the double counting issue.

- To allocate the residual charge to battery storage based on:

1 TOTAL ENERGY USED WHEN CHARGING	2 FINAL CONSUMPTION	3 FINAL CONSUMPTION MINUS LOSSES
• final consumption plus injection by battery storage	• consumption less any load plus battery storage losses	• consumption less any load less battery storage
“Double counting”	***“Single counting”***	***“No counting”*** ***– not paying the residual charge***

Our proposal

Options considered

1 TOTAL ENERGY USED WHEN CHARGING	2 FINAL CONSUMPTION	3 FINAL CONSUMPTION MINUS LOSSES
• final consumption plus injection by battery storage	• consumption less any load plus battery storage losses	• consumption less any load less battery storage
"Double counting"	*"Single counting"*	*"No counting"* ***– not paying the residual charge***

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Proposal: allocated based on final consumption

- Allocate residual charge to all grid customers based on final consumption

- This means battery storage (including grid-connected batteries) would attract a residual charge only to the extent that it finally consumes electricity

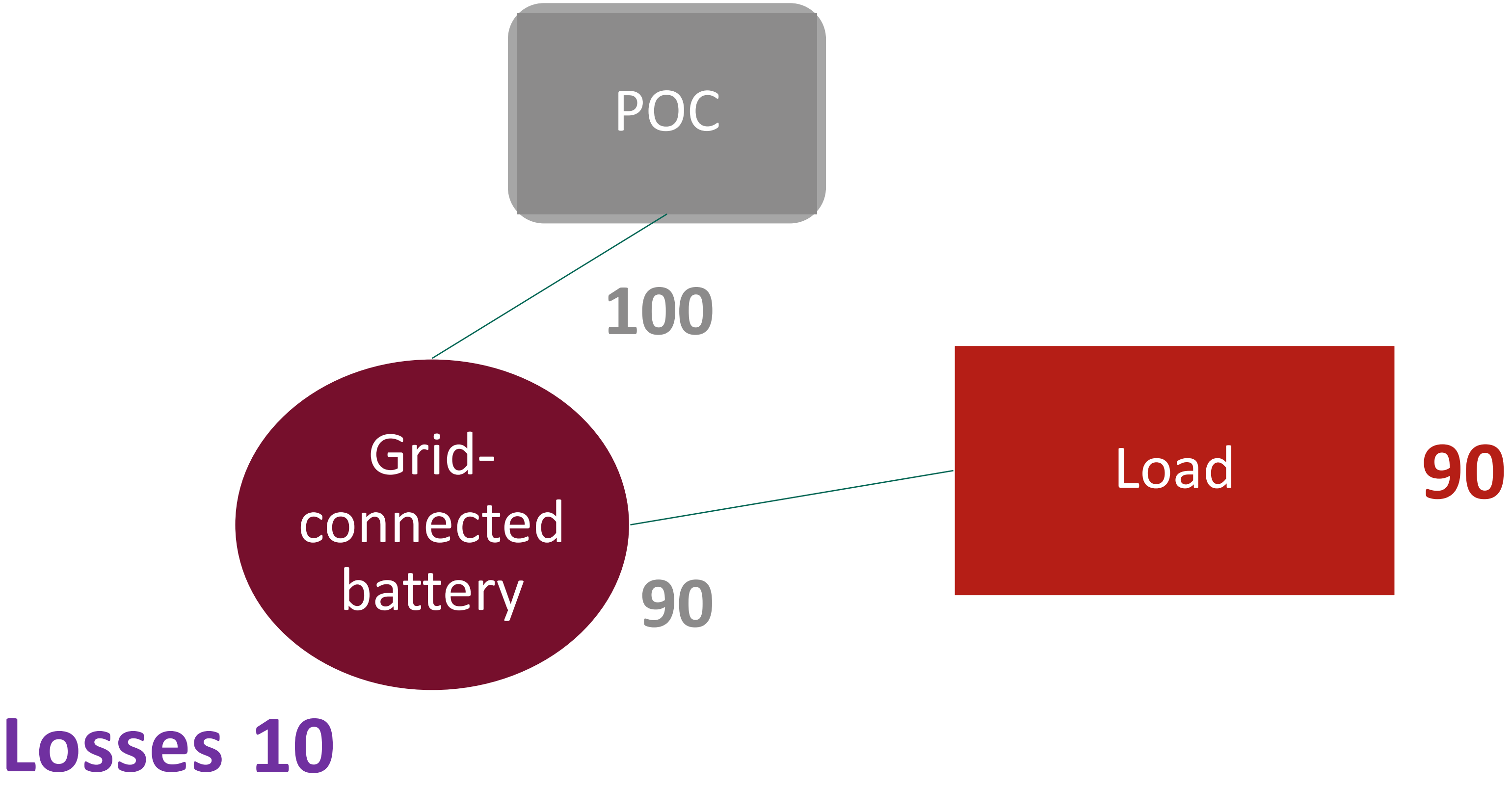
  (that is, the difference between energy in and out).

- This approach avoids double-counting of consumption

- So places battery storage on a more level playing field with other generation, embedded generation and cogeneration.

How the residual charge applies to battery storage

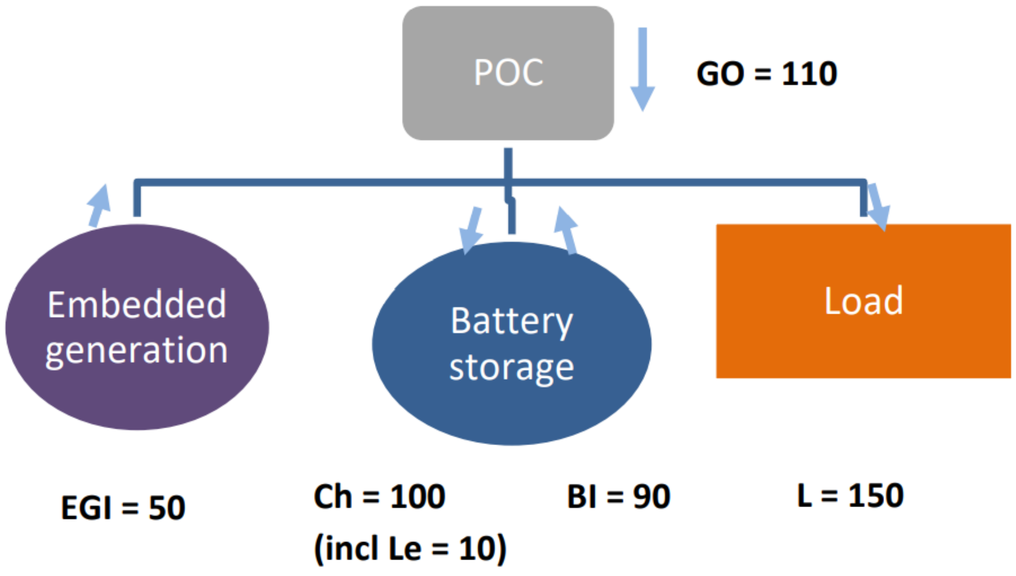
- **Allocation based on final consumption**
  - **reduces competitive disadvantage**
  - **addresses the double counting** issue
  - does not create new scale-neutrality challenges
  - would create a smaller measurement burden



Worked example – Option 2 - allocating based on final consumption

POC	= point of connection
GO	= grid offtake *(varies to balance system)*
EGI	= embedded generation injection *(fixed at 50MWh)*
Load	= Final consumption/load – *(fixed at 150MWh)*

Ch	= battery storage charging *(fixed at 100MWh)*
BI	= battery storage discharging/injection
Le	= losses (energy consumed by battery storage)



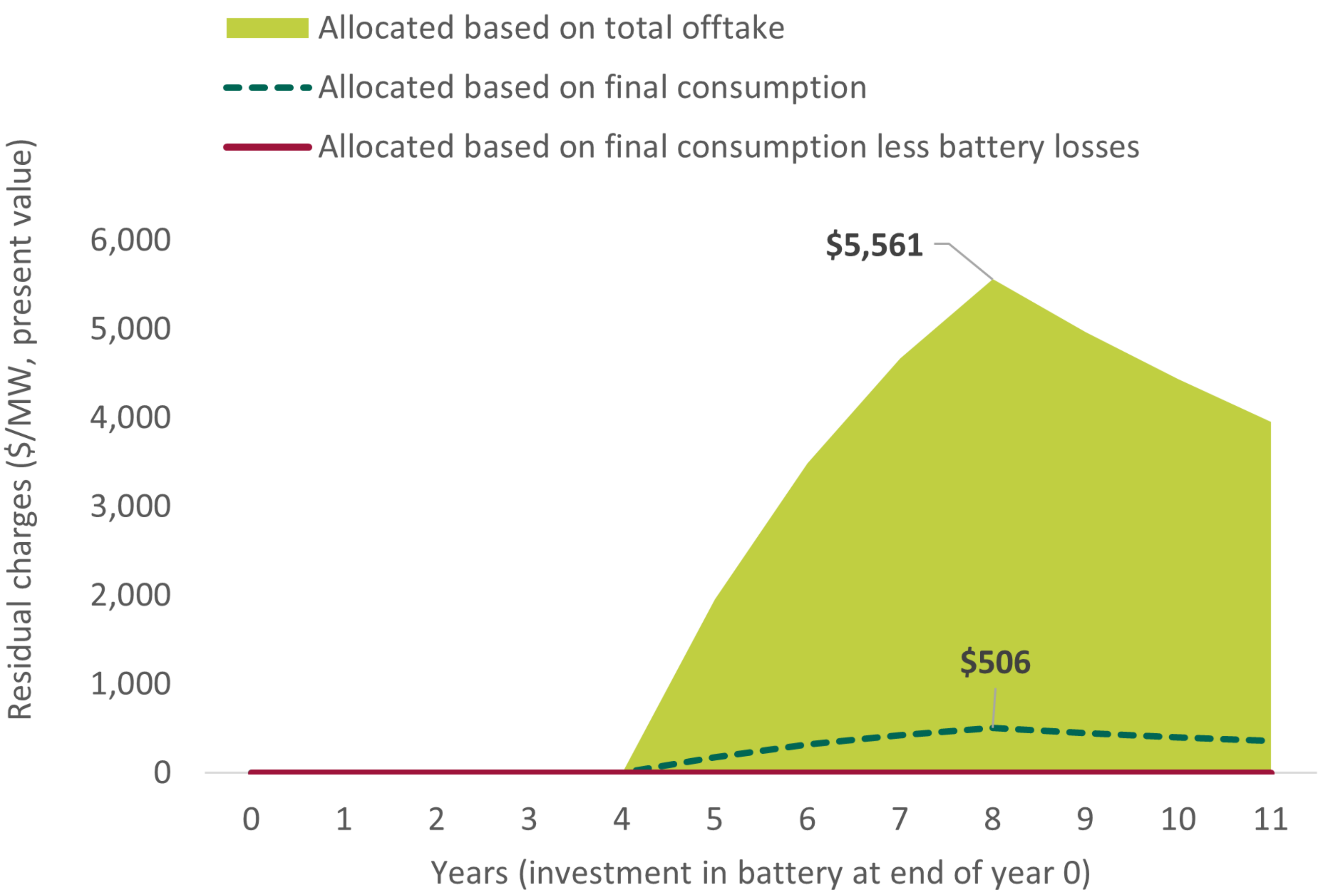
Gross energy =

GO + EGI

110 + 50 = 160

Gross energy = Load + Le

Worked example of options for application of residual charge



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Other options considered for application of residual charge to battery storage

Other options considered

1	2	3
TOTAL ENERGY USED WHEN CHARGING	**FINAL CONSUMPTION**	**FINAL CONSUMPTION MINUS LOSSES**
• final consumption plus injection by battery storage	• consumption less any load plus battery storage losses	• consumption less any load less battery storage
"Double counting"	*"Single counting"*	*"No counting"* ***– not paying the residual charge***

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Worked example: Option 2 - final consumption

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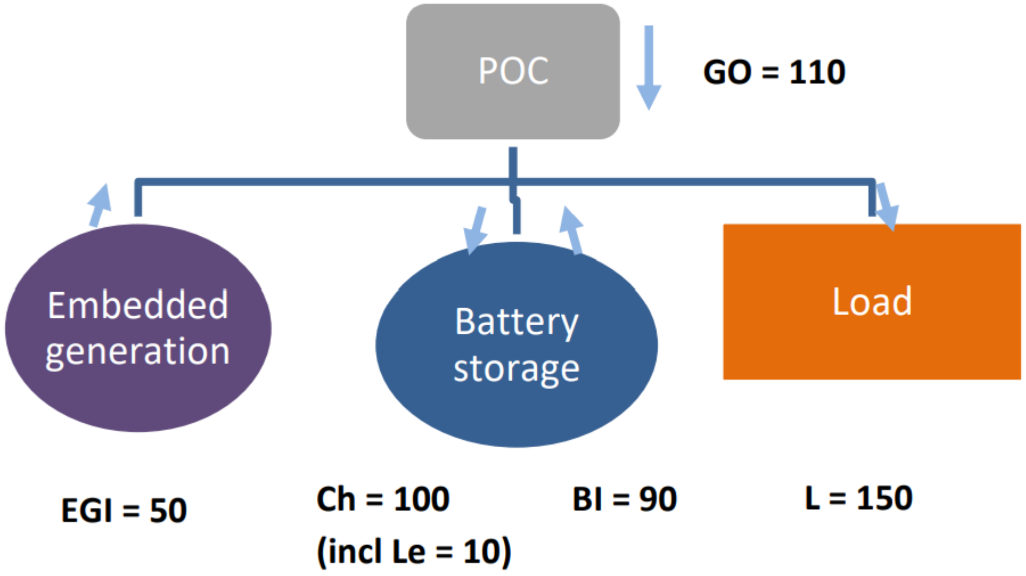


Gross energy =

GO + EGI

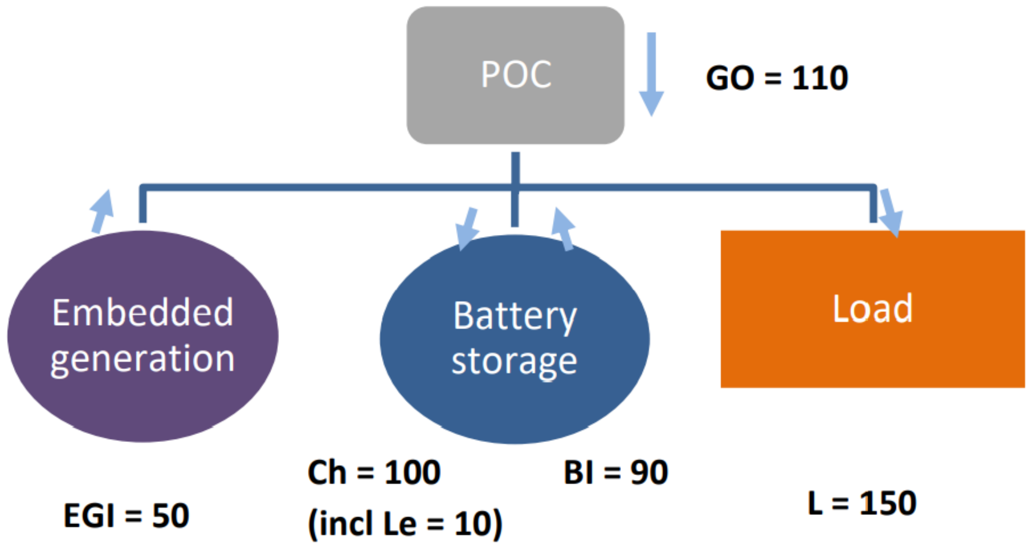
110 + 50 = 160

Gross energy = Load + Le

Worked example: Option 3 - final consumption less losses (= ‘full exemption’)

POC	= point of connection
GO	= grid offtake *(varies to balance system)*
EGI	= embedded generation injection *(fixed at 50MWh)*
Load	= Final consumption/load – *(fixed at 150MWh)*

Ch	= battery storage charging *(fixed at 100MWh)*
BI	= battery storage discharging/injection
Le	= losses (energy consumed by battery storage)



Gross energy =

GO + (EGI + BI) - Ch

110 + (50 +90) - 100 = 150

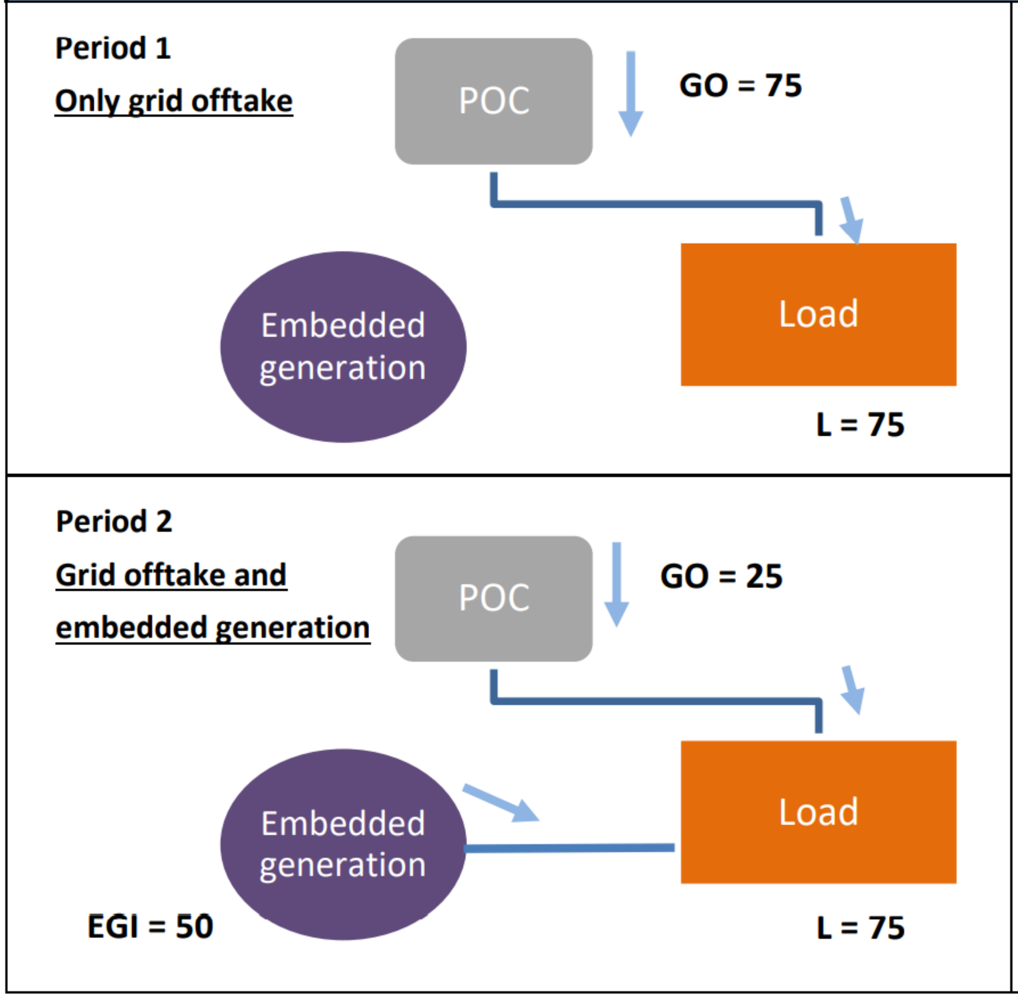
Gross energy = Load

Worked example: Calculating load for system with embedded generation

POC	= point of connection
GO	= grid offtake *(varies to balance system)*
EGI	= embedded generation injection *(fixed at 50MWh)*
Load	= Final consumption/load – *(fixed at 150MWh)*

Ch	= battery storage charging *(fixed at 100MWh)*
BI	= battery storage discharging/injection
Le	= losses (energy consumed by battery storage)

Load customer runs embedded generation



P1: GO only: = 75

P2: GO and EG: = 25 + 50 = 75

Across 2 periods: Total = 150

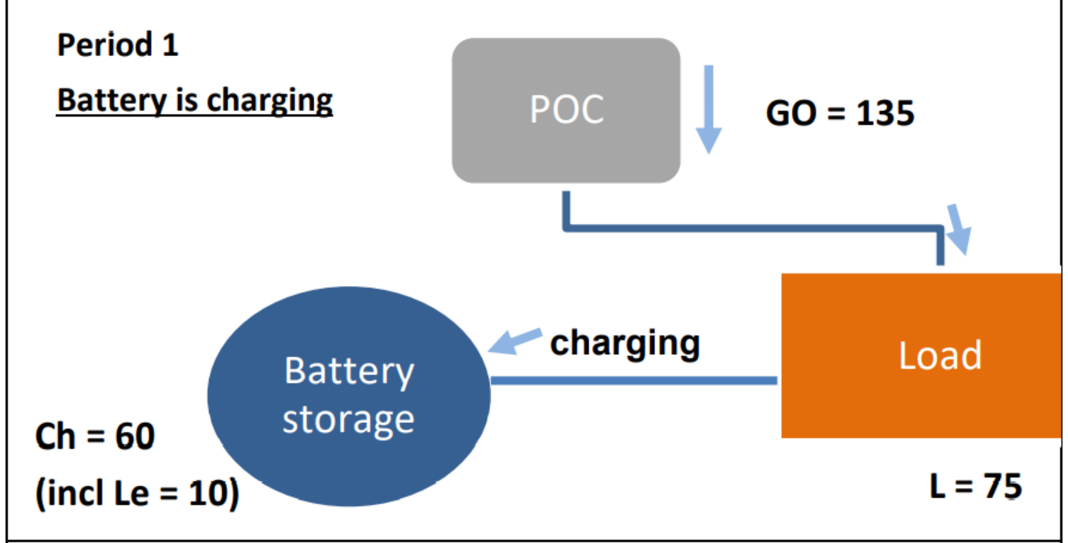
Gross energy = Load

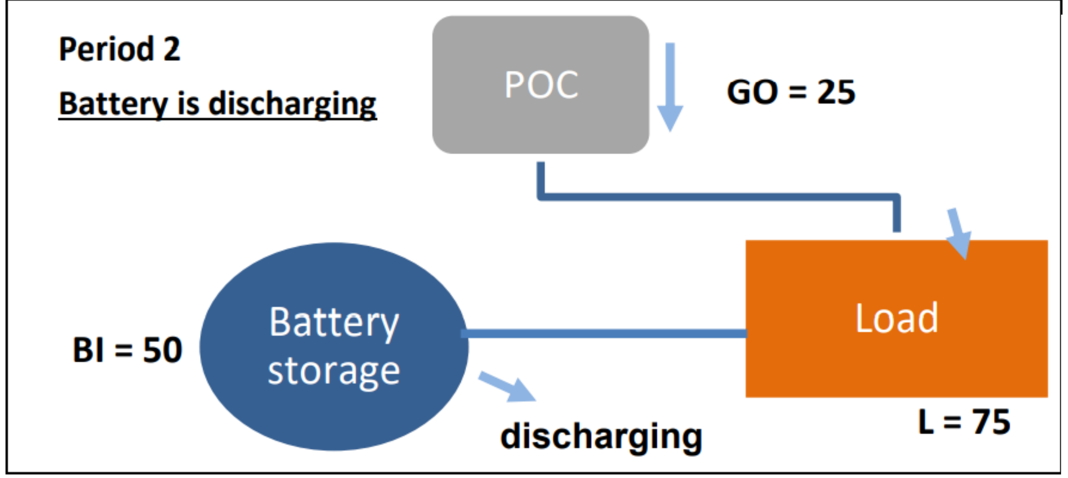
Worked example: Load customer runs a battery (splitting the measurement period 50/50 into charging and discharging) – Option 1 – allocate based on total energy

POC	= point of connection
GO	= grid offtake *(varies to balance system)*
EGI	= embedded generation injection *(fixed at 50MWh)*
Load	= Final consumption/load – *(fixed at 150MWh)*

Ch	= battery storage charging *(fixed at 100MWh)*
BI	= battery storage discharging/injection
Le	= losses (energy consumed by battery storage)

Residual charge allocated based on gross energy, indicated in red





Gross energy =

<u>TPM proposed by Transpower 30 June 2021 (allocated on total energy to charge battery):</u>

P1, charging: = GO = 135

P2, discharging: = GO + BI = 25 + 50 = <u>75</u>

Total = 210

Gross energy > Load

Gross energy > Load + Le

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Worked example: Load customer runs a battery (splitting the measurement period 50/50 into charging and discharging) – Option 2 – allocate based on final consumption

POC	= point of connection
GO	= grid offtake *(varies to balance system)*
EGI	= embedded generation injection *(fixed at 50MWh)*
Load	= Final consumption/load – *(fixed at 150MWh)*

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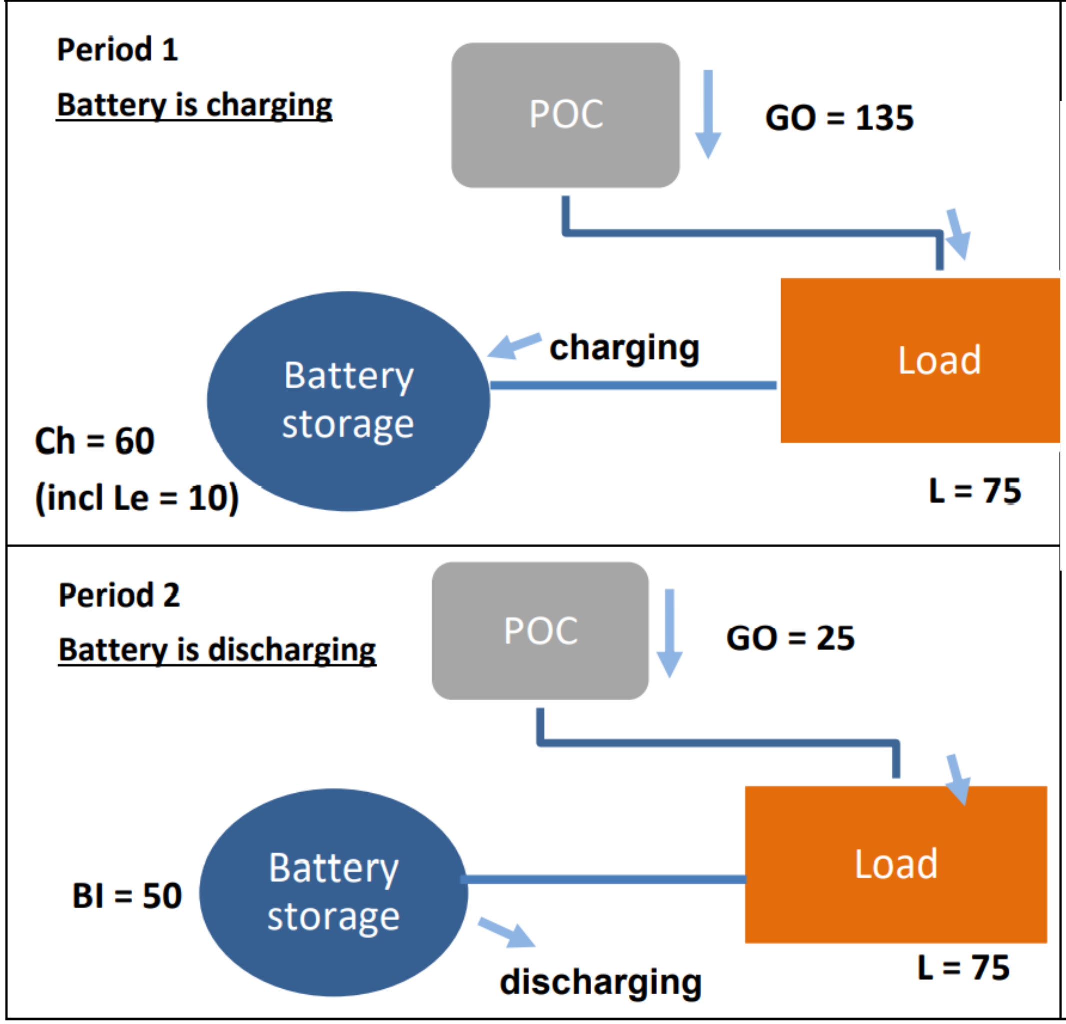
Le	= losses (energy consumed by battery storage)

Residual charge allocated based on gross energy, indicated in red



Gross energy =

Proposed TPM (allocated on final consumption):

P1, charging:	**= GO**	**= 135**
P2, discharging:	**= GO**	**= 25**
	Total	**= 160**

Gross energy = Load + Le

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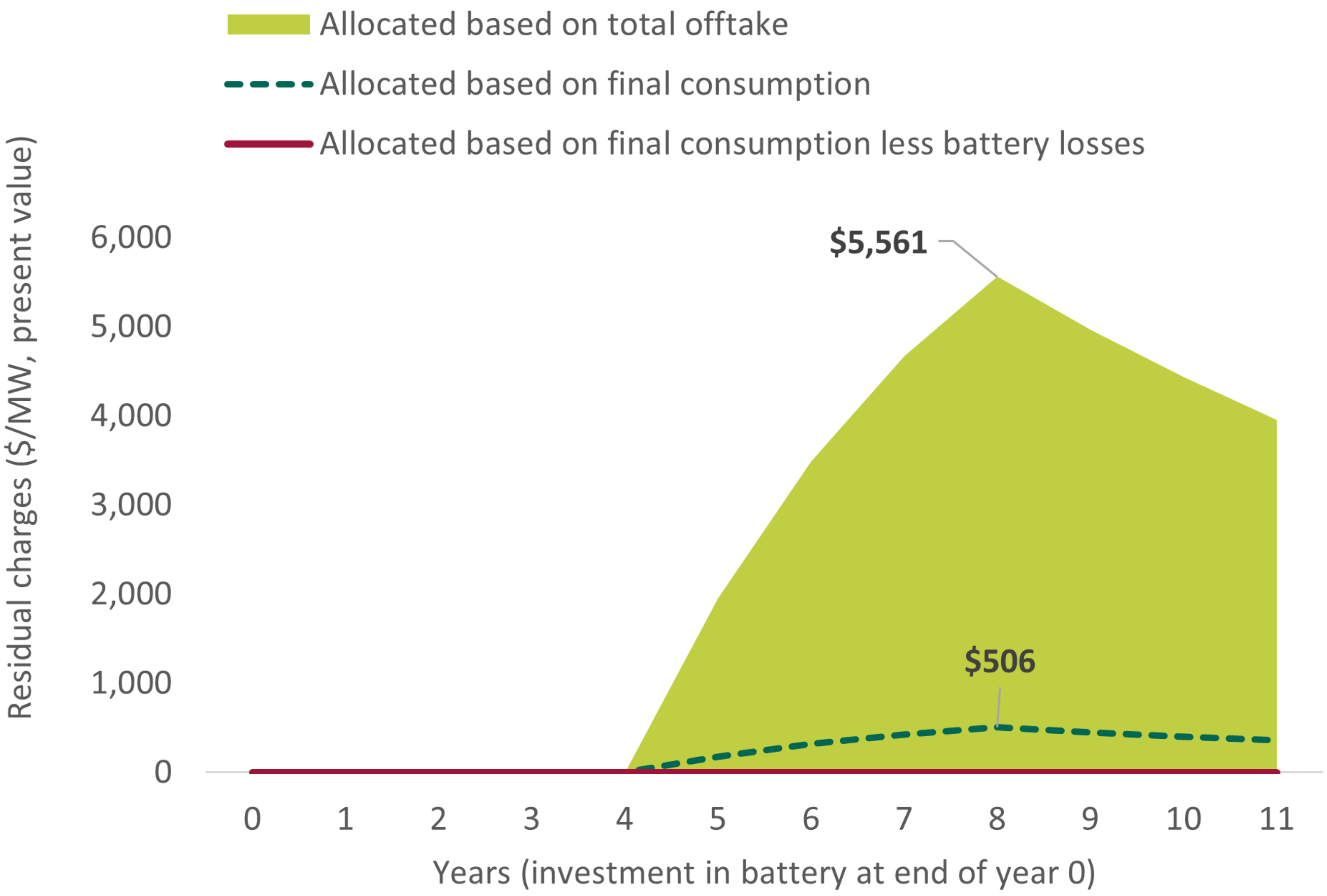
Worked example of options for application of residual charge



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Aims for residual charge's treatment of battery storage

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ensures all load attracts the residual charge on the same basis

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is future proof as new storage technologies develop

- given the market for storage is immature and storage technology is rapidly developing.

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We propose final consumption allocation because:

The Authority proposes to allocate the residual charge based on final consumption because this approach:

a. reduces any competitive disadvantage storage faces compared to other generation, and does not create any incentives for parties to alter connection and supply arrangements to avoid paying the residual charge

b. addresses the double counting issue appropriately. The approach charges batteries for what they actually consume

c. does not create new scale-neutrality challenges

d. would create a smaller measurement burden, and will necessitate far lower transaction costs to operationalise, than a full exemption

We do not propose the third approach

(which is that the residual charge is allocated based on final consumption minus battery storage losses - Transpower's 'full exemption)

- We do not propose a 'full exemption' because this:
  - could be seen as going too far, potentially providing storage with a competitive advantage over other generation:

    All other customers face the residual charge to the extent they consume electricity, and a battery's electricity consumption is the losses incurred in transformation (not the electricity reinjected into the grid or into consuming plant or a local network).

  - would be substantially more challenging to implement than a partial exemption.
  - could in practice provide more favourable treatment to utility-scale systems over smaller distributed systems (such as those operated by flexibility traders), because, to give a battery a full exemption, Transpower would need to know that battery exists.

The proposed Code

Implementing in Code via a partial exemption for battery storage

where battery storage is connected to the grid,

its residual charge will amount to its offtake

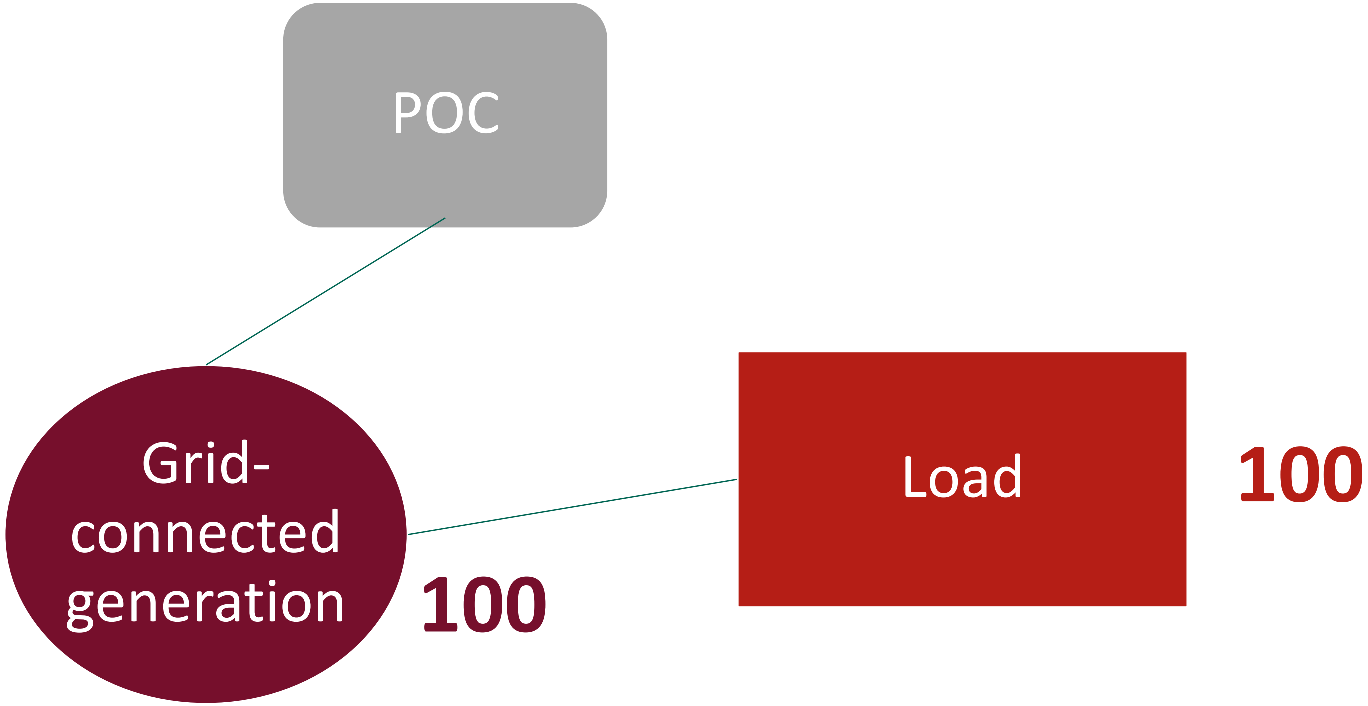
minus its injection

- The final consumption proposal is implemented via the drafted Code:
  - Clause 3(1) definitions of '**battery storage**' (was '**battery**'), and '**total gross energy**' (defined by reference to an equation in clause 5(6) which has been amended to exclude from **total gross energy** the total injection from all of the **load customer's grid**-connected **battery storage**).
  - Subjecting clause 5(1) (which defines the different types of **load customer**) to a new clause 5(2) to provide that where **generating plant** (GP) is **battery storage** the generated or **embedded electricity** referred to in clause 5(1) is deemed to be 0.
  - The flow-on effect on the calculation of residual charges in Part E (clauses 69 – 75) of the change to the definition of **total gross energy** to exclude injection from **grid**-connected **battery storage**.
- Following discussions with Transpower, the Authority proposes to enact the proposed approach by providing that
  - **batteries incur the residual charge when charging** (whether from the grid or embedded electricity)
  - but that **any injection back into the grid should be netted off**,
  - while **any embedded electricity provided to consumers or networks behind the grid by the battery discharging would not be counted** for the purposes of the residual charge.
- This has the same outcome as exempting batteries when charging (such that they are only charged the residual charge in respect of their losses)

Residual charge

Deliberately non distortionary:

- gross energy: includes all energy
- not just grid offtake
- grid-connected generators with load will pay



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How the residual charge applies to battery storage

- **Allocation based on final consumption**
  - **reduces competitive disadvantage**
  - **addresses the double counting** issue
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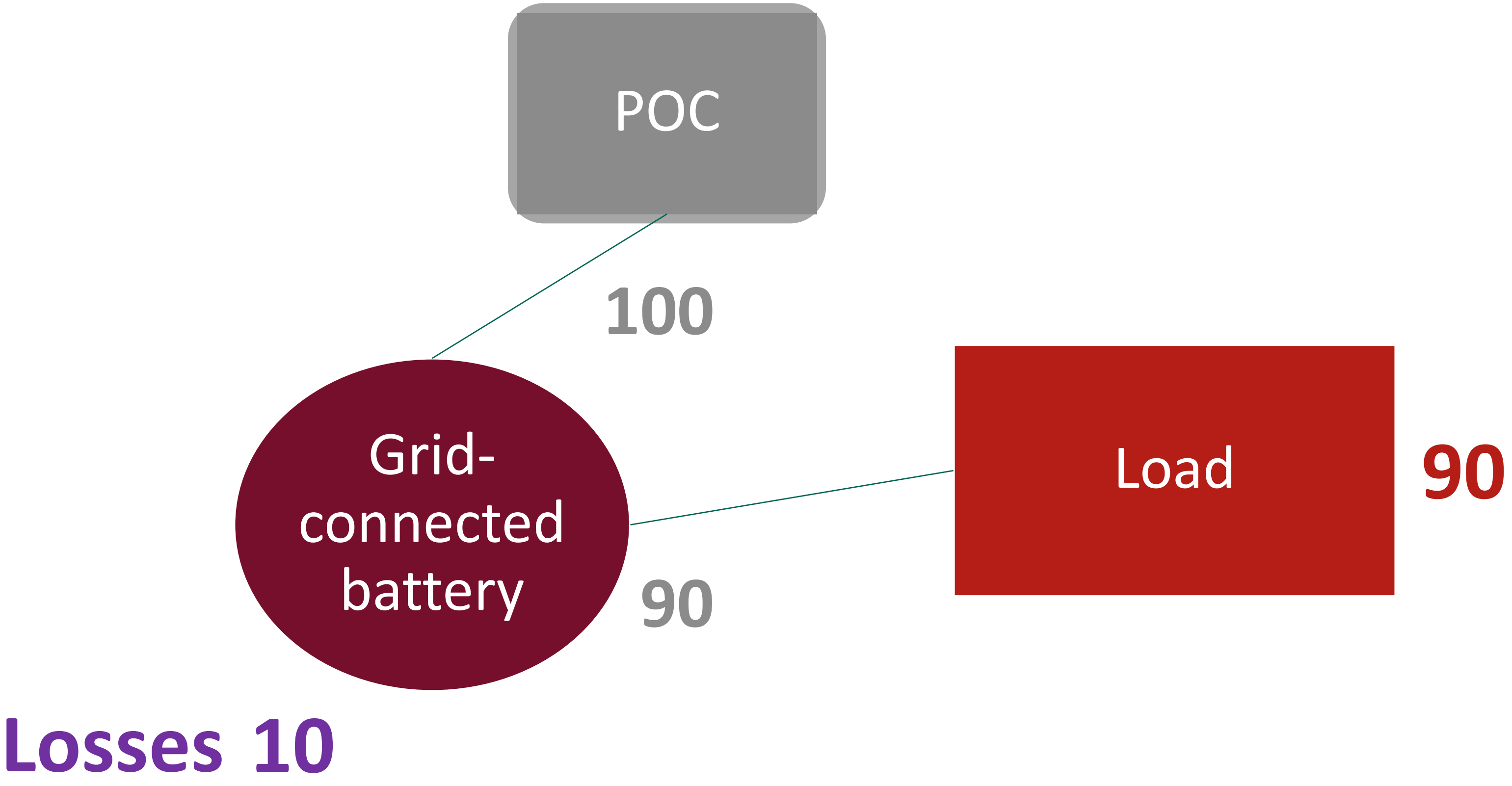
  - would create a smaller measurement burden



Application of the proposal for a new entrant

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Application of proposal to new entrant

- However, the Authority has also considered how this approach should apply when setting an initial residual charge for a new customer:
  - For a new grid-connected battery, base on AMD - final consumption (losses)
  - a different approach for a battery embedded behind a new entrant load customer. That battery is unlikely to charge during the customer's peak demand (AMD) so charging won't affect AMD. So don't count losses for AMD.
- So, when Transpower estimates the AMDR of a load customer with an embedded battery, the proposed TPM provides for it not to add any contribution from the charging or discharging of any (large) battery.
- By contrast, when Transpower estimates the AMDR of a new grid-connected battery, the proposed TPM provides for it to estimate the AMDR according to the battery's losses.
- An alternative approach would be not to make this exception in the case of battery storage embedded behind a new entrant load customer (such that the embedded battery's losses would contribute to the load customer's AMD).

Consultation dates and anticipated next steps

Consultation dates

2 minutes

- We will carefully consider submissions and cross submissions
- We are working towards a decision in first half of 2022.
- The decision date will depend on volume and complexity of submissions
- We are (currently) aiming for an April 2023 implementation date

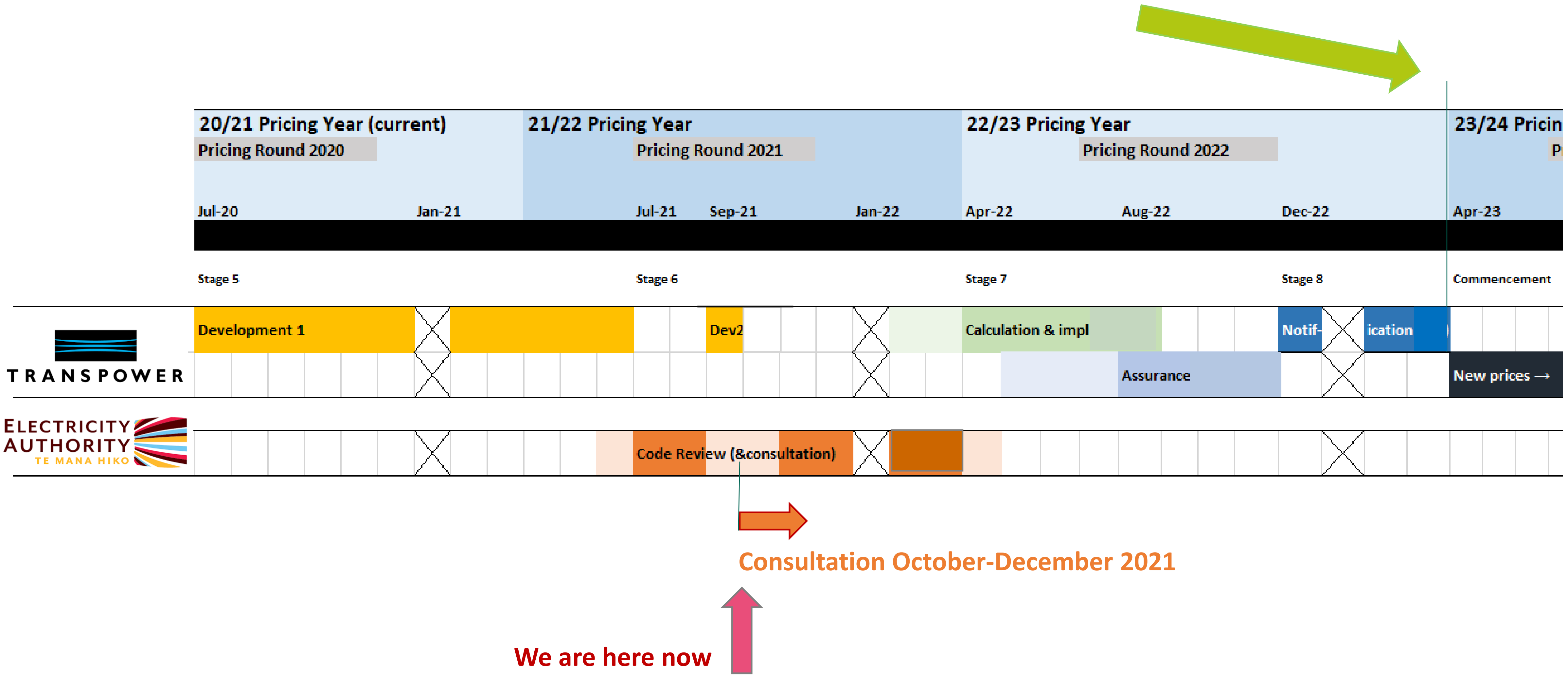
Dates for this consultation process

- Submissions close 2 December 2021
- Cross submissions close 23 December 2021

Consultation – open until 2 December, then cross submissions to 23 December

2 minutes

The process - to an April 2023 anticipated start date



Final questions?

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Thank you

TPM@ea.govt.nz

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