

“The next frontier”

Timera webinar on German BESS investment

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‘The next frontier’ - webinar scope

Agenda

1. German power market fundamentals
2. BESS revenue stack in Germany
3. BESS optimisation case study & backtest
4. Offtake & financing
5. Key investment risks
6. Q&A

Speakers

David Stokes - Managing Director



Steven Coppack - Director Power



Selina Paxton – Senior Analyst



Disclaimer

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About Timera Energy

Specialist energy consultancy

Focus on power, gas & hydrogen

Extensive industry expertise

Practical knowledge from senior industry roles

Pragmatic commercial focus

Covering investment, value monetisation & market analysis

Strong client base

Leading energy companies (e.g. producers, utilities, traders, funds)

Leading industry blog

30,000+ regular readers, publications, conferences

Timera clients include



What does Timera do?

BESS consulting advice

- BESS revenue analysis (e.g. GB, DE, FR, NL, BE, IT, ES)
- Market & price analysis
- Transaction support & DD
- Investment targeting
- Offtake structuring
- Trading performance benchmark

Battery subscription service

- Investment tool updated (Qtrly)
- GB BESS Report (Bi-annual)
- Bespoke workshop (Bi-annual)

Examples of client work

Project	Client	Description
DE BESS CDD	Fund (multiple)	Commercial DD, market & revenue analysis to support large DE BESS developer acquisition
DE BESS investment	Utility	In-depth revenue analysis of DE BESS for large pan-European utility
EU BESS platform	Bank	Commercial DD, market & revenue analysis to support large debt & equity investment in EU BESS platform (NW Europe)
IT battery platform	Fund	Commercial due diligence to support investment in large Italian RES + BESS growth platform (IT)
Growth strategy	Fund	Support leadership team define & analyse target markets & growth strategy to scale BESS portfolio (across DE, IT, BE, NL & ES)
ES battery investment	Generator	Analysis of Spanish mkt evolution & battery margin projections & regulatory hurdles (ES)
NL battery & flex investment	Large investor	Detailed analysis of NL power market evolution & multiple grid scale battery investment cases (NL)
IT battery platform	Fund	Commercial due diligence to support investment in large Italian RES + BESS growth platform (IT)
BESS offtake support	Funds	Advice on structuring & negotiation of a master PPA agreement covering BESS optimisation (IT, GB)

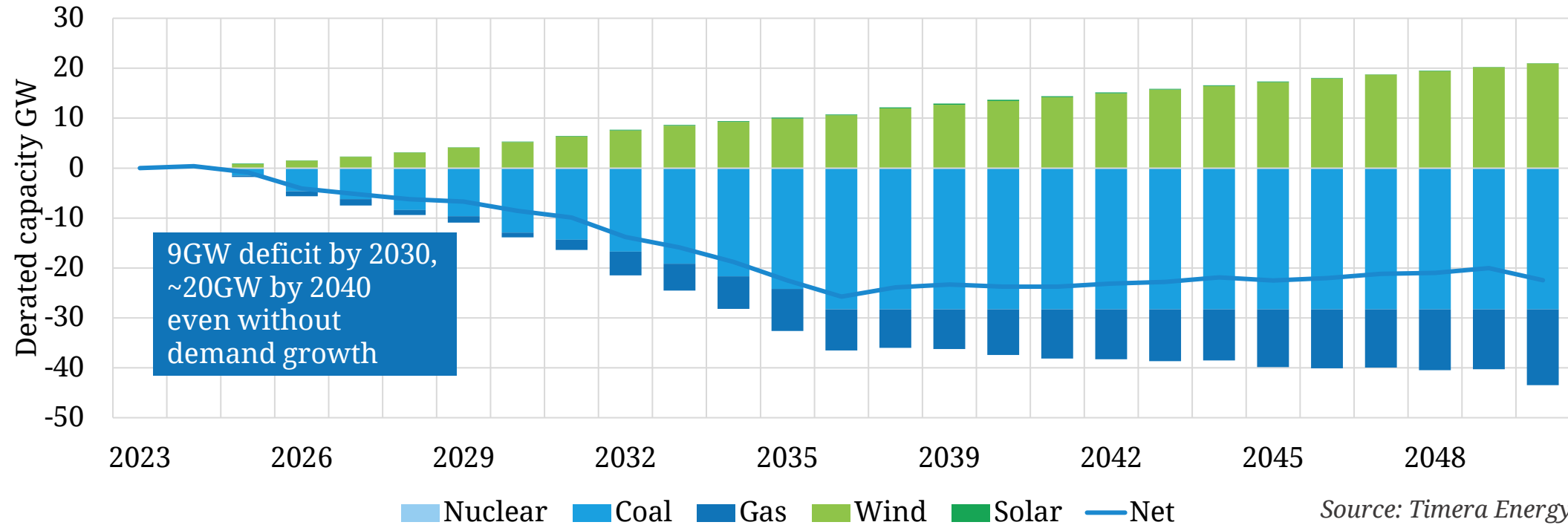
5 key takeaways

What is driving the momentum behind German BESS investment?

Takeaway	Driver
1. Flex capacity deficit	<ul style="list-style-type: none">• Thermal closures outpacing renewables build on a derated capacity basis
2. RES swing growth	<ul style="list-style-type: none">• Within-day generations swings of up to 37GW wind & 63GW solar by 2030
3. W-D market key	<ul style="list-style-type: none">• Liquid & volatile 15 min granularity Within-Day market a unique value driver
4. Strong returns 2022-23	<ul style="list-style-type: none">• Growing investment momentum supported by high recent BESS returns
5. Finance & offtake tailwinds	<ul style="list-style-type: none">• Offtake & financing terms are moving in favour of BESS developers

Thermal closures driving a flex deficit

Thermal closures materially outpace renewables build in derated capacity terms



Source: Timera Energy

Solar capacity up 48GW by 2030

Wind capacity up by 54GW by 2030

Coal + lignite -19GW by 2030

Peak demand up by 22GW by 2030

Note: Rising peak demand increases the requirement for firm capacity and increases the capacity deficit (not shown in chart).

RES intermittency drives price signals

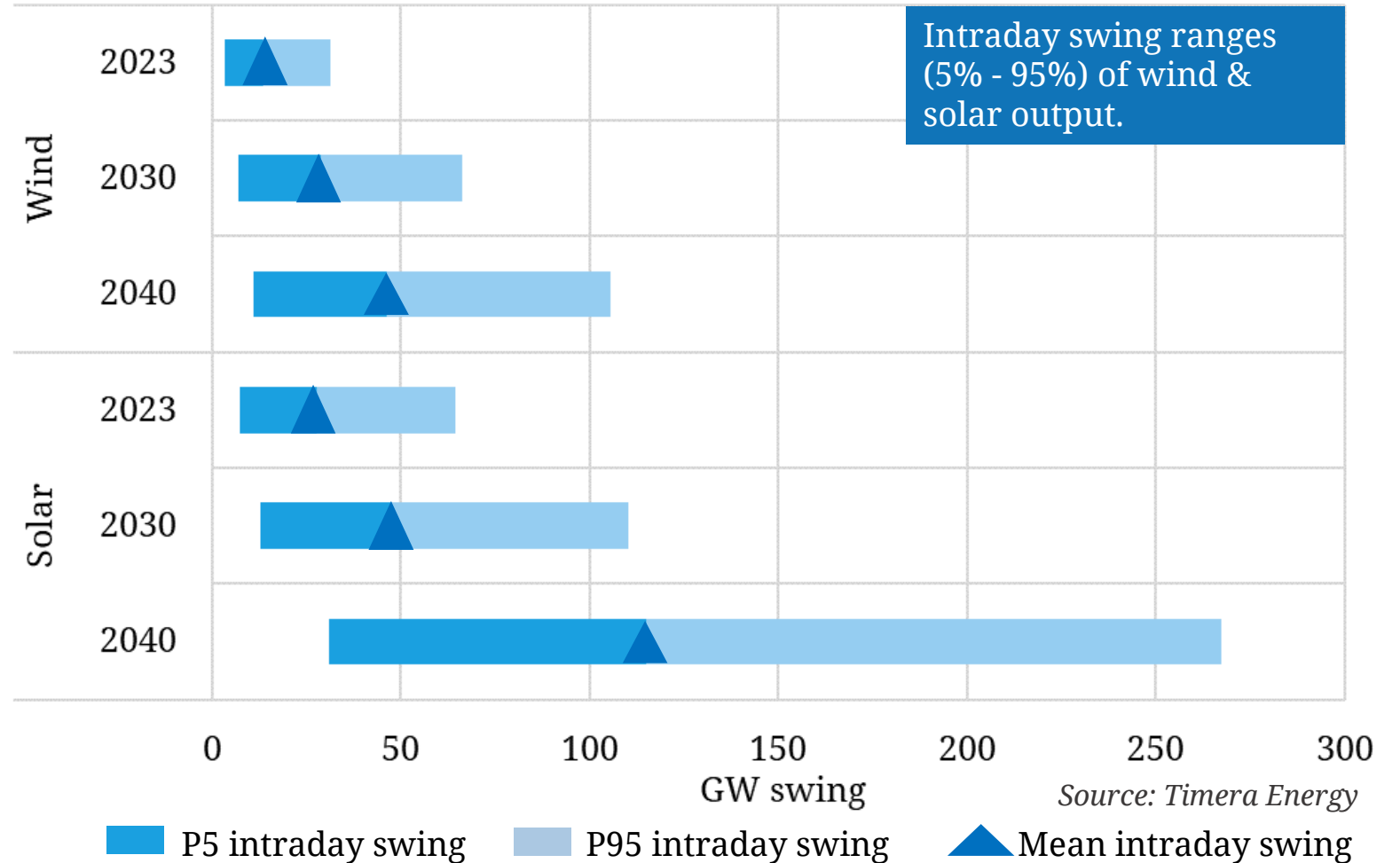
RES growth driving BESS value

- RES swings to drive large increase in intraday price volatility
- By 2030, within-day generations swings of up to:
 - 37GW wind
 - 63GW solar

Swings underpin requirement for balancing flex

- BESS ideally placed to balance swings in RES output
- Primary drivers of BESS returns:
 1. Structural price shape
 2. Intraday price volatility

RES output intraday swing distributions (GW)



Revenue stack underpinned by arbitrage

Battery investment relies on revenue stacking

1. FCR or committed aFRR (~2%)

- DA commitment of frequency services
- Paid on a capacity basis
- Shallow market, soon to saturate

2. Day-Ahead (~45%)

- Large liquid market. “Perfect” optimisation based on market design.
- Typically “first” optimisation, locking in intrinsic 1hr spreads
- Larger % of revenues for long duration BESS than short duration

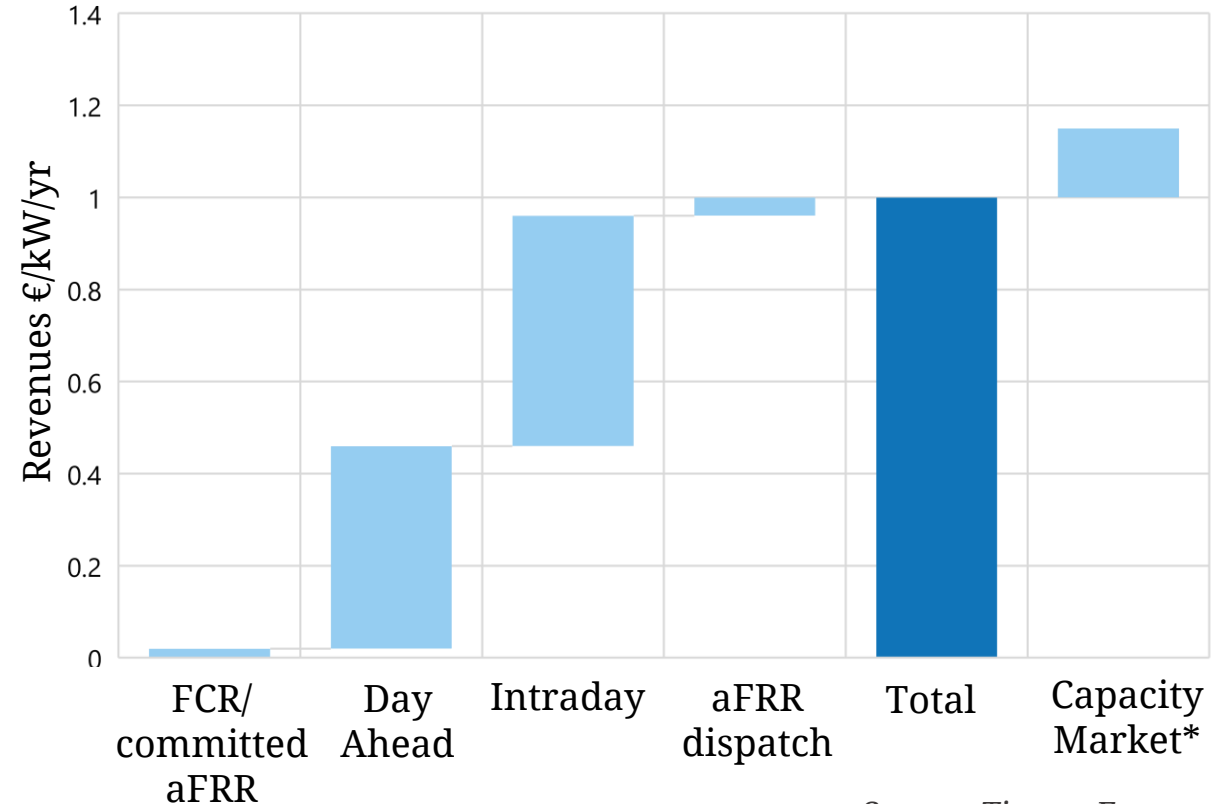
3. Within Day optimisation (~50%)

- Liquid intraday markets with good forward visibility
- Rolling, “imperfect” optimisation
- 15-minute products increase spread opportunity

4. aFRR utilisation (~3%)

- Low volume, pay as bid

Indicative lifetime revenue breakdown for 2hr battery



Source: Timera Energy

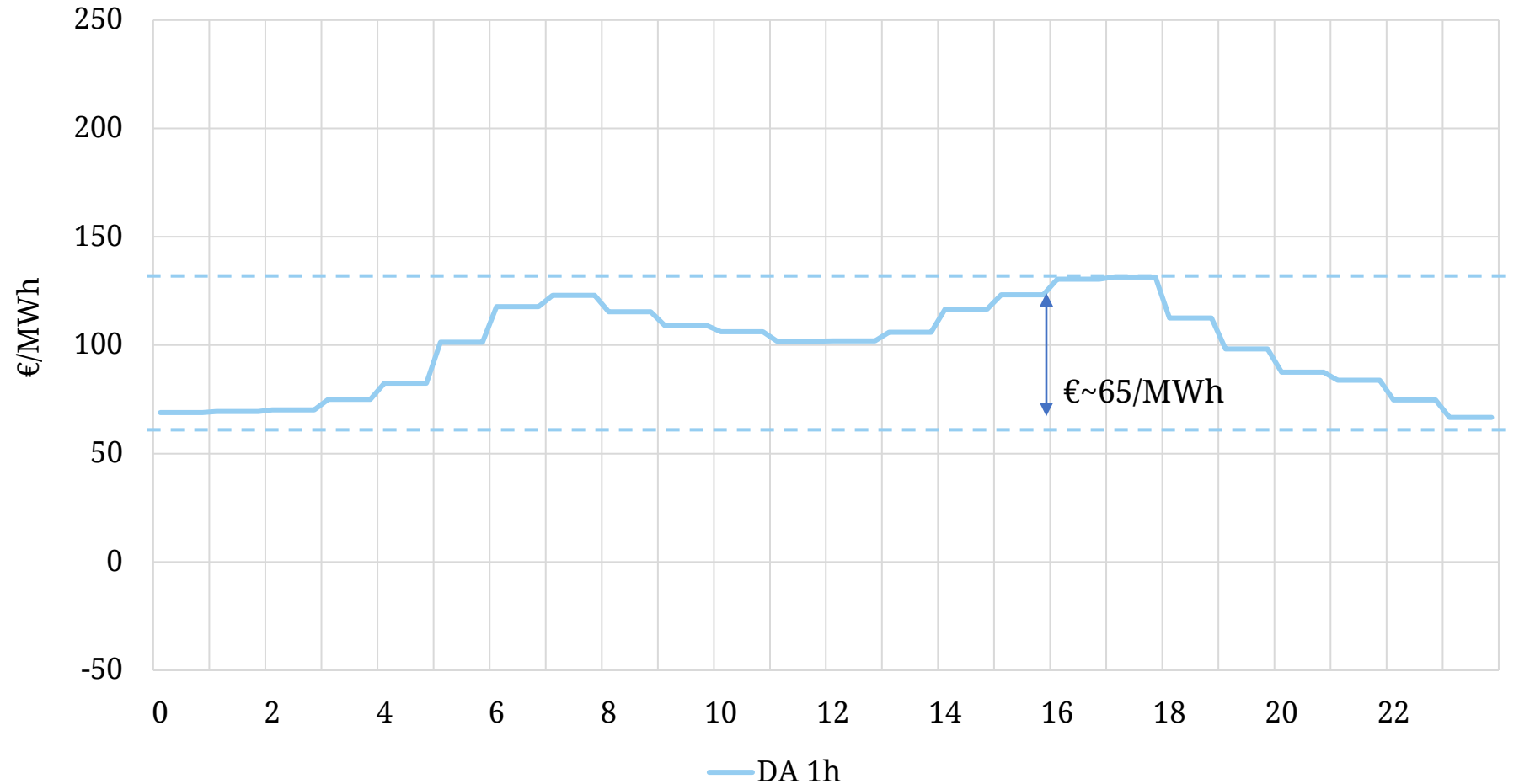
*Potential CM revenue upside depending on market design

BESS optimisation 1: Day-Ahead hourly auction

Optimisation stages

1. DA Optimisation

- BESS captures first spreads against DA hr price signals.



BESS optimisation 2: Day-Ahead 15 min auction

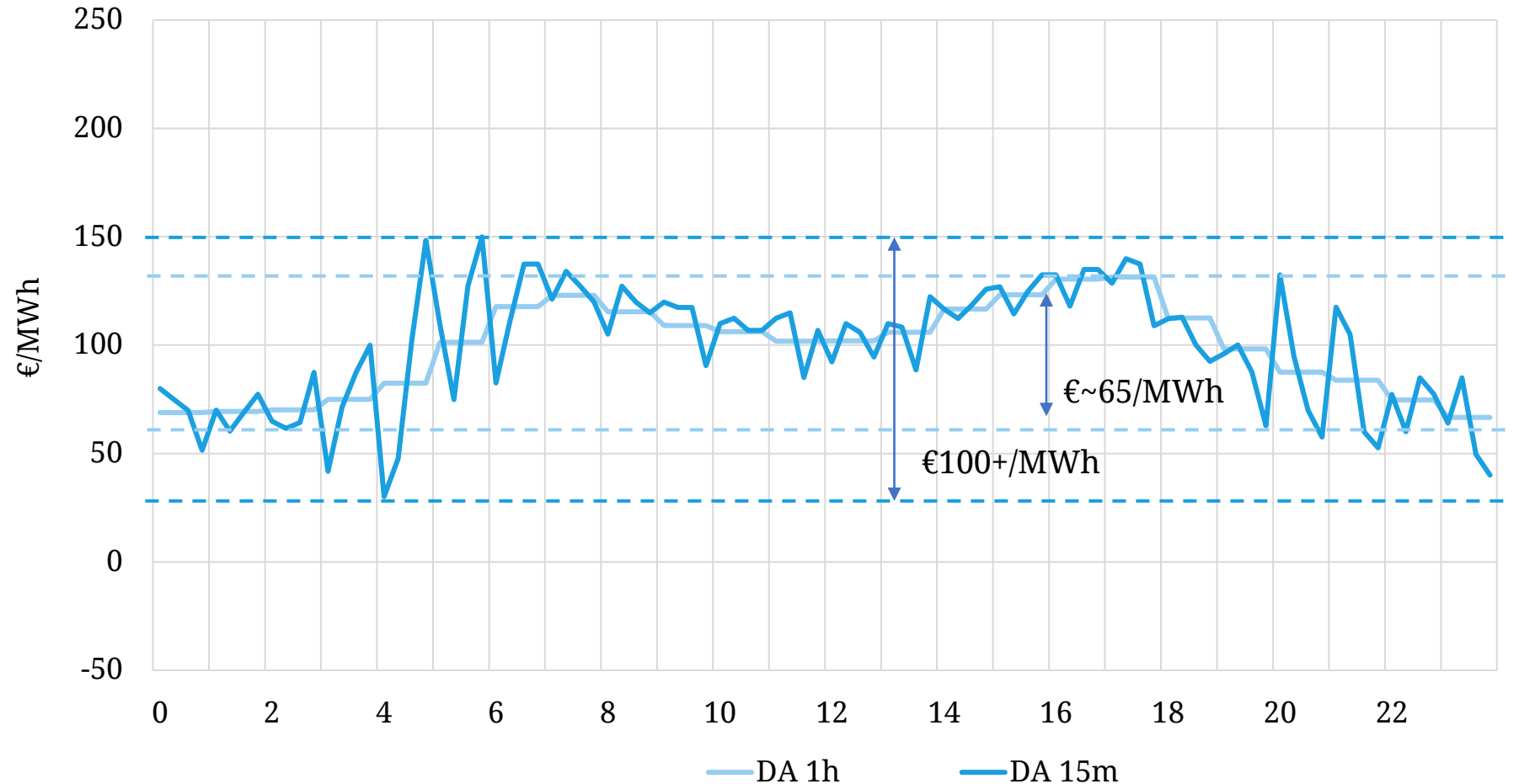
Optimisation stages

1. DA Optimisation

- BESS captures first spreads against DA hr price signals.

2. DA 15m optimisation

- The DA 15 minute auction adds an hourly shape, increasing the capturable spreads significantly
- In addition to widening the whole DA spread, spreads emerge within hour, increasing trading and cycling opportunities.



BESS optimisation 3: Within-Day 15 min trading

Optimisation stages

1. DA Optimisation

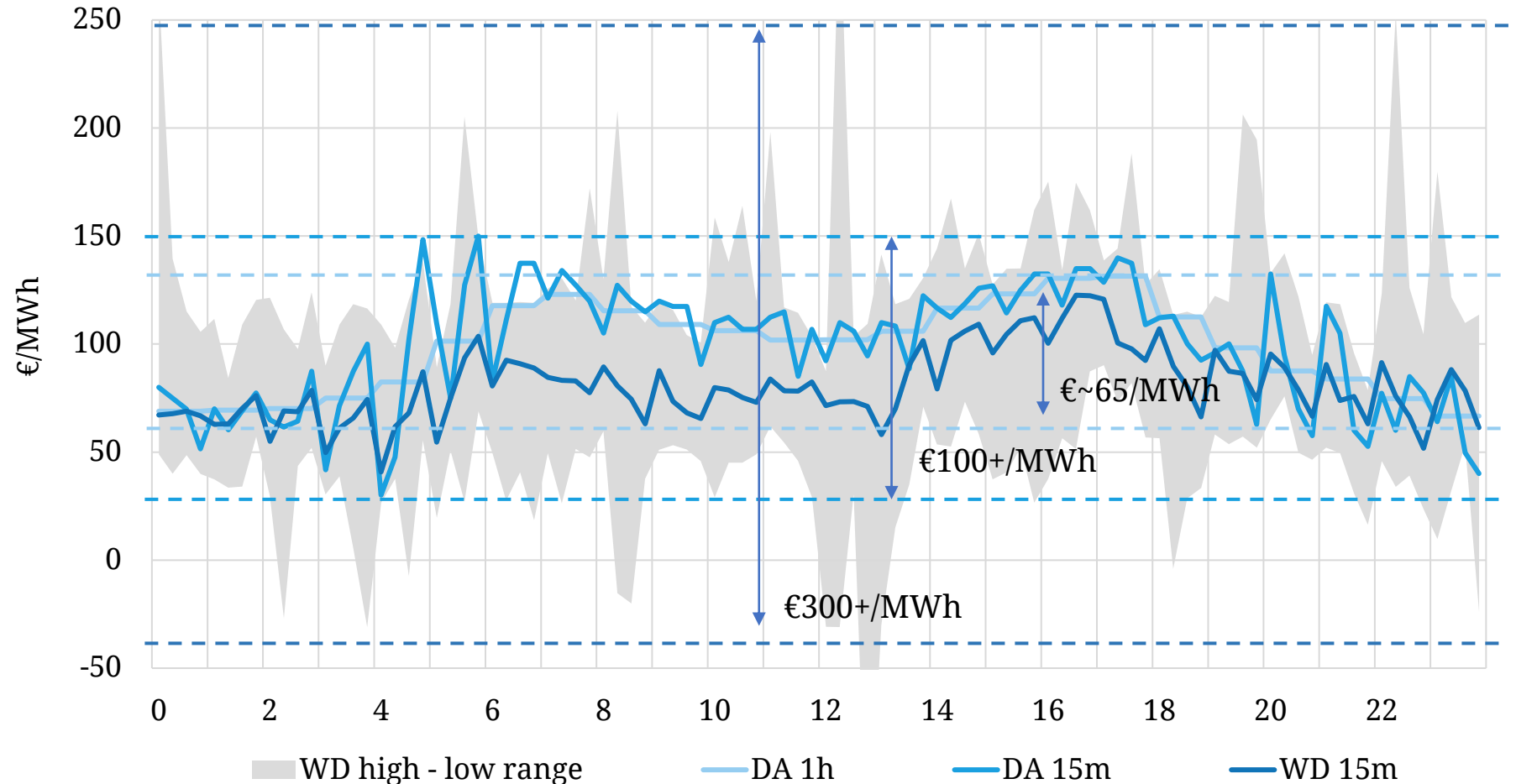
- BESS captures first spreads against DA hr price signals.

2. DA 15m optimisation

- The DA 15 minute auction adds an hourly shape, increasing the capturable spreads significantly
- In addition to widening the whole DA spread, spreads emerge within hour, increasing trading and cycling opportunities.

3. WD 15m trading

- Continuous intraday trading offers multiple re-optimisation across the day and within each period

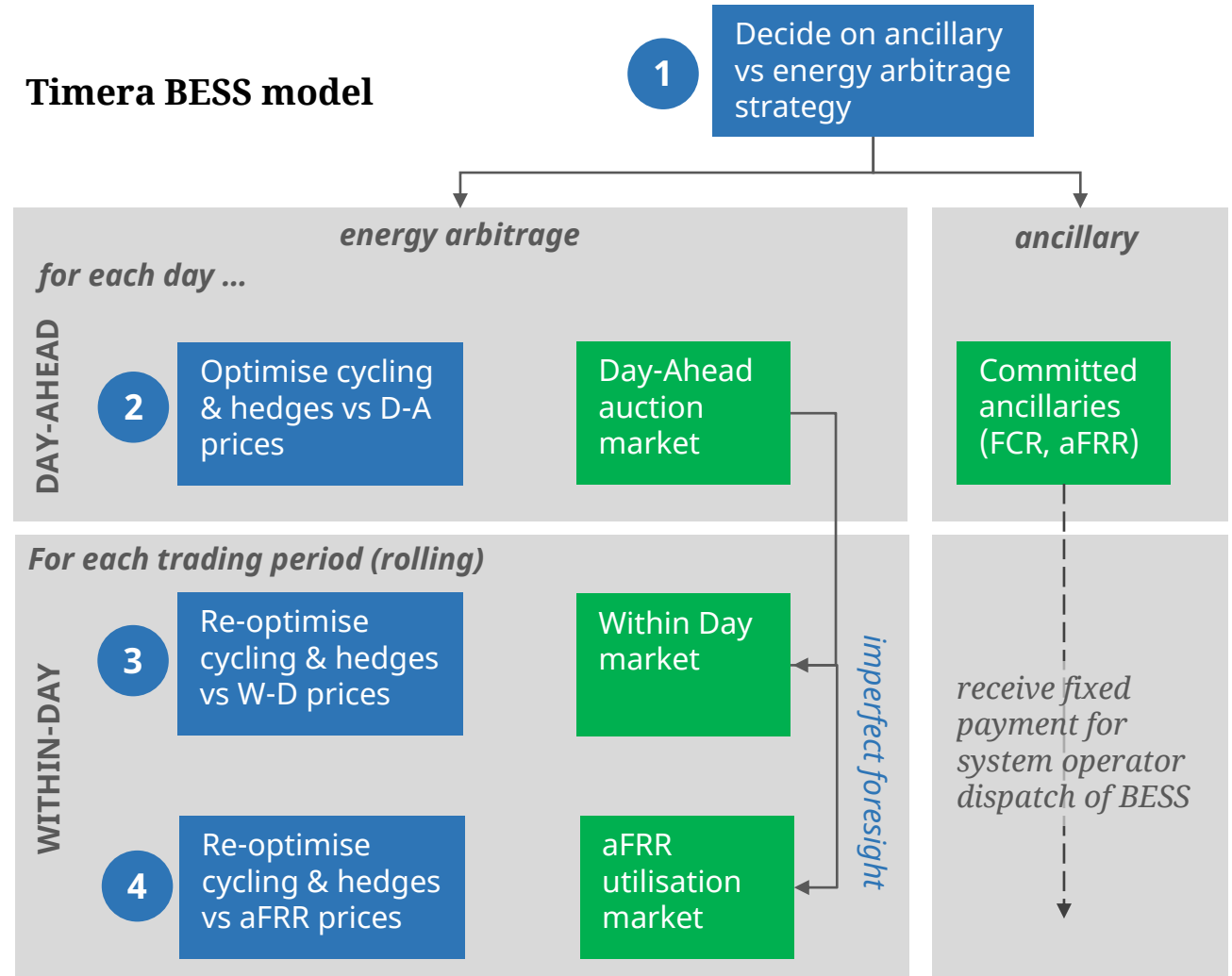


How do we model BESS value?

5 takeaways on our BESS model

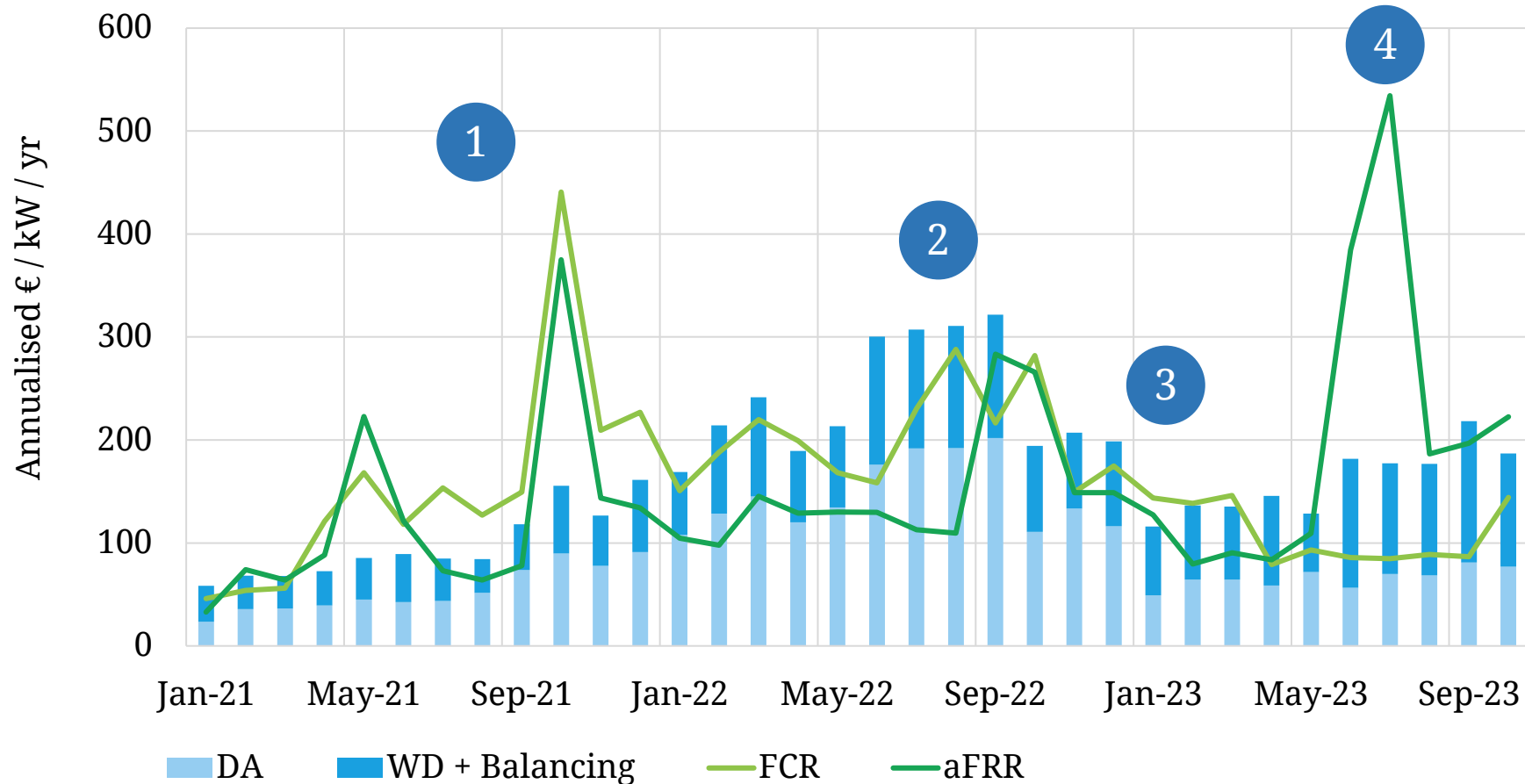
1. Developed by storage experts
2. BESS optimised against multiple (e.g. 500+) simulated price paths
3. Replicates trader's decision making with imperfect foresight
4. Focus on revenue stack optimisation that can be achieved in reality
5. Regularly benchmarked against achieved optimiser revenue results

Timera BESS model



German BESS revenue backtest

Back-tested German BESS returns (energy arbitrage strategy)



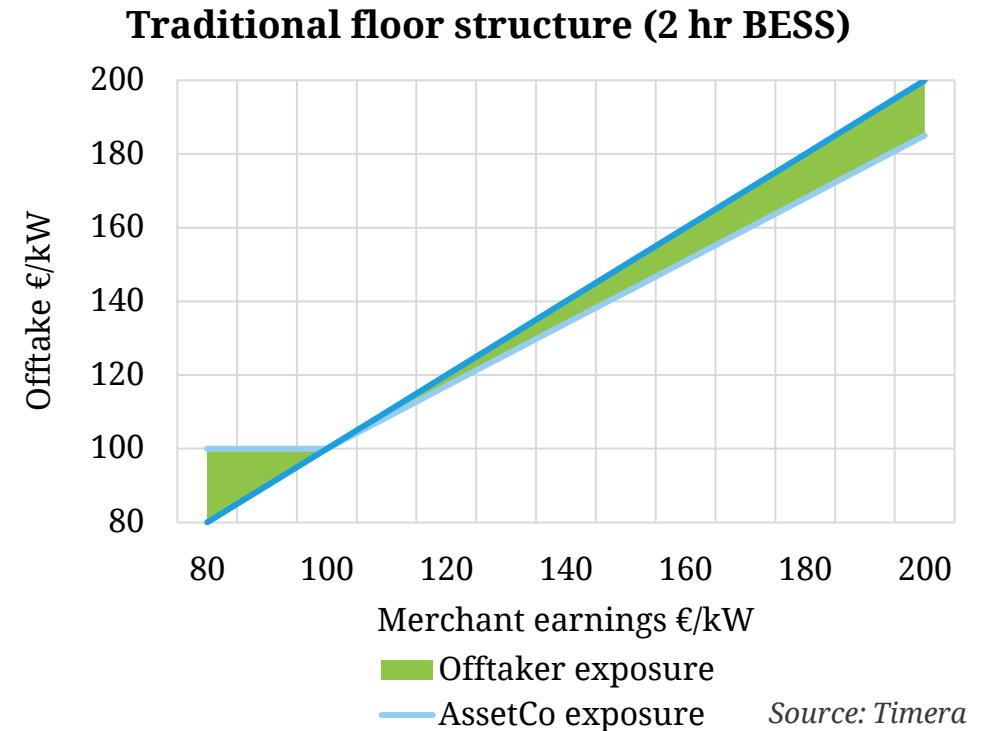
- 1 Ancillary service prices spike on tight gas and power market, winter gas fears.
- 2 Surge in gas & power prices and volatility given RU supply cuts and FR nuclear issues.
- 3 Revenues recede as FR nuclear availability improves, gas prices fall.
- 4 aFRR prices spike as low demand and high RES push thermal to the margin. aFRR prices jump to compensate for providing services whilst out-of-the-money.

Source: Timera BESS dispatch optimisation model

Offtake & financing conditions improving

5 takeaways

Area	Takeaway
1. Offtaker competition	Increase in offtaker competition improving terms & fees
2. Lenders	Lenders getting more comfortable with BESS & downside risks
3. Floors	Floor levels rising, duration extending (out to 10 yrs); but remain expensive in terms of lost upside
4. Innovation	New structures emerging e.g. 3 rd party floors and price shape swaps
5. W-D returns	Strong achieved within-day revenues supporting offtake & lending terms



Key offtake variables

- Contract duration (years)
- Floor level (€/MWh)
- Margin share %
- Tiered performance fee & fixed fee

Framework for downside risks key to success

Strong structural drivers support DE BESS investment with requirement for 12-16 GW by 2030

But investment cases need to be robust for downside risks

Risk	Summary
1. Ancillary erosion	Risk of rapid erosion of FCR & aFRR revenue streams (e.g. across 2-3 years)
2. RES vs BESS volumes	BESS build outpacing RES balancing requirement temporarily eroding value capture
3. Thermal closures	Flex competition: coal closures, new gas build, flexible biogas & electrolysers
4. Demand growth	Pace of annual & peak demand growth as other sectors electrify e.g. EVs, heat, H2
5. Policy evolution	Support for BESS vs other flex asset classes e.g. CM implementation, grid fee exemption

Q&A

Our services include

EU BESS market entry

- Structured ranking of BESS investment opportunities across European markets
- Analysis of BESS revenue stack evolution & value drivers
- Key value & risk drivers (e.g. policy, capacity mix, price shape & volatility evolution)

Bespoke consulting

- Asset valuation & market analysis
- Commercial due diligence & transaction support
- Market access & offtake contracting

GB BESS quarterly subscription service

- Battery Investment Tool – highly configurable to value wide range of GB BESS assets
- B. Storage Report - Latest data driven analysis & conclusions to support decision making
- C. Talk to the experts - ‘One on one’ workshop with Timera’s team of storage experts

Contact us to find out more: Steven Coppack, Power Director steven.coppack@timera-energy.com
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Audience Q & A

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