nationalgridESO

ESO RIIO-2 Business Plan
Annex 1 – Supporting Information

9 December 2019

1. Summary cost tables
2. Activity architecture tables
3. ESO RIIO-1 story
4. Benchmarking process
5. Assumptions about our role and those of other parties
6. Investment roadmaps

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Section 1- Summary investment tables

These tables summarise the investments in the Business Plan and help navigate the cost tables. Any small differences in totals are due to rounding.

Table 1 – ESO Summary totex

ESO £m (18/19 prices)	Business plan location	RIIO-1	2021/22	2022/23	2023/24	2024/25	2025/26	2 year average	2 year total
Ongoing opex	See table 2	62.7	71.4	70.4	70.7	69.7	66.4	70.9	141.8
Ongoing business support opex	See table 2	22.1	16.3	16.3	16.4	16.6	16.6	16.3	32.5
Ongoing IT opex	11.1.	39.7	58.4	56.0	54.8	56.5	58.8	57.2	114.4
Ongoing business support capex	See table 2	1.7	2.3	4.3	2.3	2.7	2.7	3.3	6.6
Ongoing IT capex	11.1.	56.1	59.0	38.9	33.1	32.1	30.7	48.9	97.8
Transformational opex	Annex 2	-	3.9	6.3	7.2	8.1	7.2	5.1	10.2
Transformational IT opex		-	13.1	15.8	20.9	22.1	25.1	14.5	28.9
Transformational capex		-	34.9	47.0	59.5	53.4	45.0	40.9	81.9
Total		**182.3**	**259.2**	**255.0**	**264.8**	**261.2**	**252.4**	**257.1**	**514.1**
- Opex		***124.5***	***163.0***	***164.8***	***169.9***	***173.0***	***174.1***	***163.9***	***327.8***
- Capex		***57.8***	***96.1***	***90.2***	***94.9***	***88.2***	***78.4***	***93.2***	***186.3***
- Total		***182.3***	***259.2***	***255.0***	***264.8***	***261.2***	***252.4***	***257.1***	***514.1***
- Transformational opex & capex	Section 3.1.3	***-***	***51.9***	***69.1***	***87.6***	***83.7***	***77.3***	***60.5***	***121.0***
- Ongoing opex		***62.7***	***71.4***	***70.4***	***70.7***	***69.7***	***66.4***	***70.9***	***141.8***
- Ongoing IT opex and capex		***95.8***	***117.4***	***94.9***	***87.9***	***88.6***	***89.5***	***106.1***	***212.2***
- Ongoing business support opex & capex		***23.8***	***18.5***	***20.6***	***18.6***	***19.2***	***19.2***	***19.6***	***39.1***
- Total		***182.3***	***259.2***	***255.0***	***264.8***	***261.2***	***252.4***	***257.1***	***514.1***

Note: RIIO-1 number is based on a two year average for Opex, and an 8 year average for Capex

Table 2 – Totex view by Themes 1-4

ESO £m (18/19 prices)	Business plan location	RIIO-1	2021/22	2022/23	2023/24	2024/25	2025/26	2 year average	2 year total
Theme 1	**Chapter 4**								
Ongoing opex	Chapter 4 Annex 2 - CBA	23.2	27.6	27.2	27.0	25.3	24.8	27.4	54.8
Ongoing IT opex		-	1.4	1.6	1.4	1.5	2.3	1.5	3.0
Ongoing IT capex		22.1	5.9	7.2	5.3	4.8	5.0	6.5	13.0
Transformational opex		-	2.1	2.9	3.0	3.3	3.6	2.5	5.0
Transformational IT opex		-	3.4	6.1	9.4	11.0	12.5	4.7	9.5
Transformational capex		-	18.3	29.7	40.5	36.1	26.7	24.0	48.0
Total	4.1. - Headline	**45.3**	**58.6**	**74.7**	**86.6**	**82.0**	**74.8**	**66.7**	**133.3**
- Opex	4.1. - Fig. 16	***23.2***	***34.5***	***37.8***	***40.8***	***41.1***	***43.2***	***36.1***	***72.3***
- Capex	4.1. - Fig. 16	***22.1***	***24.1***	***36.9***	***45.9***	***40.9***	***31.7***	***30.5***	***61.0***
Theme 2	**Chapter 5**								
Ongoing opex	Chapter 5 Annex 2 - CBA	12.0	16.1	16.9	18.3	19.2	17.1	16.5	32.9
Ongoing IT opex		-	5.7	3.3	3.6	3.9	5.1	4.5	9.0
Ongoing IT capex		14.3	17.6	11.0	10.8	11.3	12.4	14.3	28.6
Transformational opex		-	0.5	1.7	1.7	1.8	0.7	1.1	2.2
Transformational IT opex		-	7.0	5.8	6.2	4.6	4.8	6.4	12.9
Transformational capex		-	4.4	4.0	3.4	2.9	2.6	4.2	8.3
Total	5.1.- Headline	**26.3**	**51.2**	**42.6**	**43.9**	**43.7**	**42.6**	**46.9**	**93.8**
- Opex	5.1.4 - Fig. 23	***12.0***	***29.3***	***27.6***	***29.8***	***29.5***	***27.6***	***28.5***	***56.9***
- Capex	5.1.4 - Fig. 23	***14.3***	***22.0***	***14.9***	***14.2***	***14.2***	***15.0***	***18.5***	***36.9***
Theme 3	**Chapter 6**								
Ongoing opex	Chapter 6 Annex 2 - CBA	1.5	2.6	2.7	2.7	2.5	2.4	2.7	5.3
Ongoing IT opex		-	-	-	-	-	-	-	-
Ongoing IT capex		-	-	-	-	-	-	-	-
Transformational opex		-	0.2	0.4	0.3	0.3	0.2	0.3	0.5
Transformational IT opex		-	0.8	0.9	1.1	0.9	0.9	0.8	1.7
Transformational capex		-	3.0	3.0	3.2	1.6	1.2	3.0	6.1
Total	6.1. - Headline	**1.5**	**6.6**	**7.0**	**7.3**	**5.4**	**4.7**	**6.8**	**13.6**
- Opex	6.1.2 - Fig. 27	***1.5***	***2.8***	***3.0***	***3.0***	***2.9***	***2.6***	***2.9***	***5.8***
- Capex	6.1.2 - Fig. 27	***-***	***3.0***	***3.0***	***3.2***	***1.6***	***1.2***	***3.0***	***6.1***
Theme 4	**Chapter 7**								
Ongoing opex	Chapter 7 Annex 2 - CBA	11.7	14.9	14.9	14.8	14.7	14.2	14.9	29.8
Ongoing IT opex		-	-	-	-	-	-	-	-
Ongoing IT capex		3.3	-	-	-	-	-	-	-
Transformational opex		-	1.1	1.4	2.3	2.7	2.8	1.3	2.5
Transformational IT opex		-	1.9	2.9	4.1	5.6	6.9	2.4	4.8
Transformational capex		-	9.2	10.3	12.4	12.8	14.4	9.7	19.5
Total	7.1. - Headline	**15.0**	**27.1**	**29.5**	**33.5**	**35.8**	**38.3**	**28.3**	**56.7**
- Opex	7.1.2 - Fig. 32	***11.7***	***17.9***	***19.3***	***21.1***	***23.0***	***23.8***	***18.6***	***37.2***
- Capex	7.1.2 - Fig. 32	***3.3***	***9.2***	***10.3***	***12.4***	***12.8***	***14.4***	***9.7***	***19.5***

Table 3 – Totex view by other chapters

ESO £m (18/19 prices)	Business plan location	RIIO-1	2021/22	2022/23	2023/24	2024/25	2025/26	2 year average	2 year total
Open data	**Chapter 8**								
Ongoing opex	Chapter 8 Annex 2 - CBA	-	0.9	0.9	0.9	0.9	0.9	0.9	1.8
Ongoing IT opex		-	0.8	0.9	0.9	0.7	0.3	0.9	1.8
Ongoing IT capex		-	1.3	1.3	1.1	0.6	-	1.3	2.5
Total		**-**	**3.0**	**3.1**	**2.9**	**2.2**	**1.2**	**3.1**	**6.1**
- Opex	8.2.	***-***	***1.8***	***1.9***	***1.8***	***1.6***	***1.2***	***1.8***	***3.6***
- Capex	8.2.	***-***	***1.3***	***1.3***	***1.1***	***0.6***	***-***	***1.3***	***2.5***
It infrastructure	**Chapter 10**								
Ongoing IT opex	10.4	39.7	50.5	50.1	48.9	50.4	51.1	50.3	100.7
Ongoing IT capex	10.4	16.4	34.3	19.5	16.0	15.4	13.4	26.9	53.7
Total		**56.1**	**84.8**	**69.6**	**64.8**	**65.8**	**64.5**	**77.2**	**154.4**
- Opex		***39.7***	***50.5***	***50.1***	***48.9***	***50.4***	***51.1***	***50.3***	***100.7***
- Capex		***16.4***	***34.3***	***19.5***	***16.0***	***15.4***	***13.4***	***26.9***	***53.7***
Innovation	**Chapter 11**								
Ongoing opex	11.2	0.4	0.7	0.7	0.7	0.7	0.7	0.7	1.5
Total		**0.4**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**1.5**
- Opex		***0.4***	***0.7***	***0.7***	***0.7***	***0.7***	***0.7***	***0.7***	***1.5***
- Capex		***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***
Business Support teams	**Chapter 12**								
Ongoing business support opex	12.1	22.1	16.3	16.3	16.4	16.6	16.6	16.3	32.5
Ongoing business support capex	12.1	1.7	2.3	4.3	2.3	2.7	2.7	3.3	6.6
Total		**23.8**	**18.5**	**20.6**	**18.6**	**19.2**	**19.2**	**19.6**	**39.1**
- Opex		***22.1***	***16.3***	***16.3***	***16.4***	***16.6***	***16.6***	***16.3***	***32.5***
- Capex		***1.7***	***2.3***	***4.3***	***2.3***	***2.7***	***2.7***	***3.3***	***6.6***
Customer, stakeholder and regulation teams	**Chapter 13**								
Ongoing opex	13.1	13.9	7.7	6.3	5.6	5.6	5.5	7.0	14.0
Total		**13.9**	**7.7**	**6.3**	**5.6**	**5.6**	**5.5**	**7.0**	**14.0**
- Opex		***13.9***	***7.7***	***6.3***	***5.6***	***5.6***	***5.5***	***7.0***	***14.0***
- Capex		***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***
Pension admin costs (Totex)	**Chapter 9**								
Ongoing opex	9.6	-	0.8	0.8	0.8	0.8	0.8	0.8	1.6
Total		**-**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**1.6**
- Opex		***-***	***0.8***	***0.8***	***0.8***	***0.8***	***0.8***	***0.8***	***1.6***
- Capex		***-***	***-***	***-***	***-***	***-***	***-***	***-***	***-***

Note: RIIO-1 number is based on a two year average for Opex, and an eight year average for Capex

Table 4 – IT investments

ESO £m (18/19 prices)	Business plan location	RIIO-1	2021/22	2022/23	2023/24	2024/25	2025/26	2 year average	2 year total
IT spend by ESO specific investment and shared investment									
ESO specific transformational IT Opex	Chapter 10 Annex 8	-	13.1	15.8	20.9	22.1	25.1	14.5	28.9
ESO specific transformational IT Capex		-	34.9	47.0	59.5	53.4	45.0	40.9	81.9
ESO Specific ongoing IT Opex		-	7.9	5.9	5.9	6.1	7.7	6.9	13.7
ESO specific ongoing IT Capex		41.3	23.0	17.5	15.8	14.9	16.3	20.2	40.5
Total ESO Specific Investment (incl running costs)		**41.3**	**78.8**	**86.1**	**102.0**	**96.5**	**94.1**	**82.5**	**165.0**
IT shared and ongoing opex		**39.7**	**50.5**	**50.1**	**48.9**	**50.4**	**51.1**	**50.3**	**100.7**
IT shared Infrastructure Capex	Chapter 10 Annex 8	11.5	19.9	10.9	9.4	8.1	5.2	15.4	30.8
IT shared Cyber Capex		2.0	11.8	5.5	4.6	5.4	5.4	8.6	17.3
IT shared Business Services Capex		1.9	2.6	3.1	2.0	1.9	2.7	2.8	5.6
IT shared Capex		**15.4**	**34.3**	**19.5**	**16.0**	**15.4**	**13.4**	**26.9**	**53.7**
IT Capex delivered by ESO		0.8	1.7	1.9	1.3	1.8	1.0	1.8	3.6
Total IT opex and capex		**97.2**	**165.4**	**157.6**	**168.2**	**164.1**	**159.5**	**161.5**	**323.0**
IT spend by transformational and ongoing									
ESO specific transformational Opex	Chapter 10	-	13.1	15.8	20.9	22.1	25.1	14.5	28.9
ESO specific transformational Capex		-	34.9	47.0	59.5	53.4	45.0	40.9	81.9
Total ESO specific transformational opex and capex		**-**	**48.0**	**62.8**	**80.3**	**75.5**	**70.1**	**55.4**	**110.8**
ESO Specific ongoing Opex	Chapter 10	-	7.9	5.9	5.9	6.1	7.7	6.9	13.7
IT shared and ongoing opex		39.7	50.5	50.1	48.9	50.4	51.1	50.3	100.7
Total ongoing IT Opex		**39.7**	**58.4**	**56.0**	**54.7**	**56.5**	**58.8**	**57.2**	**114.4**
ESO specific ongoing Capex	Chapter 10 Annex 8	41.3	23.0	17.5	15.8	14.9	16.3	20.2	40.5
IT shared Infrastructure Capex		11.5	19.9	10.9	9.4	8.1	5.2	15.4	30.8
IT shared Cyber Capex		2.0	11.8	5.5	4.6	5.4	5.4	8.6	17.3
IT shared Business Services Capex		1.9	2.6	3.1	2.0	1.9	2.7	2.8	5.6
IT Capex delivered by ESO		0.8	1.7	1.9	1.3	1.8	1.0	1.8	3.6
Total Ongoing IT capex		**57.5**	**59.0**	**38.9**	**33.1**	**32.1**	**30.7**	**48.9**	**97.8**
Total Ongoing IT Opex and Capex		**97.2**	**117.4**	**94.8**	**87.9**	**88.6**	**89.5**	**106.1**	**212.2**
Total IT opex and capex		**97.2**	**165.4**	**157.6**	**168.2**	**164.1**	**159.5**	**161.5**	**323.0**
ESO Specific Investment									
ESO specific transformational Opex	Section 1.6.3.1 Chapter 10	-	12.1	11.5	13.1	10.1	9.8	11.8	23.7
ESO specific transformational Capex		-	34.9	47.0	59.5	53.4	45.0	40.9	81.9
ESO Specific ongoing Opex		-	6.5	4.2	3.9	3.9	4.7	5.4	10.7
ESO specific ongoing Capex		41.3	23.0	17.5	15.8	14.9	16.3	20.2	40.5
Total ESO Specific Investment (excl running costs)		**-**	**76.5**	**80.3**	**92.4**	**82.4**	**75.8**	**78.4**	**156.7**
ESO Specific running costs		-	2.4	5.9	9.7	14.2	18.2	4.1	8.3
Total ESO Specific Investment (inc running costs)		**-**	**78.8**	**86.1**	**102.0**	**96.5**	**94.1**	**82.5**	**165.0**

Section 2- Activity architecture tables

The summary tables below provide a snapshot of what we will be delivering in each of the four Theme areas, by when and to what cost.

Role 1 – Control Centre Operations

Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
A1.1 Ongoing activities	**D1.1.1** Balance Great Britain's demand for energy with supply from generators around the clock			This covers all of activity **A1**: **Metric 1** – Balancing cost management **Metric 2** – CNI system reliability **Metric 3** – Day ahead demand forecast accuracy	The following covers all of **A1.1**: • Capex - £5.9m (IT investment references 120, 170, 210, 240, 260) • Opex - £28.3m	The following covers all of **A1.1:** • Capex - £7.2m (IT investment references 120, 170, 210, 240, 260) • Opex - £28.2m
	D1.1.2 Maintain security of supply in real time and the ability to restart the system in the event of a partial or total loss of power					
	D1.1.3 Maintain the integrity of the transmission network, while manage the economical operation of the system					
	D1.4.4 Liaise with ENTSO-E and Coreso on the ESO's European operations					
	D1.1.5 Upgraded legacy balancing and situational awareness tools to deliver continued service levels whilst new tools are being development					

Role 1 – Control Centre Operations

Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
	(IT investment ref 210 balancing asset health and 240 ENCC asset health)			**Metric 4** – Security of supply **Metric 5** – Delivery of zero carbon operability ambition		
	D1.1.6 Assessment of future operability challenges, communicated through the Operability Strategy Report published frequently. Using the strategy to ensure the control tools has the appropriate management plans	Q2 - publish Operability Strategy Report Q4 - publish Operability Strategy Report	Q2 - publish Operability Strategy Report Q4 - publish Operability Strategy Report			
A1.1 Ongoing activities	**D1.1.7** Produce and publish detailed forecasts and analysis, for both demand and generation, published at day-ahead and other timescales. Forecasts will be enhanced using detailed statistical and machine learning (IT investment ref 260 forecasting enhancements) Provide data and insight to inform control centre decision making and performance review, and integrate relevant IT projects into business as usual					
	D1.1.8 Trading solutions to deliver a safe, secure and economical strategy for the Control Centre					

Role 1 – Control Centre Operations

Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A1.2** Enhanced balancing capability	**D1.2.1** Enhanced balancing tool, built and developed in a modular fashion that will incorporate machine learning and artificial intelligence. It will enable us to schedule and dispatch a greater number of market participants than today (IT investment ref 180 enhanced balancing capability and 480 ancillary services dispatch)	Q1 - engage with design authority on requirements and design Q1-2 - agile build of modular design Q3 - engage with design authority on procurement Q3-4 agile build of modular design, investigate procurement options Q4 - finalise project scope	Q1 - agile build of modular design check in with design authority Q2 - agile build of modular design Q3 - agile build of modular design; check in with design authority Q4 - agile build of modular design		The following cover all of **A1.2**: • Capex – £11.0m (IT investment references 130, 180, 450, 480) • Opex - £2.1m	The following cover all of **A1.2**: • Capex – £14.0m (IT investment references 130, 180, 450, 480) • Opex - £2.8m
Transformational **A1.2** Enhanced balancing capability	**D1.2.2** Inertia monitoring capabilities and other tools to address emerging technology and system management issues (as required), as outlined in future *Operability Strategy Reports*. (IT investment ref 130 emergent technology and system management)	Q1 - continue enhancement of inertia monitoring capabilities Q2 - publish Operability Strategy Report	Q1 - develop and implement tools as required Q2 - publish Operability Strategy Report			

Role 1 – Control Centre Operations
Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		Develop and implement tools as required Q3 - develop and implement tools as required Q4 - publish Operability Strategy Report Develop and implement tools as required	Develop and implement tools as required Q3 - develop and implement tools as required Q4 - publish Operability Strategy Report Develop and implement tools as required			
Transformational **A1.2** Enhanced balancing capability	**D1.2.3** Projects running, using innovation funding, to consider how greater automation, machine learning and use of artificial intelligence can be used across our activities to handles increases in the amount of data and the number of expected actions (IT investment ref 450 future innovation productionisation)	Q1-4 assess innovation projects for productionisation on a case-by-case basis	Q1-4 assess innovation projects for productionisation on a case-by-case basis			
Transformational **A1.3** Transform Network Control	**D1.3.1** New real-time situational awareness tool, so Control Centre engineers can better understand changing network limitations,	Q1- engage with design authority on priority requirements	Q1 – agile build of modular design		The following covers all of **A1.3**:	The following covers all of **A1.3**:

Role 1 – Control Centre Operations

Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
	leading to a more efficient risk-based operation of the system (IT investment ref 110 network control)	Q2 - scope and identify requirements Q3 - confirm high-level modular design Check in with design authority Q4 - start developing some modules Further requirements scoping work on other modules	Check-in with design authority Q2 – agile build of modular design Q3 – agile build of modular design Check-in with design authority Q4 - agile build of modular design		• Capex - £3.4m (IT investment references 110, 140, 150) • Opex - £0.5m	• Capex - £7.6m (IT investment references 110, 140, 150) • Opex - £1.1m
Transformational **A1.3** Transform Network Control	**D1.3.2** Enhanced network modelling capabilities with online analysis of voltage and power flow profiles closer to real time (IT investment ref 150 operational awareness and decision support)	Q1 - project start up; engage with design authority on priority requirements Q1-2 - scope and requirements work Q3 - engage with design authority on	Q – check in with design authority on development work and requirements for additional tools Continued scope and			

Role 1 – Control Centre Operations
Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

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Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		tools for priority design Q3-4 - commence design and development work of priority tools	development work Q2 – agile build of modular design Q3 – agile build of modular design Q4 – agile build of modular design Deliver first set of priority tools			
Transformational **A1.3** Transform Network Control	**D1.3.3** Upgraded control centre video walls and operator consoles, with a single interface giving an overall state of the power system. This will allow Control Centre engineers make better and quicker decisions (IT investment ref 140 ENCC operator console)		Q1 – start user experience (desks and graphical user interface) project Q2 – scope requirements Q3 – conduct design work Q4 – conduct design work			

Role 1 – Control Centre Operations

Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A1.3** Transform Network Control	**D1.3.4** Increased operational liaison with DNOs					
Transformational **A1.4** Control Centre Architecture	**D1.4.1** Creation of a data and analytics platform that will act as the foundation for our new Control Centre architecture. It will house all ESO internal data, including from the Control Centre systems, and allow users to access it in the timescales they need (IT investment ref 220 data and analytics platform). External stakeholders will be able to access it through the data portal.	Q1 – engage with design authority on requirements and design Commence project on data platform foundation and management system, Q2 – conduct work on requirements and design of data platform foundation and management system Q3 – check in with design authority Finalise requirements and design work for	Q1 – Check in with design authority Continue data platform foundation development testing Q2 – Continue data platform foundation development and testing Q3 – Check in with design authority Deliver data platform foundation		The following cover all of **A1.4**: • Capex - £3.1m (IT investment reference 220) • Opex - £0.8m	The following cover all of **A1.4**: • Capex - £5.8m (IT investment reference 220) • Opex - £1.6m

Role 1 – Control Centre Operations
Theme 1 – Ensure reliable, secure system operation to deliver electricity when customers need it

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A1** Control Centre architecture and systems

Sub activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		data platform foundation Management system development and testing Q4 – commence data platform foundation development Deliver management system	Q4 – Integrate data platform with digital engagement platform and single markets platform			
Transformational **A1.4** Control Centre Architecture	**D1.4.2** Creation of the ESO design authority, open to external stakeholders, who we will work with on the development of new balancing and control tools	Q1 – design authority meetings Q3 – design authority meetings	Q1 – design authority meetings Q3 – design authority meetings			

Role 1 – Control Centre operations
Theme 1 - Control Centre training and simulation

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A2** Control Centre training and simulation

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
A2.1 Ongoing activities	**D2.1.1** Develop and drive control centre strategic resource planning, scheduling and training			This covers all of activity **A2**: **Metric 1** – Balancing cost management **Metric 4** – Security of supply **Metric 5** – Delivery of zero carbon operability ambition	The following includes all of activity **A2**: • Capex - £0m (IT investment references 190, 200) • Opex - £2.1m	The following includes all of activity **A2**: • Capex - £0m (IT investment references 190, 200) • Opex - £2.6m
	D2.1.2 Incident analysis and investigations of abnormal events, implementing improvements where needed					
	D2.1.3 Monitoring and reporting of system performance to regulatory bodies and ENTSO-E					
	D2.1.4 Guidance on operational policies for use in the					

	control centre produced		
Transformational **A2.2** Enhanced training material	**D2.2.1** Development of new modules and (based on feedback) new qualifications in system operation, formed via an enhanced partnership with academic institutions.	Q1 – complete work with academia on defining future skillsets Q2 – complete design of new modules Refresh existing courses Q3 – run new university modules Q4 – run new university module	Q1 – run new university modules Q2 – explore appetite for enhanced courses Q3 – run university modules Develop enhanced course Q4 – run university modules Develop enhanced course
Transformational **A2.2** Enhanced training material	**D2.2.2** Enhanced training and simulation with DNOs and wider industry	Q1- Implement industry secondments	Q1-4 – explore requirements with industry on possible training using enhanced ESO simulators
Transformational **A2.3** Training simulation and technology	**D2.3.1** Upgrades to current simulators, including annual scenario snapshot refreshes, ahead of developing new training simulation capability, including end-to-end bespoke training scenarios and simulated	Q1-4 – explore best practice training and simulation technology Q3 – update simulators with scenario snapshots	Q1-4 – explore best practice training and simulation technology Q3 – update simulators with scenario snapshots

	operational systems using live data (IT investment ref 200 future training simulator)		
	D2.3.2 New training methods and platforms, including online and e-learning, introduced to support training and new starters and continued development of existing staff	Q1-4 - use new video and e-learning training enhancements Training platforms used as part of academic and industry courses	Q1-4 - use new video and e-learning training enhancements Training platforms used as part of academic and industry courses
Transformational **A2.4** Workforce and change management	**D2.4.1** Personalised updates and automated shift logins, allowing for learning and operational investments to made available on different platforms and updated to a user's profile, giving better training and operational decision making (IT investment ref 190 workforce and change management tools)		Q1 - Review of rota automation Document management improvements project start up Q2 - Scope requirements for document management improvements Q3-4 – design work for document management improvements. Start rota management improvements project

	D2.4.2 Content and infrastructure for personalised training plans designed, developed and delivered	Q1-4 - develop content for new training plans to incorporate new system simulation	Q1-4 - develop content for new training plans to incorporate new system simulation

Role 1 – Control Centre operations
Theme 1 – Restoration

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A3** Restoration

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
A3.1 Ongoing activities	**D3.1.1** Control centre has fully tested skills, processes, plans and tools to support incident management and disaster recovery.			This covers all of activity **A3**: **Metric 5** – Delivery of zero carbon operability ambition	The following covers all of **A3.1**: • Capex - £0m • Opex - £0.7m	The following covers all of **A3.1**: • Capex - £0m • Opex - £0.6m
	D3.1.2 Restoration plans for GB with the necessary stakeholders, developed, maintained and validated.					
	D3.1.3 Engage and collaborate with industry to plan and develop the new Great Britain restoration standard, including the annual assurance framework, consistent with our licence obligations					

Role 1 – Control Centre operations
Theme 1 – Restoration

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A3** Restoration

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
A3.1 Ongoing activities	**D3.1.4** Advice and oversight of Black Start and restoration strategy for the future provided					
	D3.1.5 Fully competitive Black Start procurement process with submissions from a wide range of technologies connected at different voltage levels on the network, with DNOs playing a more active role in the restoration approach.					
Transformational **A3.2** Restoration standard	**D3.2.1** Facilitate and compile, on behalf of the Great Britain (GB) industry, the annual assurance process for GB Black Start	Q1 – implement GB restoration standard licence conditions	Q2 – annual assurance framework data collection and validation		The following covers all of **A3.2** and **A3.3**: • Capex - £0.9m (IT investment references 460 and 510 • Opex - £0.1m	The following covers all of **A3.2** and **A3.3**: • Capex - £2.3m • (IT investment references 460 and 510) • Opex - £0.8m
	D3.2.2 Validate restoration timelines for GB using the assurance data	Q2 – implement GB restoration standard licence conditions	Use outputs to recommend improvements			
	D3.2.3 Maintain obligations and requirements against the new standard for Black Start capability provision	Q3 - restoration standard in place (12 months after licence condition)	Q3 - implement improvements			

Role 1 – Control Centre operations
Theme 1 – Restoration

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A3** Restoration

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A3.2** Restoration standard	**D3.2.4** Restoration decision making support tool designed and developed to aid faster restoration times in line with stakeholder expectations (IT investment ref 510 restoration decision support)	Q3 - restoration standard in place (12 months after licence condition)	Q1 – Project start up Engage with design authority on project requirements Q2 - Scope requirements Q3 – engage with design authority on design Commence design work Q4 – design work			
Transformational **A3.3** Innovation project in restoration	**D3.3.1** Trial case studies based on different technology types **D3.3.2** (Subject to project findings) Proof of concept findings implemented and new system and communication methods implemented (IT investment ref 460 restoration)	Q2 – select 2 or 3 case studies to confirm feasibility and cost Q2-3 - Implement case studies	Q1 - assess learning from innovation project Q2 - assess learning from innovation project			

Role 1 – Control Centre operations
Theme 1 – Restoration

ESO Ambition statement: An electricity system that can operate carbon free

Activity: **A3** Restoration

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		Q4 – End of innovation project	Q3 - Engage with industry on productionisation Q4 - produce roadmap for productionisation			

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A4** Build the future balancing service and wholesale markets

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A4.1** Manage existing balancing services markets	**D4.1** Balancing and ancillary services efficiently procured to deliver security of supply at optimal cost Ancillary services settlement refresh (IT investment reference 410)	Q1 - Ancillary service settlements IT system complete		This covers all of **A4** **Metric 6** -	• Capex - £2.1m (IT investment 410) • Opex - £4.1m	• Capex - £0.2m (IT investment 410) • Opex - £2.8m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A4** Build the future balancing service and wholesale markets

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
				Proportion of balancing services procured through competitive means.		
Ongoing **A4.2** Power Responsive	**D4.2.1** Regular and specific metrics and publications across Distribution System Operator development and co-development of local flexibility markets through a variety of innovation projects				• Capex – £0.0m • Opex – £0.6m	• Capex – £0.0m • Opex – £0.6m
	D4.2.2 Regular and specific metrics and publications for multi sector approaches focusing on opportunities for household, community energy, small business participation, zero carbon technologies, and electrification of heat in DSF					
Transformational **A4.3** Deliver a single day-ahead response and reserve market	**D4.3.1** We will work with stakeholders, including DNOs, to ensure that ESO markets are consistent and coordinated with other markets				• Capex – £0.0m • Opex – £4.9m	• Capex – £0.0m • Opex – £3.5m
	D4.3.2 Day Ahead market for frequency response	Q1 - DA market for frequency response operational				

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A4** Build the future balancing service and wholesale markets

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
	D4.3.3 New Reserve products	Q2 - Control and dispatch solutions for reserve Q3 - Standard contract terms for reserve Q4 - New reserve products go live				
	D4.3.4 Full co-optimised auction for Response and Reserve at day ahead or even closer to real time		Q4 - Single day-ahead response and reserve market			
	D4.3.5 Auction capability (Auction capability IT investment 420)	Q3 - Auction capability development and testing Q4 - Auction capability implementation				
Transformational **A4.4** Deliver a single,	**D4.4.1** A market platform through which market participants will be able to participate in balancing and capacity markets. The markets platform will cover	Q1 - Day Ahead response market integrated with	Q1 - Asset register implementation		• Capex - £3.1m	• Capex - £3.1m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A4** Build the future balancing service and wholesale markets

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
integrated platform for ESO Markets	the end to end process for market participation including communications, data input and management, messaging and validation IT investment reference 400 - single markets platform	single market platform Q3 - Asset register requirements and design Q4 - Markets platform requirements and design Q4 - Asset register development and testing Q4 Reserve products integrated with single markets platform	Q3 - Markets Platform Development and testing Q4 - Procurement of all balancing and ancillary services through single markets platform		(IT investment 400) • Opex – £2.2m	(IT investment 400) • Opex – £2.8m
	D4.4.2 Common standards, including interoperable systems, a common data model and shared minimum specifications between ESO and other flexibility platforms, including at the distribution level					

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere

Activity: **A5** Transform access to the capacity market

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing activity **A5.1** EMR Delivery body	**D5.1** Continuation of EMR delivery body obligations	Q2 - Prequalification opens Q3 - Prequalification closes Q4 - Capacity Market auctions	Q2 - Prequalification opens Q3 - Prequalification closes Q4 - Capacity Market auctions	This covers all of **A5** **Metric 7** - EMR decision quality	• Capex – £1.2m (IT investment 320) • Opex – £3.5m	• Capex – £ 0.9 million (IT investment 320) • Opex – £ 3.2 million
Transformational Deliver an enhanced platform for the Capacity Market within the single, integrated ESO markets platform	(shared with **D4.4**) IT system to allow all participants in ESO markets (including Capacity Market and contracts for difference) a single point of access for services and data - IT investment 400 and 420	See **D4.4** milestones	See **D4.4** milestones	**Metric 8** – EMR demand forecast accuracy	Part of single market platform (IT investment 400 and 420)	Part of single market platform (IT investment 400 and 420)

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere

Activity: **A5** Transform access to the capacity market

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A5.3** Improve our security of supply modelling capability	**D5.3** Use of enhanced modelling and more granular data sets to improve security of supply modelling	Q1 - Production of the Electricity Capacity Report Q4 - Enhance the modelling for distributed generation, duration-limited storage and demand response, maximising the use of the data from the DCUSA modification in RIIO-1 Q4 - Enhancements of European market modelling, as level of interconnection increases over RIIO-2 period	Q1 - Production of the Electricity Capacity Report Q4 - Improved modelling of security of supply for intermittent technology and demand side response Q4 Support modelling changes to the review of the reliability standards, in particular around the implementation of the clean energy package		• Opex - £0.8m	• Opex - £0.7m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere

Activity: **A5** Transform access to the capacity market

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
			Q4 - Review and continued enhancements of European market modelling, as level of interconnection increases over RIIO-2 period			

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing	**D6.1** Continued facilitation of industry changes to the Grid Code, Connection and Use of System Code (CUSC),	Q1 - IT investment 280 system	Q1 - IT investment 280 system	This covers all of **A6**	• Capex – £2.7m	• Capex – £2.7m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
A6.1 Code management / market development and change	System Operator Transmission Owner Code (STC) and Security and Quality of Supply Standards (SQSS). Also, delivery of Great Britain driven regulatory change - IT investment 280	requirement and design stage Q3 - IT investment 280 development and testing stage Q4 - IT investment 280 implementation stage	requirement and design stage Q3 - IT investment 280 development and testing stage Q4 - IT investment 280 implementation stage	**Metric 9** – Code Administrator Code of Practice survey	(IT investment 280) • Opex – £3.6m	(IT investment 280) • Opex – £3.6m

Ongoing **A6.2** EU code change and relationships	**D6.2** Continued facilitation of EU driven code changes into GB market. Also, delivery of IT requirement to comply with EU regulations - IT investment 270	Q2 - IT investment 270 CACM/CGM development and testing Q2 - IT investment 270 MARI development and testing Q3 - IT investment 270 CACM/CGM implementation Q3 - IT investment 270 MARI implementation Q4 - IT investment 270 clean energy package requirements and design Q4 - IT investment 270 TERRE post go live changes implementation	Q3 IT investment 270 clean energy package development and testing Q4 - IT investment 270 clean energy package implementation	• Capex – £10.2m (IT investment 270) • Opex – £6.0m	• Capex – £7.6m (IT investment 270) • Opex – £6.0m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A6.3** Industry revenue management	**D6.3** Continued managing, collecting and disbursing charges relating to the operation of the transmission system. Also delivering a refresh of charging and billing IT system and changes to the charging regime for CUSC - IT investments 290 and 300	Q2 - IT investment 300 access & forward-looking charges changes requirements and design Q3 - IT investment 290 Revenue 21 (CAB Replacement) development and testing Q3 - IT investment 290	Q3 - IT investment 300 access & forward-looking charges changes development and testing Q4 - IT investment 300 access & forward-looking charges changes implementation		• Capex – £2.6m (IT investment 290 and 300) • Opex – £3.2m	• Capex – £0.5m (IT investment 290 and 300) • Opex – £1.8m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		targeted charging review changes development and testing Q4 - IT investment 290 Revenue 21 (CAB Replacement) implementation Q4 - IT investment 290 targeted charging review changes implementation				
Transformational **A6.4** Transform the process to amend our codes	**D6.4** Change from a code administrator to a code manager	Q1 - Dedicated ESO legal support for code changes Q2 - Recruit people and set up new teams and investigate the methods to	Q1 - Licence change to support transform the process to amend our codes Q2 - Begin detailed		• Opex – £0.5m	• Opex – £1.5m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		transform the process to amend our codes Q3 - Stakeholder engagement and consultation on the process to amend our codes Q4 - Investigate licence changes required to transform the process to amend our codes Q4 - Create and consult with stakeholders on plan to deliver the transformed codes process	scoping and prioritising work for new process go live Q3 - Transform the process to amend our codes - Go Live			
Transformational **A6.5** Work with all stakeholders to create a fully digitalised,	**D6.5** The Grid code combines transmission and distribution codes in an IT system with AI-enabled navigation and, document and workflow management tools - IT investment 330	Project not initiated	Q1 - Recruit people and set up project team		• Capex – £0.0m (IT investment 330)	• Capex – £0.0m (IT investment 330)

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
whole system Grid Code by 2025			Q2 - Scope detailed project work plan Q2 - IT investment 330 Project start up and scoping Q4 - Engage and consult industry, in particular distribution stakeholders, on whole system Grid Code and digitalise capability Q4 - IT investment 330 system requirement and design stage		• Opex – £0.0m	• Opex – £1.1m

Role 2 – Market development and transactions
Theme 2 – Transforming participation in smart and sustainable markets

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A6** Develop code and charging arrangements that are fit for the future

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A6.6** Look at fully or partially fixing one or more components of Balancing Services Use of System (BSUoS) charges	**D6.6** Delivery of the recommendation from the BSUoS taskforce around reducing the volatility of BSUoS forecasting	Q4 - Continue the process to modify industry codes to allow for a fixed BSUoS – including industry engagement, project implementation and ESO financing arrangements	Q1 - Proposed Go Live of fixed BSUoS		None – changes not proposed to go live until 2022	If delivered, subject to review, additional risk financing of between £2.2m and £7.4m a year for the ESO

Role 3 – System insight, planning and network
Theme 3– Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A7** Network development

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A7.1** Analyse and communicate future network needs	**D7.1** *Electricity Ten Year Statement* (*ETYS*)	Q3	Q3	This covers all of **A7** **Metric 10** - Consumer value savings from *NOA*	• Opex £2.5m	• Opex £2.4m
Ongoing **A7.2** Advise on economic efficient ways to address networks needs	**D7.2** *NOA* Annual Report	Q4	Q4			
Ongoing **A7.3** Undertake ad hoc analysis in response to external requests	**D7.3** Strategic Wider Works projects, Connections and Infrastructure Options Note and CBAs for small schemes.	As required	As required			

Role 3 – System insight, planning and network
Theme 3– Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A7** Network development

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A8** Enable all solution types to compete to meet transmission needs

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A8.1** Rollout of pathfinder approach and optimise assessment and communication of future needs	**D8.1** Pathfinder projects outputs incorporated into *NOA* methodology (*Forward Plan 2019/21*)			This covers all of **A8** **Metric 10** - Consumer value savings from *NOA*	• Opex £0.1m	• Opex £0.1m
Transformational **A8.2** Enhance tendering models	**D8.2** Improved tender approaches that enable more participants to enter the market	Q4 New areas of need identified that will be tendered	Q4 Tenders prepared and run on 2021/22 work			

Role 3 – System insight, planning and network
Theme 3– Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A7** Network development

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A8.3** Support Ofgem establish enabling regulatory and funding frameworks	**D8.3** Frameworks based on competitive regime not monopoly regime	Q4: adapt processes to accommodate any new funding arrangements	Q4: work with industry to implement any other framework changes that may be needed; support Ofgem to consider ED2 funding implications			

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A9** Extend *NOA* approach to end of life asset replacement decisions and connections wider works

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A9.1** Expand network planning processes to enable more connections wider works to be assessed	**D9.1** Developed and trialled CWW processes with TOs	Q3: Review existing network planning processes and identify where and how to extend		This covers all of **A9** **Metric 10** - Consumer value savings from *NOA*	• Opex £0.0m	• Opex £0.1m
Transformational **A9.2** Trial assessment of all connection wider works in one region	**D9.2** Completed and published CWW trials, in selected regions, in *NOA*		Q4: Complete and publish CWW trials			
Transformational **A9.3** Expand to all connections wider works	**D9.3** Make recommendations on all connections wider works in *NOA* 2026					

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A9** Extend *NOA* approach to end of life asset replacement decisions and connections wider works

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A9.4** Develop process with TOs to input into ESO analysis of end of life asset replacement decisions	**D9.4** Efficient planning process agreed with TOs					

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A10** Support decision-making for investment at distribution level

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A10.1** Support DNOs to develop *NOA*	**D10.1** *NOA* expertise shared with DNOs		Q4: Engage with DNOs to help them develop *NOA*	**Metric 10** - Consumer value	• Opex £0.0m	• Opex £0.1m

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A10** Support decision-making for investment at distribution level

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
type assessment processes			type proposals for the ED2 business plans	savings from *NOA*		

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A11** Enhance analytical capabilities

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A11.1** Refresh and integrate economic assessment tools to support future network modelling needs	**D11.1** Improved identification of when is the most economical time to invest and the most efficient solution	Q1: Start Economic Assessment (EA) tool refresh Q2-3: Gather requirements and design EA tool	Q4 2021/22-Q3 2022/23: Develop and test EA tool Q4: Implement EA tool	This covers all of **A11** **Metric 10** - Consumer value	• Capex £3.0m • Opex £0.8m (Primary enabling IT Investments - 220 Data and Analytics Platform	• Capex £3.0m • Opex £0.9m (Primary enabling IT Investments

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A11** Enhance analytical capabilities

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A11.2** Implement probabilistic modelling	**D11.2** Improved identification of network needs	Q1: Gather requirements and design Probabilistic Model (PM) Q2: Develop and test PM Q4: Implement PM		savings from *NOA*	- 390 *NOA* Enhancements)	- 220 Data and Analytics Platform - 390 *NOA* Enhancements)
Transformational **A11.3** Build voltage assessment techniques into an optimisation tool	**D11.3** Improved assessment of voltage requirements, and ability to look across a range of network needs at the same time.	Q4: Start full Voltage Optimisation (VO) tool development	Q1-Q2: Gather requirements and design VO tool Q3-Q4: Develop and test VO tool			
Transformational **A11.4** Build stability assessment techniques into an optimisation tool	**D11.4** Subject to modelling tools, online portal available allowing stakeholders to see visual representation of network needs		Q2: Start full Stability Assessment (SA) tool development Q3-Q4: Gather requirements			

Role 3 – System insight, planning and network Theme 3 – Unlocking consumer value through competition						
ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner						
Activity: **A11** Enhance analytical capabilities						
Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
			and design SA tool			

Role 3 – System insight, planning and network Theme 3 – Unlocking consumer value through competition						
ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner						
Activity: **A12** Review SQSS						
Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A12.1** Scope project, building on the BEIS recommendations	**D12.1.1** Review fully scoped and target issues agreed	Q2: Establish initial review scope		This covers all of **A12** **Metric 10** - Consumer value	Opex - £0.2m	Opex - £0.3m
	D12.1.2 Engaged with relevant stakeholders to validate scope, identifying and agreeing target issues to be addressed	Q4 Engage with stakeholders re scope and target issues				

Role 3 – System insight, planning and network
Theme 3 – Unlocking consumer value through competition

ESO Ambition statements: An electricity system that can operate carbon free; Competition everywhere; Trusted partner

Activity: **A12** Review SQSS

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A12.2** Identify solutions	**D12.2** Potential solutions identified, and direction established			savings from *NOA*		
Transformational **A12.3** Implement changes	**D12.3** Key changes to SQSS made or in progress					

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A13** Leading the debate

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A13.1** Carry out analysis and scenario modelling on future energy demand	**D13.1** Published FES, *Winter Outlook* and Review, *Summer Outlook* and other thought pieces	Q1: *Winter Review* Q2: *FES* Call for Evidence Q2: *FES* Launch Q2-Q3: *FES* Network Forum (new) Q3: *FES Stakeholder Feedback Document* Q3: *Winter Outlook* Q4: *Summer Outlook*	Q1: *Winter Review* Q2: *FES* Call for Evidence Q2: *FES* Launch Q2-Q3: *FES* Network Forum (new) Q3: *FES Stakeholder Feedback Document* Q3: *Winter Outlook* Q4: *Summer Outlook*	No metric proposed for **A13**	• Opex - £1.2m (Primary IT supporting investment 220 Data Analytics Platform)	• Opex - £1.2m (Primary IT supporting investment 220 Data Analytics Platform)
Ongoing **A13.2** Conduct mathematical modelling and	**D13.2** Created pan-European and country level electricity and energy demand models	Q1: Gather new data and information inputs and cleanse Q2: Identify				

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A13** Leading the debate

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
market research on local and wider geographic demand information		model improvement requirements Q3: Implement improvements Q4: Conduct modelling				
Ongoing **A13.3** Maintain external communication channels with consumers and stakeholders	**D13.3** Shared insights on future energy expectations and requirements	Q1: Develop a communication strategy aligned to target audiences Create future energy insights content to share through selected channels			• Opex - £1.3m	• Opex - £1.3m
Transformational **A13.4** *FES*: Bridging the gap to net zero	**D13.4** Provided insights and analysis beyond *FES* to inform energy policy development	Q3: Establish broader industry engagement and events Q4: Published focussed and	Q3: Establish broader industry engagement and events Q4: Published focussed and		• Opex - £1.2m	• Opex - £1.3m

Role 3 – System insight, planning and network

Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A13** Leading the debate

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
		deeper whole energy system reports	deeper whole energy system reports			
Transformational **A13.5** *FES:* Integrating with other networks	**D13.5.1** Replaced electricity demand model, within Whole system/net zero modelling	Q2: Completed electricity demand modelling requirements gathering and design work	Q2: Developed and tested model Q4: Implemented model			
Transformational **A13.5** *FES:* Integrating with other networks	**D13.5.2** Developed new energy demand model	Q3: Completed review of available energy data and established stakeholder modelling requirements	Q1: Developed energy demand model plan, including pilots and full scale development Q3: Built, tested and validated model Q4: Implemented model			

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A14** Take a whole electricity system approach to connections

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A14.1** Provide contractual expertise and management of connection contracts including provision of connection offers	**D14.1.1** Connection offers for customers **D14.1.2** Contract management of connection agreements	As required	As required	**Metric 11** - Right first time	• Opex - £3.4m	• Opex - £3.3m
Ongoing **A14.2** Ensure Grid Code compliance of new connections	**D14.2.1** Compliance monitoring of new connections	As required	As required			
Transformational **A14.3** Further enhance the	**D14.3.1** Established dedicated DER account management function	Q2			• Opex - £0.4m	• Opex - £0.4m

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A14** Take a whole electricity system approach to connections

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
customer connection experience, including broader support for smaller parties	**D14.3.2** Delivered first whole electricity system connections seminar		Q2			
	D14.3.3 Whole electricity system connection seminars (ongoing)		Q4			
Transformational **A14.4** Facilitate development of customer connections hub	**D14.4.1** Implemented first phase of connections hub, including online account management and integration with other network organisation websites		Q4	**Metric 11** - Right first time	• Opex - £0.6m (Primary IT supporting investment 380 Connections Platform) • Capex - £0.7m	• Opex - £0.6m (Primary IT supporting investment 380 Connections Platform) • Capex - £0.7m

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A15** Taking a whole energy system approach to promote zero carbon operability

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A15.1** Develop the *System Operability Framework* (*SOF*) and provide solutions up to real time of ownership of network related operability issues.	**D15.1.1** *SOF* documentation **D15.1.2** Innovation projects developing new operability solutions	As required	As required	This covers all of **A15** **Metric 12** - Future balancing costs saved by operability solutions **Metric 13** - Capacity saved through operability solutions	• Opex - £4.0m • Capex - £2.9m	• Opex - £4.3m • Capex - £3.2m
Ongoing **A15.2** Provide technical support to the connections process	**D15.2.1** Updates to customer offers and agreements	As required	As required			
Ongoing **A15.3** Assess the technical implications of framework developments	**D15.3.1** Changes to business procedures and processes following framework developments.	As required	As required			

Role 3 – System insight, planning and network

Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A15** Taking a whole energy system approach to promote zero carbon operability

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
and implement changes into business procedures and systems.						
Ongoing **A15.4** Manage operational data and modelling requirements for the ESO	**D15.4.1** Data transfers between network organisations in accordance with Grid Code requirements	Q1 and Q3	Q1 and Q3			
	D15.4.2 Technical modelling for use across the ESO	As required	As required			
Ongoing **A15.5** Develop Regional Development Programmes (RDPs)	**D15.5.1** Start RDP1 of RIIO-2	Q1			Primary IT supporting investment 340 RDP implementation and extension	Primary IT supporting investment 340 RDP implementation and extension
	D15.5.2 Start RDP2 of RIIO-2		Q1			
	D15.5.3 Start RDP3 of RIIO-2		Q3			

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A15** Taking a whole energy system approach to promote zero carbon operability

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A15.6** Transform our capability in modelling and data management	**D15.6.1** Phase 1 data management scoping complete to feed into data & analytics platform (see Theme 1)	Q2			• Opex - £0.3m (Primary IT supporting investment 360 Offline network modelling) • Capex - £1.2m	• Opex - £0.3m (Primary IT supporting investment 360 Offline network modelling) • Capex - £0.8m
	D15.6.2 Further Grid Code mods (arising from O/N 2020 work programme) completed	Q4				
	D15.6.3 Scoping complete. Add requirements into implementation of data analytics platform foundation (see Theme 1)		Q2			
	D15.6.4 Data analytics platform foundation in place (see Theme 1)		Q3			
	D15.6.5 Data platform extension complete		2025/26			
	D15.6.6 CACM & short circuit go live in Offline Network	Q3				

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A15** Taking a whole energy system approach to promote zero carbon operability

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
	D15.6.7 Deeper Outage Planning go live in Offline Network Modelling	Q4				
Transformational **A15.7** Deliver an operable zero carbon system by 2025	**D15.7.1** Commence System State Targeted MCS stage roll out	Q1			• Opex - £0.4m (Primary IT supporting investment 500 Zero carbon operability) • Capex - £4.0m	• Opex - £1.1m (Primary IT supporting investment 500 Zero carbon operability) • Capex - £5.2m
Transformational **A.15.8** Provide technical support to DSO and whole electricity system alignment	**D15.8.2** Completion of any DSO associated code changes ahead of RIIO-ED2	Q4			• Opex - £0.2m	• Opex - £0.2m

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A15** Taking a whole energy system approach to promote zero carbon operability

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Transformational **A15.9** Identify Future Operability Needs Across Whole Energy System	**D15.9.1** Trial new innovation projects for whole energy system operability		Q1		• Opex £0.0m	• Opex £0.0m
Transformational **A15.10** Develop a regime for an integrated offshore grid	**D15.10.1** Initial scoping report published	Q3			• Opex £0.2m	• Opex £0.4m

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A16** Delivering consumer benefits from improved network access planning

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A16.1** Manage access to the system to enable the TOs to undertake work on their assets, liaising with customers where access arrangements impact them.	**D16.1.1** Year ahead regional outage programmes	Q4	Q4	This covers all of **A16** **Metric 14** - Capacity saved through our access planning actions **Metric 15**- Number of short notice changes to planned outages	• Opex - £4.5m	• Opex - £4.5m
	D16.1.2 Detailed week ahead operational documentation for National Control	Weekly	Weekly			
Transformational **A16.2** Enhance the Network Access Policy (NAP) process with TOs	**D16.2.1** Great Britain wide NAP process goes live	Q1			• Opex - £0.1m	• Opex - £0.1m
Transformational **A16.3** Work more closely	**D16.3.1** Trials on closer working relationships (commenced in *2019/21 Forward Plan*) concluded	Q3			• Opex - £0.0m	• Opex - £0.1m

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A16** Delivering consumer benefits from improved network access planning

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
with DNOs and DER to facilitate network access	**D16.3.2** Learnings from trials published alongside recommendations for GB roll out	Q4				
	D16.3.5 Code change process concluded		Q4			
Transformational **A16.4** TOGA / Outage Notification	**D16.4.1** Scoping exercise concluded		Q2		• Opex - £0.1m (Primary IT supporting investment 350 Planning and outage data exchange) • Capex - £0.4m	• Opex - £0.1m (Primary IT supporting investment 350 Planning and outage data exchange) • Capex - £0.4m

Role 3 – System insight, planning and network
Theme 4 – Driving towards a sustainable whole energy future

ESO Ambition statements: An electricity system that can operate carbon free; Trusted partner

Activity: **A17** Data portal

Sub-activities	Deliverables	Key milestones		Metrics	Cost	
		2021/22	2022/23		2021/22	2022/23
Ongoing **A17.1** Develop foundational data portal	**D17.1** Open data portal with limited data sets (2019)	Q2 All published ESO data in machine readable format Q3 ESO data list and publication schedule		This covers all of **A17** **Metric 16** Proportion of ESO data shared	• Capex - £1.3m • Opex - £1.8m	• Capex - £1.3m • Opex - £1.9m
Ongoing **A17.2** Publish ESO data in machine readable format	**D17.2** All published ESO data in machine readable format					
Ongoing **A17.3** Publish ESO data list and publication schedule	**D17.3** ESO data list and publication schedule					
Ongoing **A17.4** Automisation of data publishing	**D17.4** All published data automated reducing publishing time (2024)					

Section 3 - ESO RIIO-1 story

3.1. The external environment

The electricity system has seen an unprecedented amount of change over the course of RIIO-1, moving from a centralised fossil fuel dominated system, to an increasingly decentralised low carbon one. Whilst change was anticipated, the nature of that change, and the overall scale and pace was not. The increase in renewable generation (particularly at a distributed level), growth in the number of market participants and new technology advances all add significant complexity to what we do.

Installed solar capacity was forecast in 2011 to be 1 GW by 2020, it is currently over 13 GW. Distribution connected generation now makes up a third of generating capacity. This has resulted in different challenges to manage on the system coupled with a much higher number of market participants to interact with, with new and different needs.

This unprecedented level of change in the electricity sector has led to a step change in the task of balancing the system for the Electricity System Operator (ESO), well beyond the extent anticipated at the time of the RIIO-1 settlement. The industry has changed in two significant ways which has substantially increased the demands on the ESO:

- the mix of participants on the system has changed fundamentally, which makes the task of operating the system more complex, through intermittency and two way flows of power, as well as different generation and demand patterns; and
- the nature of the participants on the system has changed, which gives rise to a need for very different tools and capabilities to operate the system. Specifically, there are increased numbers of participants with non-traditional business models. Our customers now have different and diverse needs and varying levels of experience of operating in this industry.

The level of influence of European Union (EU) regulation has also expanded over RIIO-1, through the Third Energy Package[1] and the implementation of eight European Network Codes[2] (ENC). We are also influenced by changes beyond the makeup of the Great Britain (GB) electricity system, with the changing cyber environment bringing new and increased risks to our critical national infrastructure and changing the way we manage cyber security.

3.2 Our performance in RIIO-1

In our detailed plan for System Operation, we set out three main aims for RIIO-1. These were:

- maintain security of supply and the reliability of the transmission network
- minimise constraints and maximise the output of renewable generation
- maximise the benefit introduced by the transmission owner (TO) capital plans and utilisation of smart network assets.

[1] https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation/third-energy-package
[2] https://www.nationalgrideso.com/codes/european-network-codes

To meet these aims against a rapidly changing backdrop, we initiated and invested in several activities, some of them new. These included:

- maintaining high levels of transmission system reliability at over 99.999%
- implementing products to ensure sufficient generation capacity in advance of the introduction of the Capacity Market (Supplemental and Demand Side Balancing Reserve[3])
- becoming the Electricity Market Reform (EMR) delivery body, in which we run Capacity Market (CM) and Contracts for Difference (CfD) auctions and provide analysis to support government decisions related to these
- development of our critical infrastructure through the replacement of scheduling and dispatch tools
- leading the Power Responsive programme to stimulate increased participation in balancing markets from flexible technology, with over 1,500 participants signed up
- setting a clear direction of travel for development of our balancing services through the *System Needs and Products Strategy (SNAPS)* and product roadmaps that flow from it. We now have over 250 new provider conversations each year
- continuing to invest in our relationship with Distribution Network Operators (DNOs) through innovation projects and Regional Development Programmes (RDPs)
- taking on an extended role in the Integrated Transmission Planning Regulation[4] (ITPR) including running the *Network Options Assessment* (*NOA*) process to coordinate efficient and economic network investment in GB
- investing in over 40 innovation projects, working with other parties to deliver improvements in the energy industry
- becoming a legally separate entity within the National Grid Group to make sure we provide transparency in our decision-making, and to give us confidence that everything we do will promote competition, which is ultimately for the benefit of consumers.

We have responded to the changing energy environment by investing in our people and delivering to a consistently high standard. As RIIO-1 has progressed, our role has evolved, and we have increased resource to take on new responsibilities in response to the ever more complex and decentralised energy system and to improve our customer service.

3.2.1 Key metrics, outputs delivered and performance against incentives

The ESO did not have its own RIIO-1 price control but was integrated with the England and Wales transmission owner as National Grid Electricity Transmission (NGET). The incentives set generally apply to NGET but in some cases, for example the Balancing Services Incentive Scheme[5] (BSIS), incentives were wholly within the remit of the ESO. The ESO's portion of the RIIO-1 price control is shown below.

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[3] https://www.nationalgrideso.com/codes/connection-and-use-system-code-cusc/modifications/cmftp232-demand-side-balancing-reserve-and
[4] https://www.ofgem.gov.uk/electricity/transmission-networks/integrated-transmission-planning-and-regulation
[5] https://www.nao.org.uk/wp-content/uploads/2014/05/Electricity-Balancing-Services.pdf

Table 1 – ESO capex – forecast, allowance and outturn

ESO capex – forecast, allowance and outturn (£m)					
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Actual	41.0	43.8	42.6	57.4	62.1
Forecast	105.2	49.9	42.5	41.0	42.3
Final proposals allowance	50.9	44.4	38.2	35.3	38.4
Latest allowance[6]	51.1	46.7	38.8	37.4	40.1

Table 2 – ESO opex – forecast, allowance and outturn

ESO opex – forecast, allowance and outturn (£m)					
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Actual	105.7	104.4	107.2	112.7	120.3
Forecast	101.8	105.8	109.1	111.6	112.8
Final Proposals Allowance Proportion	94.0	95.4	98.1	100.1	101.1
Latest Allowance Proportion	94.4	99.4	108.9	114.1	118.5

3.2.2 Customer and stakeholder satisfaction

The ESO was incentivised, as part of NGET, to deliver good customer and stakeholder satisfaction through two incentive schemes. Throughout the RIIO-1 period we have seen the number of customers and service providers grow. We have worked hard to deliver for our customers and stakeholders, and this is reflected by our improving customer and stakeholder satisfaction scores (CSAT and SSAT scores) over the RIIO-1 period. It is not possible to apportion these between the ESO and NGET.

[6] Latest allowance proportion reflects the RIIO-1 allowances plus any reopeners.

Table 3 – Customer and stakeholder incentives

Customer and stakeholder incentives					
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**
NGET customer survey target score	6.90	6.90	6.90	6.90	6.90
NGET customer survey score	7.41	7.40	7.54	7.40	7.74
Stakeholder survey target	N/A	N/A	N/A	7.4	7.4
Stakeholder survey score	7.53	7.74	7.53	7.66	7.88

3.2.3 Environmental Discretionary Reward (EDR)

This discretionary reward[7], shared across transmission owners, encourages network companies to find ways to reduce their carbon footprint, and act in a more environmentally friendly way. It is not possible to apportion this between the ESO and NGET.

Table 4 – Environmental discretionary reward

Environmental discretionary reward					
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**
NGET score	Proactive	Leadership	Proactive	Proactive	Proactive

3.2.4 Balancing spend

We have worked hard to manage balancing costs over the period, and against a backdrop of complexity brought by the changes to the electricity system. These balancing costs have remained broadly flat despite the increasingly challenging operating environment.

Table 5 - ESO Balancing spend

ESO Balancing Spend (£m)					
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Target (price as year of spend)	960	957	1082	963.5	1,042

[7] https://www.ofgem.gov.uk/publications-and-updates/decision-2017-environmental-discretionary-reward

Target (2017/18 prices)	1,048.4	1,025.0	1146.5	999.6	1,042
Incentivised balancing cost (price as year of spend)	970.8	922.7	917.6	985.5	999.7

3.2.5 Levels of return earned

Table 6 - ESO revenue

ESO revenue (£m)					
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Net underlying revenue	128.8	142.8	147.6	167.6	172.2
Incentives	25.5	23.3	26.8	28.0	0.7
Total underlying revenue	154.3	166.1	174.4	195.6	172.9

3.2.6 Dividends paid out

Prior to April 2019 NGESO[8] was part of NGET and did not have a separate dividend. NGET typically paid a dividend to maintain gearing approximately in line with the notional rate (60 per cent). Chapter 9 – Financing our plan, in our main Business Plan, and Annex 5 – Finance Report provide more information about the dividend policy for the legally separate ESO in RIIO-2.

[8] NGESO - National Grid Electricity System Operator

Section 4 - Benchmarking process

4.1 International benchmarking

This chapter provides more detail on the high-level benchmarking exercise we conducted as part of our approach to ESO cost efficiency. This approach is set out in chapter 3 Assumptions underpinning our plan, in our main Business Plan.

We carried out this exercise as part of a proportionate approach to benchmarking, in order to provide an initial whole company view of ESO costs against those of comparable organisations. The results should be considered alongside the more detailed activity level benchmarking we carried out which is detailed in the Business Plan.

4.1.1 Defining the long list of comparator organisations

We identified an initial long list of potential comparators that may share similar characteristics with the ESO. This was based on a set of criteria including:

- economically developed countries where there is less variation in the wider regulatory environments and system operator requirements
- organisations with comparable functions
- organisations that operate in a similar geography and have a similar scale.

The resulting long list of potential candidate countries and organisations is below.

Table 7 - Proposed long list of comparators

Country	Type	Company	Company Name
Australia	ISO	AEMO	Australian Energy Market Operator
Austria	TSO	APG	Verbund - Austrian Power Grid
Belgium	TSO	Elia	Elia System Operator
Denmark	TSO	EN	Energinet.dk
Finland	TSO	FG	Fingrid
France	TSO	RTE	Réseau de Transport d'Électricité
Germany	TSO	TBW	TransnetBW
Germany	TSO	TTG	Tennet TSO
Germany	TSO	AMP	Amprion
Ireland	TSO	EG	EirGrid
Italy	TSO	TER	Terna
Norway	TSO	STN	Statnett
Norway	TSO	NOR	Nordpoll
Portugal	TSO	REN	Redes Energéticas Nacionais

Country	Type	Company	Company Name
Spain	TSO	REE	Red Eléctrica de España
Sweden	TSO	SVK	Svenska Kraftnät
Switzerland	TSO	Swissgrid	Swissgrid
USA	ISO	CAISO	California ISO
USA	ISO	NYISO	New York ISO
USA	ISO	ERCOT	Electric Reliability Council of Texas
USA	ISO	MCISO	Midcontinent ISO
USA	ISO	ISO-NE	New England ISO
USA	ISO	AESO	Alberta Electric SO
USA	ISO	IESO	Independent Electric SO
USA	RTO	PJM	PJM Interconnection
USA	RTO	SWPP	South West Power Pool
Ireland	ISO	EG	EirGrid
United Kingdom	ISO	SONI	System Operator for Northern Ireland

4.1.2 Short listing of comparators

From these potential comparators, we reviewed the companies' financial statements and annual reports to collect relevant cost information to use in the benchmarking.

The lack of formal separation of the ESO function in many of the organisations has limited the availability of comparable data from those statements and accounts. The comparator group has been further reduced because we are seeking to benchmark direct operating costs of the equivalent of the ESO activities. In addition, the comparator group has been further reduced because:

- the available documents did not include the relevant segmented cost information
- the cost information extracted was not directly comparable with ESO cost components, for example Tennet, Svenka Kraftnat and SwissGrid
- for two companies, the financial statements only included revenue information.[9]

The process detailed above has identified nine comparator companies listed in the table below and the type of benchmarking that is currently achievable.

[9] Further adjustments may allow these to be used (subject to testing), these have currently been excluded (Terna and Elia).

Table 8 - Proposed short list of comparators

Country	Company Name	High level	Granular
Australia	Australian Energy Market Operator	✓	X
Norway	Statnett	✓	X
United Kingdom	SONI	✓	X
Ireland	Eirgrid	✓	X
US	California ISO	✓	✓
US	New York ISO	✓	✓
US	Midcontinent ISO	✓	✓
US	New England ISO	✓	✓
US	PJM Interconnection	✓	✓

4.1.3 Developing the high-level metrics mapping

Using the shortlisted companies, the relevant comparative metrics were extracted from the financial statements.

Cost lines in the accounts and financial statements have been interpreted to seek the best match with the ESO direct operating costs. Table 9 below provides the metrics that have been used for each of the organisations.

Table 9 - High level metrics

Country	Company Name	Comparative Metrics
Australia	Australian Energy Market Operator	National Electricity market and National Transmission Planner opex (labour, contractor and consulting)
Norway	Statnett	System service costs
United Kingdom	SONI	Opex (payroll)
Ireland	EIRGRID	Opex (staff costs and contractors)
US	California ISO	Federal Energy Regulatory Commission (FERC) Form 1[10] cost data; aggregation of the account codes shown in the table below.
US	New York ISO	
US	Midcontinent ISO	
US	New England ISO	

[10] https://www.ferc.gov/docs-filing/forms/form-1/data.asp

For US ISOs the FERC Form 1 provides granular data over the period 2009-18. An initial mapping exercise has been undertaken to align these granular costs with cost groups for ESO.

This mapping is summarised in the table below. Certain ESO cost items have been removed from the benchmark to seek to maintain consistency with peers. The cost groups which have not been included in the overall ongoing activities costs for this analysis are:

- market development and change
- code management (commercial)
- code management (technical)
- EU code change and relationships
- innovation business as usual activities
- regulation business as usual activities.

Table 10 - Mapping of ISO costs

Cost Groups	ESO detailed cost lines	FERC account code	FERC Form 1, line description
Control room	Operate the system - control room Control system support Data cyber and Artificial Intelligence Control system review	560	Operation, supervision and engineering
		561	Load dispatching
		561.1	Load dispatch - reliability
		561.2	Load dispatch - monitor and operate transmission system
		561.4	Scheduling, system control and dispatch services
		575.1	Operation supervision
		575.2	Day-ahead and real-time market facilitation
		575.6	Market monitoring and compliance
Ancillary services (AS)	Managing existing AS markets Continued reform of ancillary service markets	575.5	Ancillary services market facilitation
	Charging - Settlements	901	Supervision

Cost Groups	ESO detailed cost lines	FERC account code	FERC Form 1, line description
Invoicing [billing, revenue shared services]	Charging - Revenue	902	Meter reading expenses
		903	Customer record and collection expenses
		904	Uncollectible accounts
		905	Miscellaneous customer accounts expenses
Capacity market	EMR stakeholder and compliance	575.4	Capacity market facilitation
	Capacity Market and CfD auctions		
	EMR modelling		
CUSC	Market development and change		Not mapped (Carried out by the ISO, but unclear where costs fall)
	Code management (commercial)		
Grid Code			
Commercial/Technical	Code management (technical)		
	EU code change and relationships		
LT planning	*NOA*	561.5	Reliability, planning and standards development
	Network operability		
	Market insights, future outlooks (leading the debate train)	561.8	Reliability, planning and standards development services
Managing Bilateral contracting	Customer connections	561.6	Transmission service studies
		561.7	Generation interconnection studies
ST planning	Network access planning	561.3	Load dispatch - transmission service and scheduling
	Energy forecasting	575.3	Transmission rights market facilitation
Innovation	Innovation BAU		Not mapped
Regulation	Regulation BAU	928	Regulatory Commission Expenses
Rates	RIIO 2 BAU		
Running the business	Business change BAU		Not mapped

Cost Groups	ESO detailed cost lines	FERC account code	FERC Form 1, line description
	Assurance BAU		
	Business Continuity	575.8	Market facilitation, monitoring and compliance services
	Data, transparency and insight	907	Supervision
Customer and data	Publish user friendly info	908	Customer assistance expenses
	Customer & stakeholder BAU	909 910	Informational and instructional expenses Miscellaneous customer service and Informational expenses

4.1.4. Making adjustments for comparability

The information extracted requires adjustment to allow robust comparison across organisations. Preliminary adjustments have been made in this phase of the work. This has used a Purchase Power Parity (PPP) adjustment (2018 OECD[11] PPP index currency conversion rates) to eliminate differences in input price levels between countries. The index is a ratio of prices for a basket of goods and services which includes; household consumption, government services, capital formation and net exports.

The time series trend of ESO and comparable organisation costs has been adjusted to bring all values to 2018 prices using the UK RPI inflation index as published monthly by the Office for National Statistics.

4.1.5. Identifying normalisation factors

The metrics also need to be normalised to eliminate various effects to make cost comparisons more like-for-like, for example:

- the relative scale of peers is a key driver of overall variation in cost across peers, with larger companies being more likely to realise potential economies of scale that may exist, and
- the complexity in terms of generating mix will also impact cost, this occurs through the inherent uncertainty associated with renewable energy sources which results in higher system operator costs.

The post-adjustment figures presented below are then normalised for:

- population served, accounting for population differences, the results are presented in per capita units, and
- network service, adjusting for the kilometres of networks the organisation oversees.

[11] http://www.oecd.org/about/

Each is presented separately comparing ESO with the shortlisted comparators in 2018.

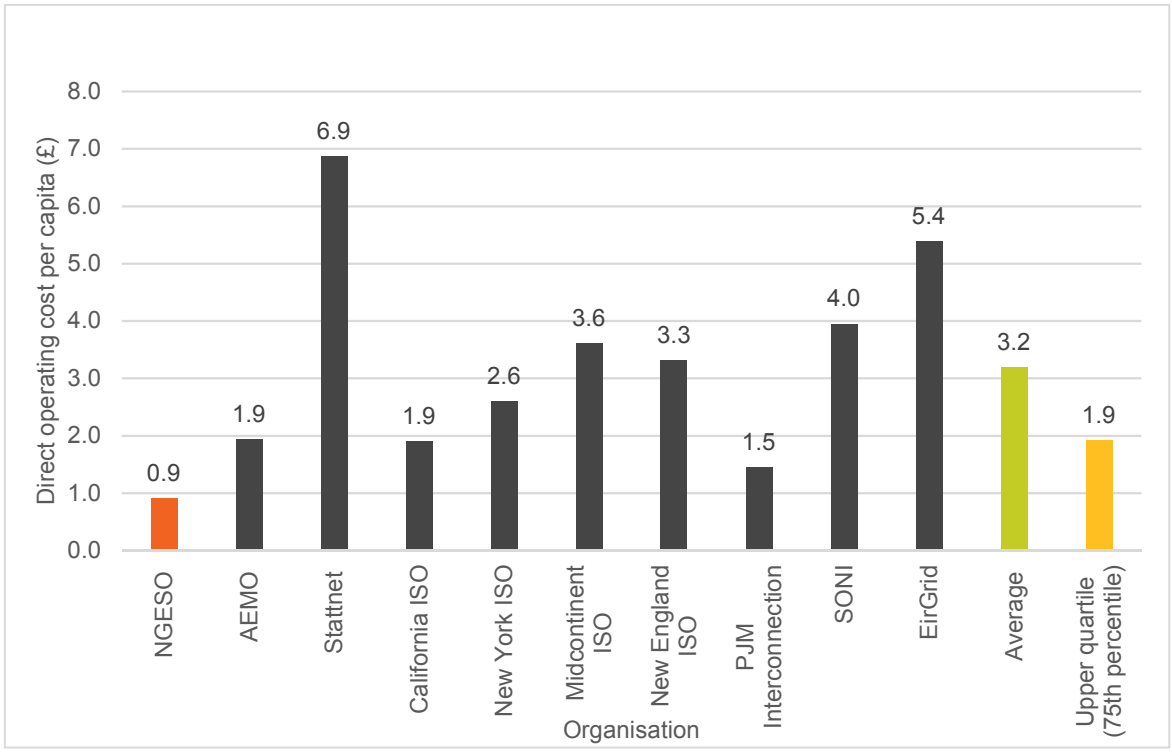


Figure 1- High-level benchmarking: direct operating costs per capita (£, 2018 prices)

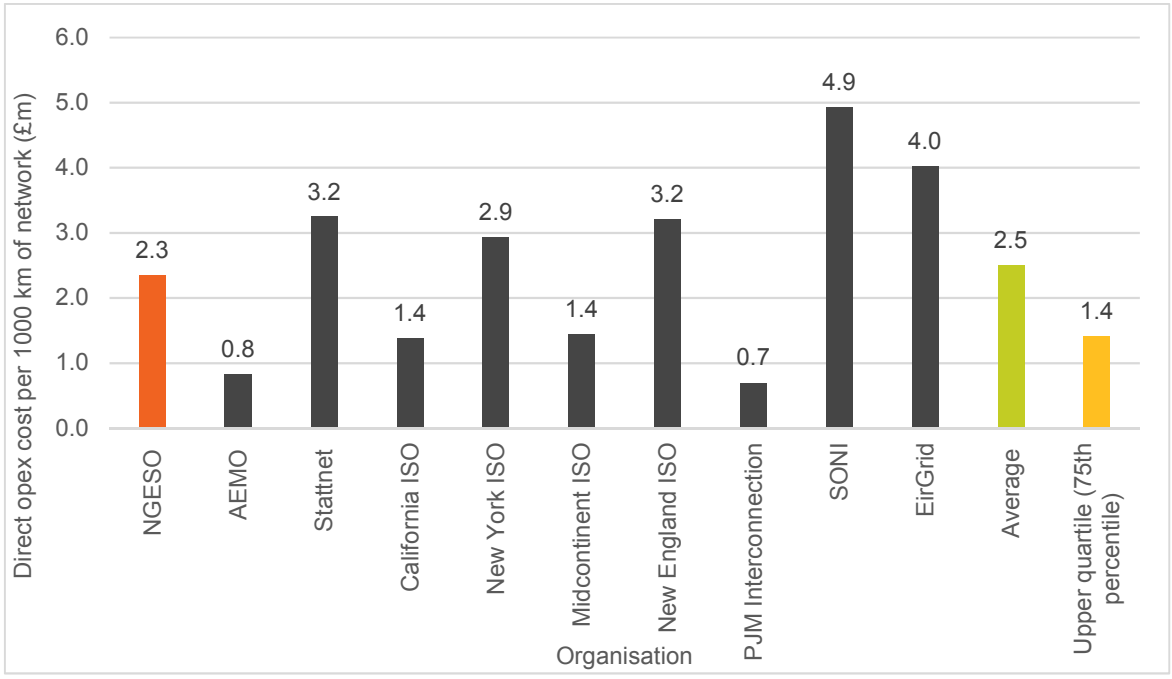


Figure 2 - High-level benchmarking: direct operating costs per 1000 km of network (£m, 2018 prices)

4.1.6 Benchmarking of cost trends

We conducted some high-level analysis of historical adjusted, but not normalised, cost trends versus the comparator companies. The costs are expressed in 2018 prices (using RPI index).

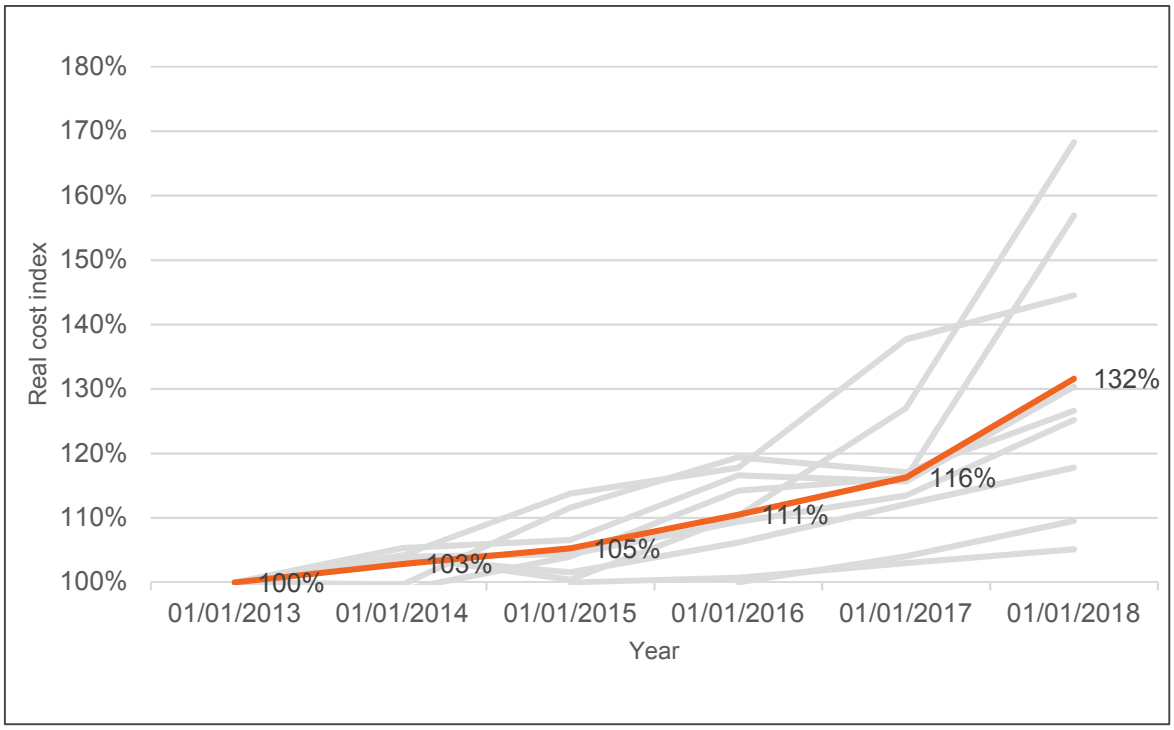


Figure 3 - Historic real costs index (RPI inflation adjusted)

The orange line on the graph shows average increasing real costs through the period 2015-2018, with the grey lines showing individual organisations. Reviews of the commentary in the accounts and financial statements, suggest the main reason for this is that the organisations are seeing a transformation in the energy market, and an associated increase in complexity in managing the electricity systems.

Cleaner forms of energy like wind and solar are increasingly replacing traditional fossil fuel generation. We have highlighted in the past, for example in *The changing role of the Electricity System Operator* in 2017, how these changes are presenting challenges for infrastructure and security of energy supplies, and how we will need to evolve to meet these challenges[12].

The challenges mentioned by the ESO translate to additional complexity and higher costs. This is also recognised by other system operators. For example, the Australian Energy Market Operator (AEMO)[13], in its final budget and fees report notes “the changing energy environment is resulting in additional resources and investment being needed to

[12] https://www.nationalgrideso.com/document/87351/download.

[13] https://www.aemo.com.au/

manage increased complexities of managing the grid day by day”[14]. The AEMO also states that “labour increase includes increases in resources along with a provision for ongoing resources to manage the increasing complexity of our work. Consulting costs are higher in 2018/19. Consulting costs provisioned in 2018/19 include specialist advice and support relating to modernising our markets and managing the complexities of the grid”[15].

4.2 Conclusion

We have taken a number of steps to adjust the available data to provide a high-level benchmarking exercise. There are complexities and limitations to the data that mean this analysis should be considered as part of a wider consideration of ESO efficiency, which includes more specific, cross-sector activity-based benchmarking as detailed in the main business plan document.

[14] AEMO Electricity Final Budget and Fees 2018-19, page 2

[15] AEMO Electricity Final Budget and Fees 2018-19, page 6

Section 5 - Assumptions about our role and that of other parties

This section sets out the specific assumptions about our role and our interactions with other parties that we have made to develop our Business Plan. They complement the assumptions to the energy landscape we set out in chapter 3 Assumptions underpinning our plan, in our main Business Plan.

5.1 Assumptions tables

Our business plan makes several assumptions about our role and our interactions with other parties. We have grouped these into four categories:

A. Future power system operation
B. Future markets
C. Future governance
D. Future relationships with network operators, network owners and other parties.

The tables below list our assumptions, their categorisation and our confidence. The impacts are based on the assumption **not** being realised.

5.2 Theme 1: Ensure reliable, secure system operation to deliver electricity when consumers need it

5.2.1 A1 Control centre architecture and systems

Table 11 - Control centre architecture and systems assumptions

Assumption	Category	Confidence	Impact if assumption is not realised	
The energy landscape continues the transition to increased levels of smaller, variable, renewable and distributed generation. This will lead to more data for the Control Centre to analyse and visualise, and a greater number of market participants to dispatch.	A, B, C	High – based on *FES* scenarios, wider industry trends and stakeholder engagement	**Activity**	Would pursue modernisation and like-for-like incremental solutions, for example Option 1 or Option 3 in section 2.1.7 of Annex 2 – Cost-benefit analysis (CBA) report, rather than proposed transformational activity
			Timeline	Likely to be similar or longer, because changes would be made online to live systems
			Cost	Higher opex in control room due to less automation
			Benefit	Less benefit realised as balancing costs remain high Less efficient use of low carbon plant Realisation of the wider capabilities of the TO and DNO networks would not be achieved

Assumption	Category	Confidence	Impact if assumption is not realised	
Direction of the energy industry, including changes to GB and EU regulation is pushing procurement of	A, C, D	High	**Activity**	Would make incremental changes to existing systems as required
			Timeline	Changes would take longer to implement due to large, inflexible systems

balancing service into shorter timescales. This means agile systems are needed.			**Cost**	Individual changes would be costlier (although there may be less of them)
			Benefit	Benefits from regulatory changes would take longer to be realised

Assumption	**Category**	**Confidence**	**Impact if assumption is not realised**	
Systems will need to be more agile in responding to changing services, technology and policy (e.g. net zero)	A	High	**Activity**	Would make incremental changes to existing systems as required, but less ability for the ESO to flex with need
			Timeline	Changes would take longer to implement due to large, inflexible systems
			Cost	Individual changes would be costlier (although there may be less of them)
			Benefit	Benefits from new services and technology would take longer to be realised

Assumption	**Category**	**Confidence**	**Impact if assumption is not realised**	
Design authority input will enhance the development of new balancing and control capability	D	High – based on stakeholder feedback which demonstrates a shared vision, and previous experience (e.g. Platform for Ancillary Services)	**Activity**	Review whether a design authority is appropriate
			Timeline	No change
			Cost	Slight decrease to opex from not having a design authority
			Benefit	Likely to be reduced, as lack input from market participants could lead to new systems not fully reflecting the needs of stakeholders.

5.2.2 A2 Control centre training and simulation

Table 12 - Control centre training and simulation assumptions

Assumption	Category	Confidence	Impact if assumption is not realised	
Academia are interested in developing enhanced training material course	D	Medium – support for modules, less certain our longer enhanced course	**Activity**	Run own qualification and more in-house training
			Timeline	Development of enhanced training would take longer
			Cost	Extra FTE needed
			Benefit	Same benefit, likely to be realised later

Assumption	Category	Confidence	Impact if assumption is not realised	
Sufficient attraction rate to proposed courses	D	High – based on conversations with academia	**Activity**	Would need to expand direct entry rather than recruiting via academic schemes
			Timeline	No impact
			Cost	No change – cost of running new courses likely to be offset by expanded direct entry recruitment costs
			Benefit	Reduced, as new starters may have less experience No guarantee of pipeline of talent into industry

Assumption	Category	Confidence	Impact if assumption is not realised	
DNOs are interested in using our training facilities	D	Medium	**Activity**	Potentially less need for ESO to training DNO/distribution system operation engineers
			Timeline	Dependent on DNO to distribution system operation transition – potentially pushed back
			Cost	Likely to decrease if there are reduced numbers for the ESO to train
			Benefit	Reduced benefit of whole system training and understanding ESO may keep more trainees (rather than them working for other network organisations)

Assumption	Category	Confidence	Impact if assumption is not realised	
Operating environment will become increasingly complex, meaning new training and simulation capabilities are needed	A	High	**Activity**	Would pursue incremental upgrades to simulator and training facilities
			Timeline	Likely to be as per current as is situation with annual snapshots
			Cost	Decrease, as not developing transformational capability
			Benefit	Reduced benefit as Control Centre engineers can only be trained on limited scenarios. Scope for whole system training and simulation exercises reduced.

5.2.3 A3 Restoration

Table 13 - Restoration assumptions

Assumption	Category	Confidence	Impact if assumption is not realised	
New restoration standard implemented	A, C	High	**Activity**	Decreased requirement for assurance activities and collation
			Timeline	None
			Cost	Less cost incurred
			Benefit	Less benefit – restoration timescales not guaranteed

Assumption	Category	Confidence	Impact if assumption is not realised	
ESO is funded to implement the standard in 2020/21 (based on expected implementation in Q3 2020/21)	A, C	Medium	**Activity**	Delay to restoration standard implementation
			Timeline	Up to 12 months delay
			Cost	None
			Benefit	Same benefit but on the delayed timescale

Assumption	Category	Confidence	Impact if assumption is not realised	
Distributed ReStart project will deliver the expected services and/or volume of services	A	Medium	**Activity**	Less requirement to implement solutions
			Timeline	None
			Cost	Less cost incurred
			Benefit	Reduced, as opportunities for increase in black start provision not realised

5.3 Theme 2: Transforming participation in smart and sustainable markets

5.3.1 A4 Build the future balancing service and wholesale markets

Table 14 - Transforming participation in balancing markets assumptions

Assumption	Category	Confidence	Impact if assumption is not realised	
Theme 1 work is carried out	A	High	**Activity**	Lack of capability to schedule and dispatch volume and diversity of market participants realised from market transformation. Market transformation activity would proceed but with reduced scope.
			Timeline	Delivery would be delayed, some elements may be not be delivered
			Cost	Cost reduced as scope smaller
			Benefit	Benefits of market transformation would be reduced

Assumption	Category	Confidence	Impact if assumption is not realised	
Increased distributed generation, distribution system operation and flexible assets	A	High	**Activity**	No material change
			Timeline	Delayed – may need to create intermediate steps
			Cost	No change but incurred later
			Benefit	Less, as fewer participants smaller “size of the prize”

Assumption	Category	Confidence	Impact if assumption is not realised	
Continued Capacity Market	B	High	**Activity**	Continue with platform, but without Capacity Market element

Assumption	Category	Confidence	Impact if assumption is not realised	
			Timeline	None
			Cost	None
			Benefit	Less, as smaller “size of the prize”

5.3.2 A4 Designing the markets of the future

Table 15 - Designing markets of the future assumptions

Assumption	Category	Confidence	Impact if assumption not realised	
Large volumes of zero marginal cost generation (i.e. a change to the market to justify a review)	B	High-medium	**Activity**	Delay / re-plan the review
			Timeline	Delayed
			Cost	Removed, or incurred later
			Benefit	N/A – would be dependent on output of review

5.3.3 A5 Transform access to the capacity market

Table 16 - Transform access to the capacity market assumptions

Assumption	Category	Confidence	Impact if assumption not realised	
Capacity market restarts after European Court of Justice standstill order	B	High[16]	**Activity**	All Capacity Market activities would be at standstill
			Timeline	Delayed until the market is restarted
			Cost	Ongoing cots will still be incurred, transformational costs incurred later, once revised delivery timelines are clear
			Benefit	Lower, as transformational activities would be delayed and not deliver benefits until restart
Increase in small scale, renewable and interconnection to provide security of supply	A	High	**Activity**	All activities would happen as planned, potentially the enhanced modelling capability and single platform is underutilised with fewer participants and slower evolving energy landscape to model
			Timeline	No change
			Cost	No change
			Benefit	Likely to be smaller, as fewer participants to improve the market for and a slower evolving energy landscape to model

16 The Capacity market was reinstated in October 2019: https://www.gov.uk/government/publications/capacity-market-reinstatement-letters-from-beis-to-national-grid-eso-and-esc-october-2019

5.3.4 A6 Develop codes and charging arrangements that are fit for the future

Table 17 - Develop codes and charging arrangements that are fit for the future assumptions

Assumption	Category	Confidence	Impact if assumption not realised	
Stakeholder support for regulatory change (Energy Codes Review)	C	High	**Activity**	Pause to review the scope of the activities
			Timeline	Subject to the nature and scope of stakeholder views, potential to delay timelines
			Cost	Subject to the nature and scope of stakeholder views, potential reduced costs if activities are not undertaken
			Benefit	Subject to the nature and scope of stakeholder views, potential for reduced benefits if activities are not undertaken
Licence change to allow ESO to undertake enhanced role	C	Medium	**Activity**	Pause to review the scope of the activities
			Timeline	Subject scope of licence changes, potential to delay timelines
			Cost	Subject scope of licence changes, potential reduced costs if activities are not undertaken
			Benefit	Subject scope of licence changes, potential for reduced benefits if activities are not undertaken
Positive outcome from BSUoS review	C	High	**Activity**	Pause to review the scope of the activity
			Timeline	Subject to the outcome of the review, potential to delay timelines
			Cost	Uncertain as costs are associated with financing of ESO risk, rather than opex or capex

	Benefit	Subject the outcome of the review, potential for reduced benefits if activities are not undertaken

5.4 Theme 3: Unlocking consumer value through competition

5.4.1 Network development

The assumptions below apply to all of the activities below:

- A8 Implement and enhance competition to enable all solution types to compete to meet transmission needs
- A9 Extending *NOA* to end-of-life asset replacement decisions and connections wider works
- A10 Support decision making investment at the distribution level
- A11 Enhance our analytical capabilities to support these activities

Table 18 – Review of the Network development assumptions

Assumption	Category	Confidence	Impact if assumption is not realised	
Network operability will become more difficult and expensive	A	High	**Activity**	No change.
			Timeline	Operability improvements moved backwards
			Cost	Rate of cost increase reduces
			Benefit	Less in RIIO-2

Assumption	Category	Confidence	Impact if assumption is not realised	
Competition will be available to encourage more solutions	B	High	**Activity**	Network needs would continue to be met by incumbent TOs
			Timeline	Moved backwards
			Cost	Costs associated with competitive processes to source alternative network solutions would not need to be incurred

			Benefit	Network needs would continue to be met by incumbent TOs, the efficiency of which would not be tested against other potential solutions

Assumption	**Category**	**Confidence**	**Impact if assumption is not realised**	
There will be a balancing mechanism which the ESO can use to fix network issues in lieu of other options. This remains the counterfactual for all *NOA*-related activities	B	High	**Activity**	A suitable alternative would be needed
			Timeline	Moved backwards
			Cost	Increase, as would need to incorporate an alternative into our analytical process
			Benefit	Depends on alternative counterfactual. In theory, the result should be similar

Assumption	**Category**	**Confidence**	**Impact if assumption is not realised**	
Key role for the ESO is to highlight the need for network capabilities and facilitate assessment and recommendation of the most efficient option	D	High	**Activity**	Reduced range of potential solutions
			Timeline	Moved backwards
			Cost	Decrease – less cost associate with competitive processes
			Benefit	Less in RIIO-2 Potential for missed cost reduction opportunities

Assumption	Category	Confidence	Impact if assumption is not realised	
DNOs will have funding and resource necessary to feed in options to a *NOA*-type process	C, D	Medium – depends on RIIO-ED2 and Ofgem implementing whole system licence conditions	**Activity**	Reduced DNO activity leading to reduced ESO activity
			Timeline	Moved backwards
			Cost	Reduced
			Benefit	Not realised – potential benefits missed

A12 Review of the SQSS

Assumption	Category	Confidence	Impact if assumption is not realised	
There is a need to update the SQSS to ensure it remains fit for purpose to support a carbon free network and competition	C	High	**Activity**	No need to carry out the proposed review
			Timeline	Moved backwards
			Cost	Reduced or potentially moved backwards
			Benefit	Reduced due to security framework not reflecting market and not supportive of carbon free ambition and enabling greater competition

5.5 Theme 4: Driving towards a sustainable, whole energy future

5.5.1 A13 Leading the debate

Table 19 – Leading the debate assumptions

Assumption	Category	Confidence	Impact if assumption is not realised	
To fulfil carbon free operation by 2025 and reach net zero by 2050 there is a need for deeper insights to inform effective energy policy development	A, B, C, D	High	**Activity**	Continue with *FES* as currently is
			Timeline	N/A due to no new activity
			Cost	Lower internal ESO cost
			Benefit	Reduced due to less input from stakeholders on key recommendations and increased likelihood of suboptimal policy development.

5.5.2 A14 Taking a whole electricity system approach to connections

Table 20 - Taking a whole electricity system approach to connections

Assumption	Category	Confidence	Impact if assumption is not realised	
More non-traditional and "needs guidance" parties wanting to connect, due to continued push for a low carbon future	A, B, C	High	**Activity**	Levelling off in connection activity
			Timeline	Timeline for portal and connections work would remain the same
			Cost	No change, but would need to consider how to fund the portal if spread across fewer participants
			Benefit	Less benefit realised as less participants benefits from our work creating a simplified process and easier route to market.

and an open and competitive market				

Assumption	Category	Confidence	Impact if assumption is not realised	
No change to licence conditions - we are contract holder for connection and manage the commercial process	C, D	High	**Activity**	Connections work would still need to be done, but potentially by a different party or parties
			Timeline	Depends on licence conditions
			Cost	Same, possibly incurred by a different party
			Benefit	Same, possibly realised by a different party

Assumption	Category	Confidence	Impact if assumption is not realised	
The connection platform is a whole system tool, starting with transmission and then moving to distribution	C, D	Medium	**Activity**	A reduced roll out if only implemented by transmission companies
			Timeline	Faster roll out
			Cost	Reduced, as reduced roll out
			Benefit	Reduced, as smaller “size of the prize” and continued complexity

Assumption	Category	Confidence	Impact if assumption is not realised	
	C, D	Medium	**Activity**	A reduced roll out if only implemented by transmission companies

RIIO-ED2 aligns the objectives of DNOs to wider industry (regarding connection portal concept)	**Timeline**	Faster roll out
	Cost	Reduced, as reduced roll out
	Benefit	Reduced, as smaller “size of the prize” and continued complexity

Assumption	Category	Confidence	Impact if assumption is not realised	
All other network organisations will work with us to develop co-ordinated connection hubs	D	Medium	**Activity**	Standalone hubs produced
			Timeline	Longer to deliver.
			Cost	Increased due to higher development integrations costs
			Benefit	Reduced benefit, as customers are confused as to process

5.5.3 A15 Taking a whole electricity system approach to promote zero carbon operability

Table 21 - Taking a whole electricity system approach to promote zero carbon operability

Assumption	Category	Confidence	Impact if assumption is not realised	
Anticipated increase in decentralisation of generation and flexibility services	A	High	**Activity**	If less, reduced work **/** If more, likely to “firefight”
			Timeline	If less, flatten off **/** If more, work pushed back
			Cost	If less, decrease – no need to spend **/** If more, risk of increased balancing cost due to reactive (not proactive) work
			Benefit	If less, fewer opportunities to realise benefit / If more, benefits reduced and pushed back

Assumption	Category	Confidence	Impact if assumption is not realised	
DNO to distribution system operation transition takes place	A	High on need; transition rates may vary between DNOs	**Activity**	Potential need to do more work and early on Work could vary between different DNOs
			Timeline	Depends on transition
			Cost	Slower transition would lead to less risk of increase in short term costs, but may push costs back Faster transition could lead to more costs if firefighting
			Benefit	A transition done too quickly could reduce innovation. Transition needs to be agreed across industry and coordinated to ensure short and long-term benefits.

Assumption	Category	Confidence	Impact if assumption is not realised	
Anticipated increase in levels of decarbonisation	**A**	**High**	**Activity**	If less, unlikely to change as would deliver on decarbonisation ambition in line with customer wishes and government policy / If more, likely to "firefight"
			Timeline	If less, unlikely to change / If more, work pushed back
			Cost	If less, unlikely to change / If more, risk of increased balancing cost due to reactive (not proactive) work
			Benefit	If less, unlikely to change / If more, benefits reduced and pushed back

Assumption	Category	Confidence	Impact if assumption is not realised	
There will be whole system	C, D	Medium	**Activity**	No need for holistic changes to codes and framework
			Timeline	N/A (as no need for activity)

changes to network planning standards across transmission and distribution	**Cost**	Reduced change cost but potential higher longer-term costs of maintaining discrete standards
	Benefit	Missed opportunities for whole system efficiencies

Assumption	Category	Confidence	Impact if assumption is not realised	
DNOs funded for new ways of working	C, D	Medium – depends on RIIO-ED2 and Ofgem implementing whole system licence conditions	**Activity**	Reduced progression on supporting transition to distribution system operation
			Timeline	Activities moved backwards
			Cost	Higher costs of system operation
			Benefit	Not realised

Assumption	Category	Confidence	Impact if assumption is not realised	
Innovation projects will lead to new whole energy system opportunities	D	Medium	**Activity**	Opportunities missed to use cross-vector solutions to contribute to net zero, resulting in less whole energy system work
			Timeline	Activities moved backwards as whole energy system aspirations move back
			Cost	Potential reduced cost from work not happening, but higher overall costs as whole system efficiencies not realised
			Benefit	Reduced opportunities to realise whole system benefits

5.5.4 A16 Delivering consumer benefits from improved network access planning

Table 22 - Delivering consumer benefits from improved network access planning

Assumption	Category	Confidence	Impact if assumption is not realised	
Anticipated increase in levels of decentralised generation	A	High	**Activity**	If less, then reduced level of access planning coordination required / If more, likely to respond inefficiently due to working reactively
			Timeline	If less, same timeline for rolling out proposals or potentially not rolled out / If more, proactive work moved back due to working reactively
			Cost	Decrease – less FTE needed / If more, risk of increased balancing cost due to working reactively
			Benefit	No opportunity to realise benefits / If more, benefits reduced and moved backwards due to working reactively

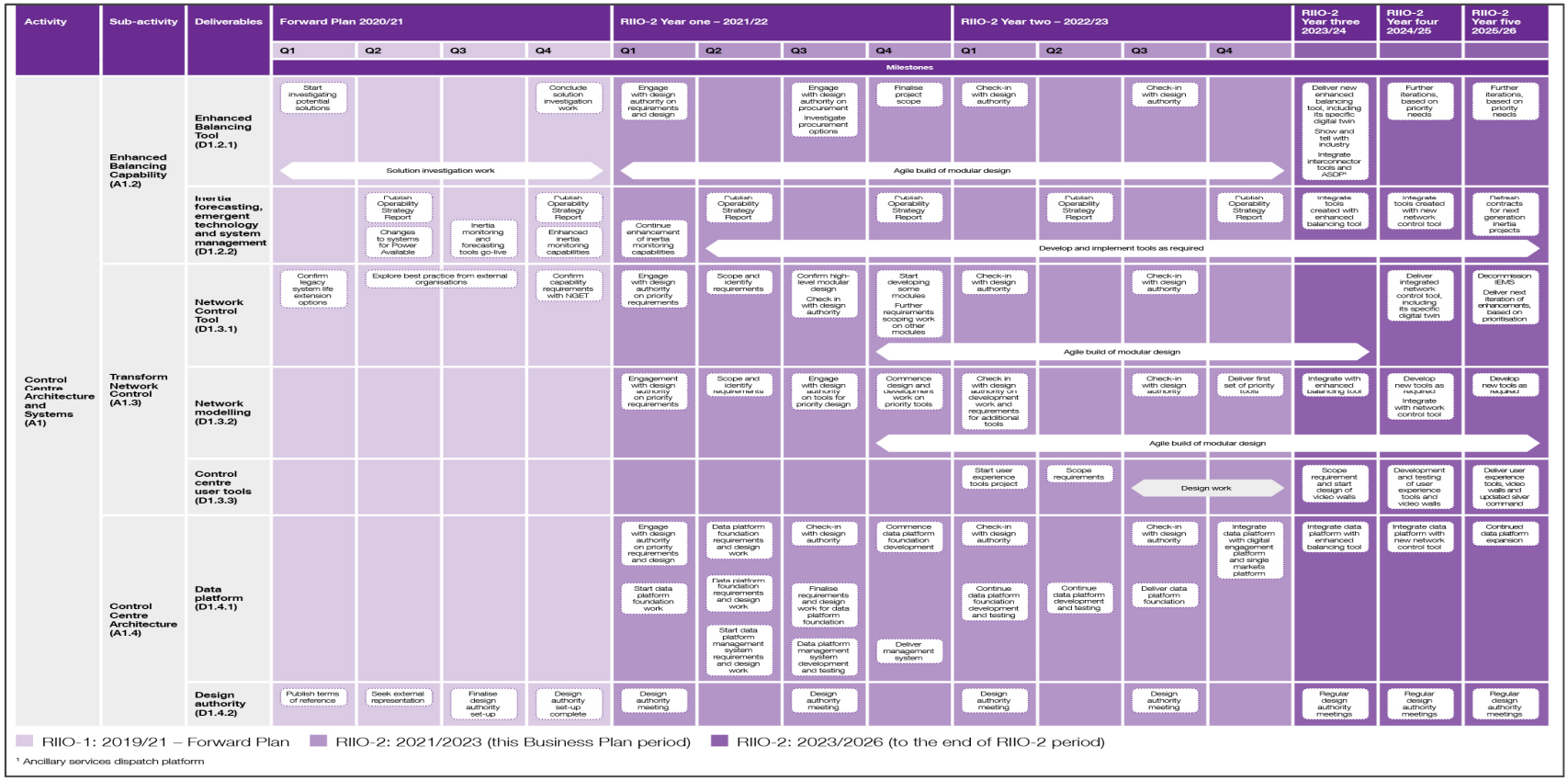
Assumption	Category	Confidence	Impact if assumption is not realised	
Anticipated increased in levels of active network management from DNOs/DSOs	A	High	**Activity**	If less, reduced levels of coordination required / If quicker transition – large increase in work due to more reactive working /
			Timeline	If less, potentially same timeline or not at all / If quicker, would need to bring forward
			Cost	If less, reduced internal costs but potentially higher overall costs / If quicker, most cost and earlier on
			Benefit	If less, reduced opportunity to realise benefits / If quicker, same benefit but shifted with timeline

Section 6 - Investment roadmaps

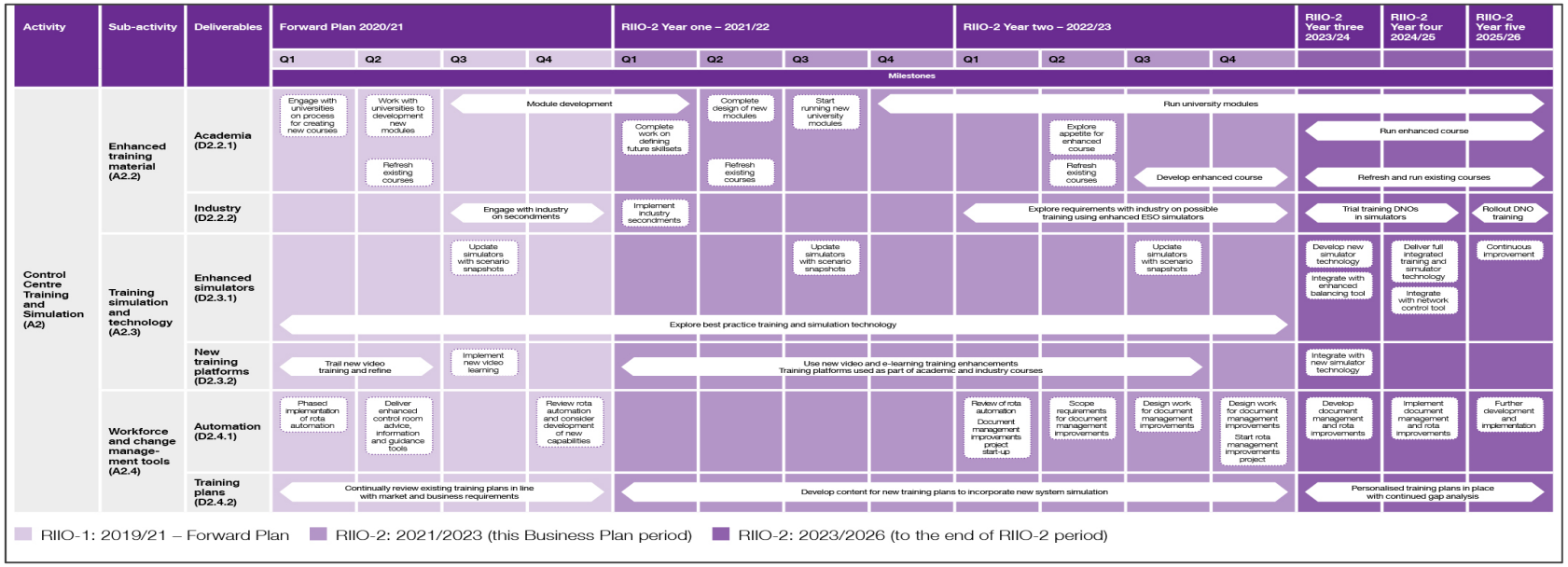
In each of the Theme chapters 4 to 7 and in chapter 8 - Digitalisation and open data unlocking zero carbon system operation and markets in the Business Plan, there are investment roadmaps against the different activities. To view these with more ease, see the diagrams below.

6.1 Theme 1

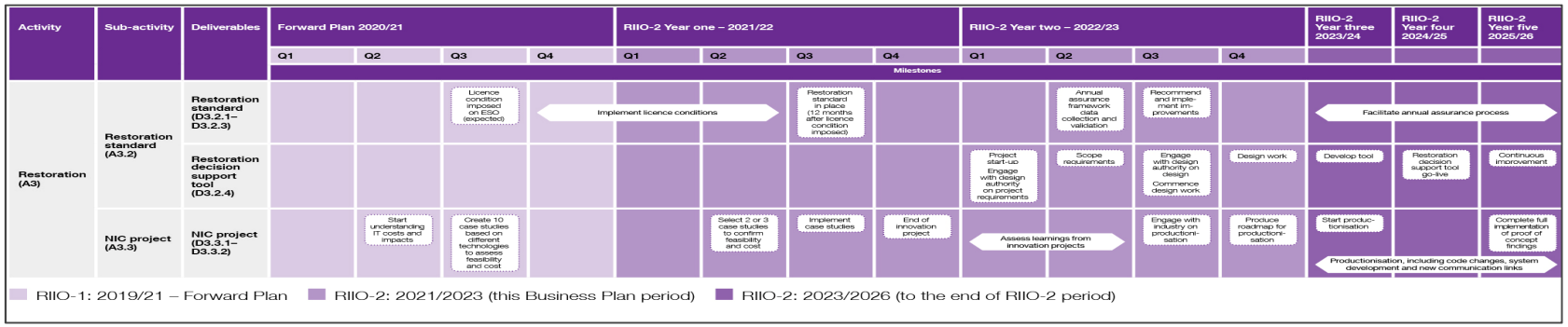
Section 4.2 – Control Centre architecture and systems roadmap



Section 4.3 – Control Centre training and simulation roadmap

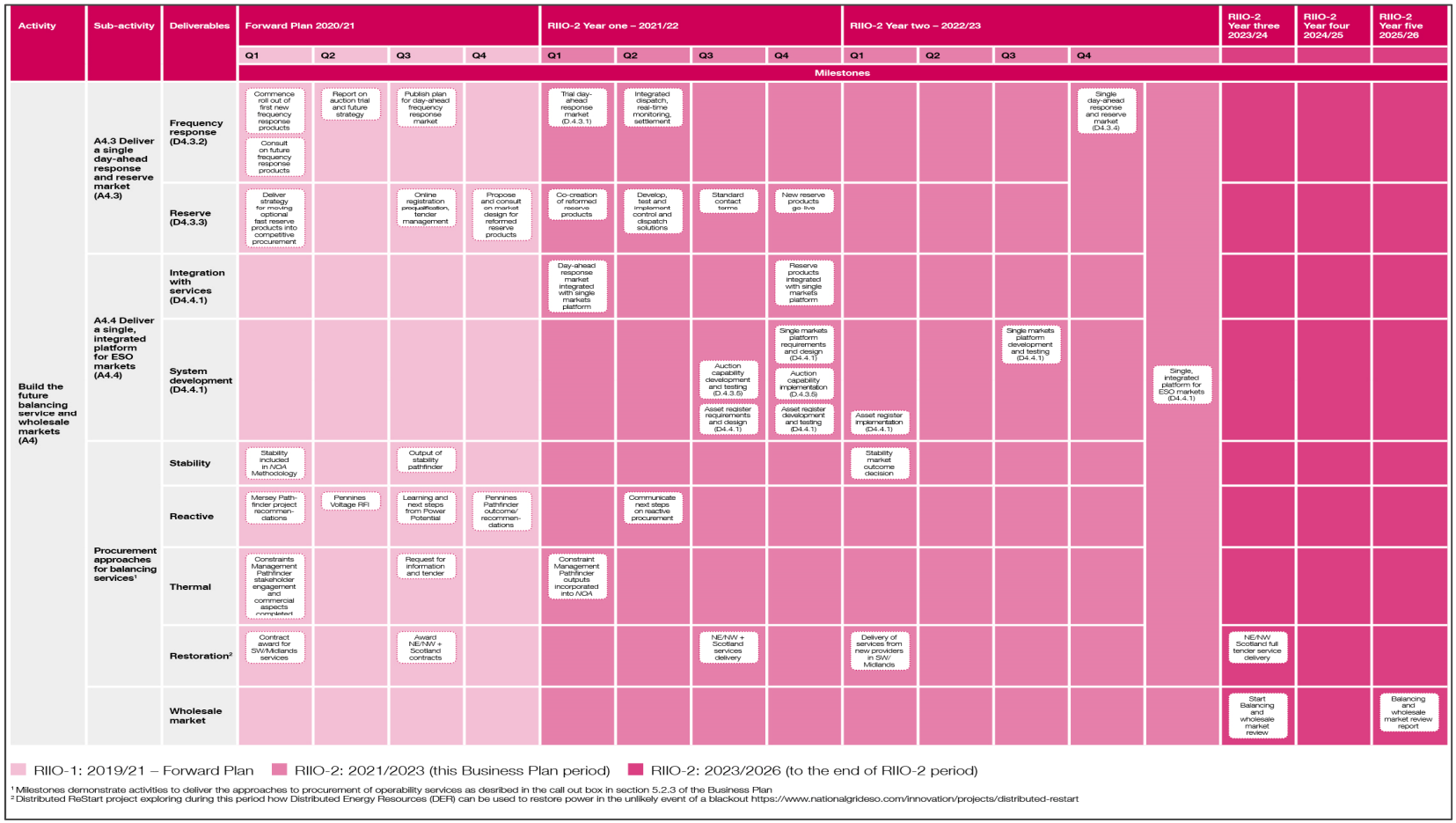


Section 4.4 – Restoration roadmap



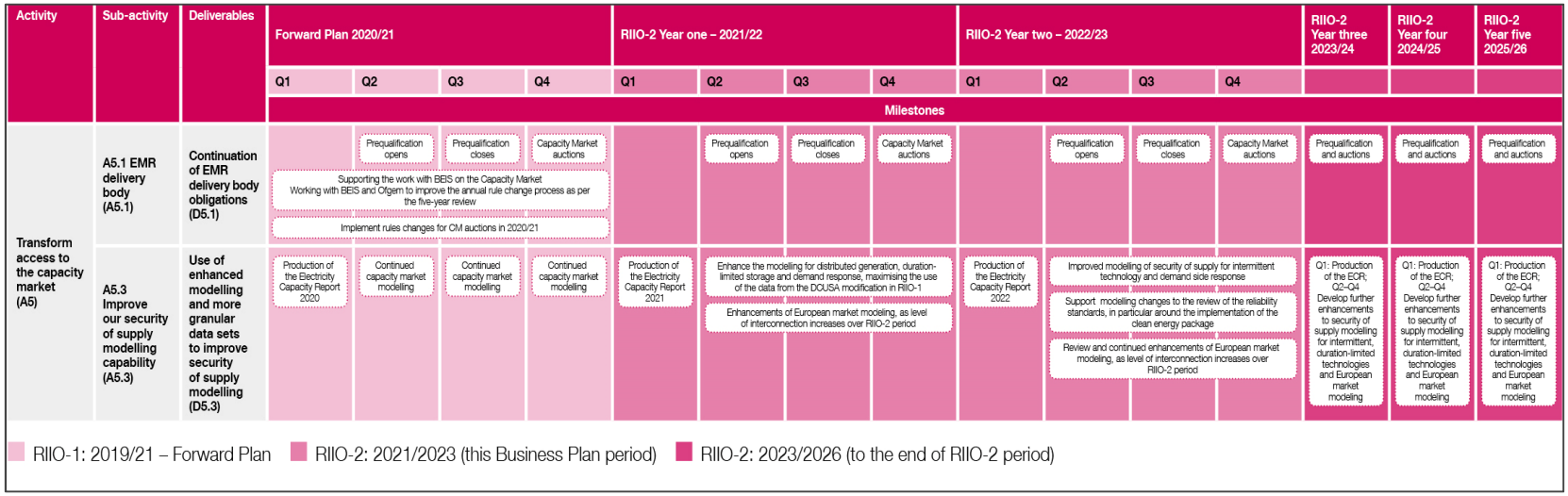
6.2 Theme 2

Section 5.2 – Build the future balancing service and wholesale markets roadmap

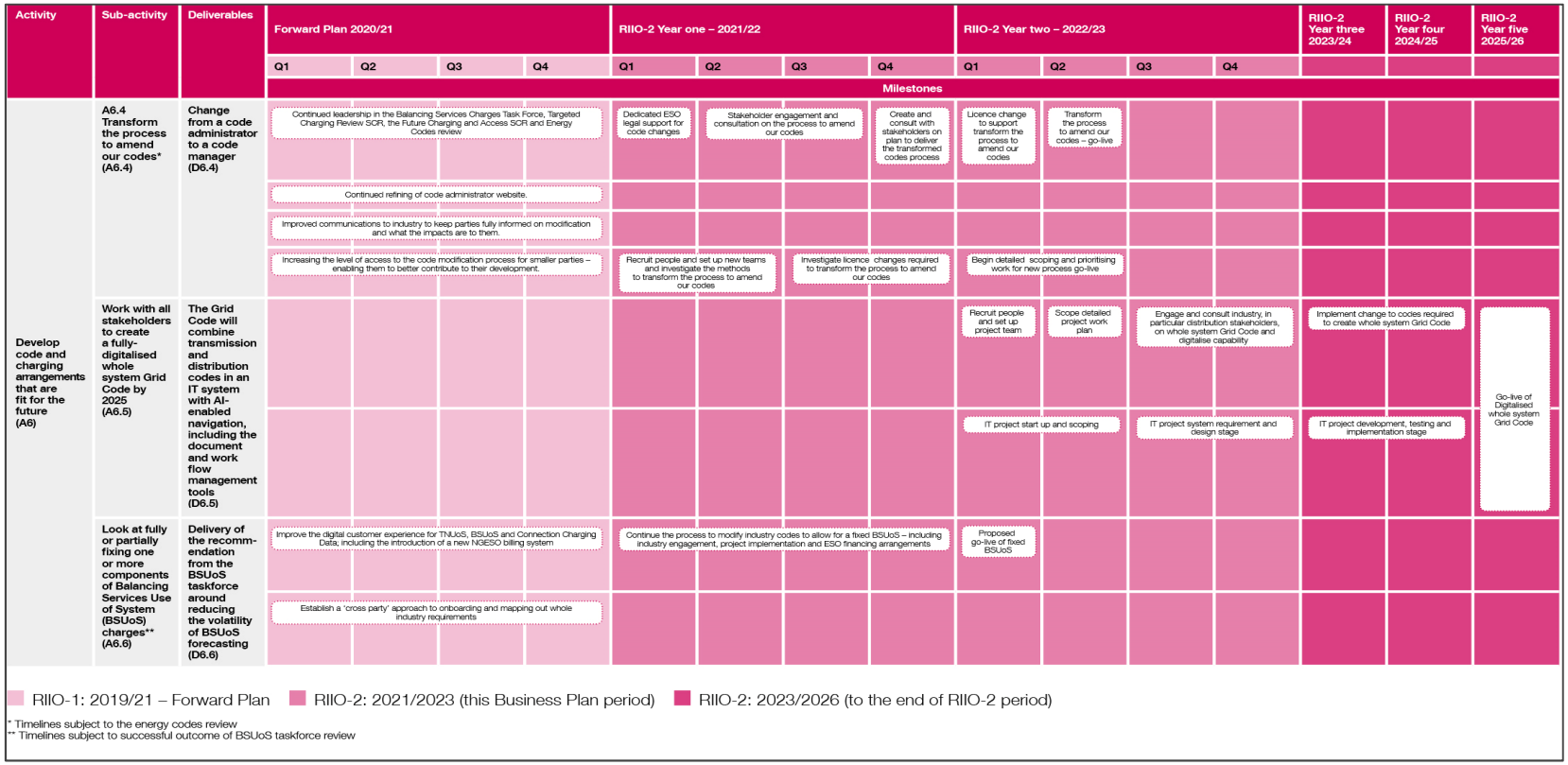


[1] Milestones demonstrate activities to deliver the approaches to procurement of operability services as desribed in the call out box in section 5.2.3 of the Business Plan
[2] Distributed ReStart project exploring during this period how Distributed Energy Resources (DER) can be used to restore power in the unlikely event of a blackout https://www.nationalgrideso.com/innovation/projects/distributed-restart

Section 5.3 – Transform access to the Capacity Market roadmap

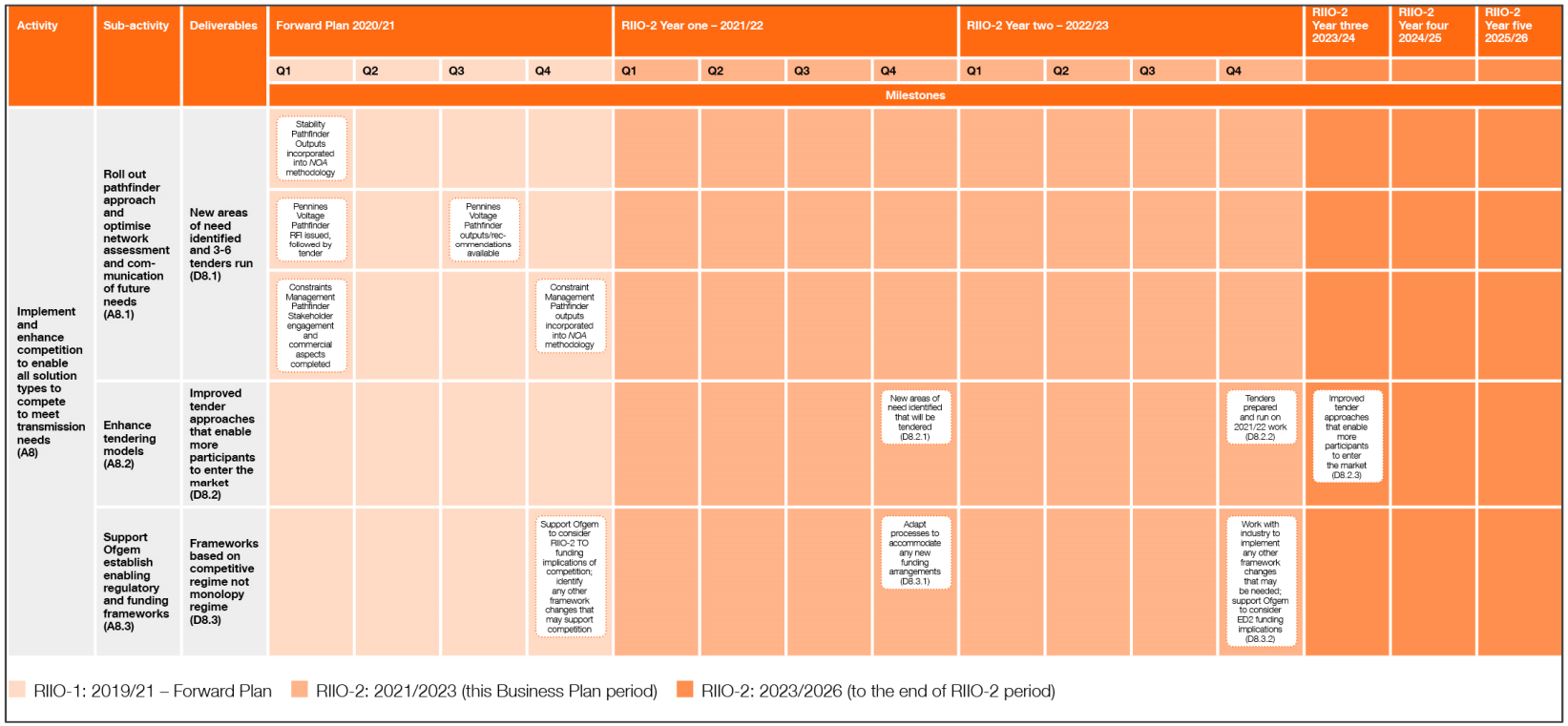


Section 5.4 – Develop code and charging arrangements that are fit for the future

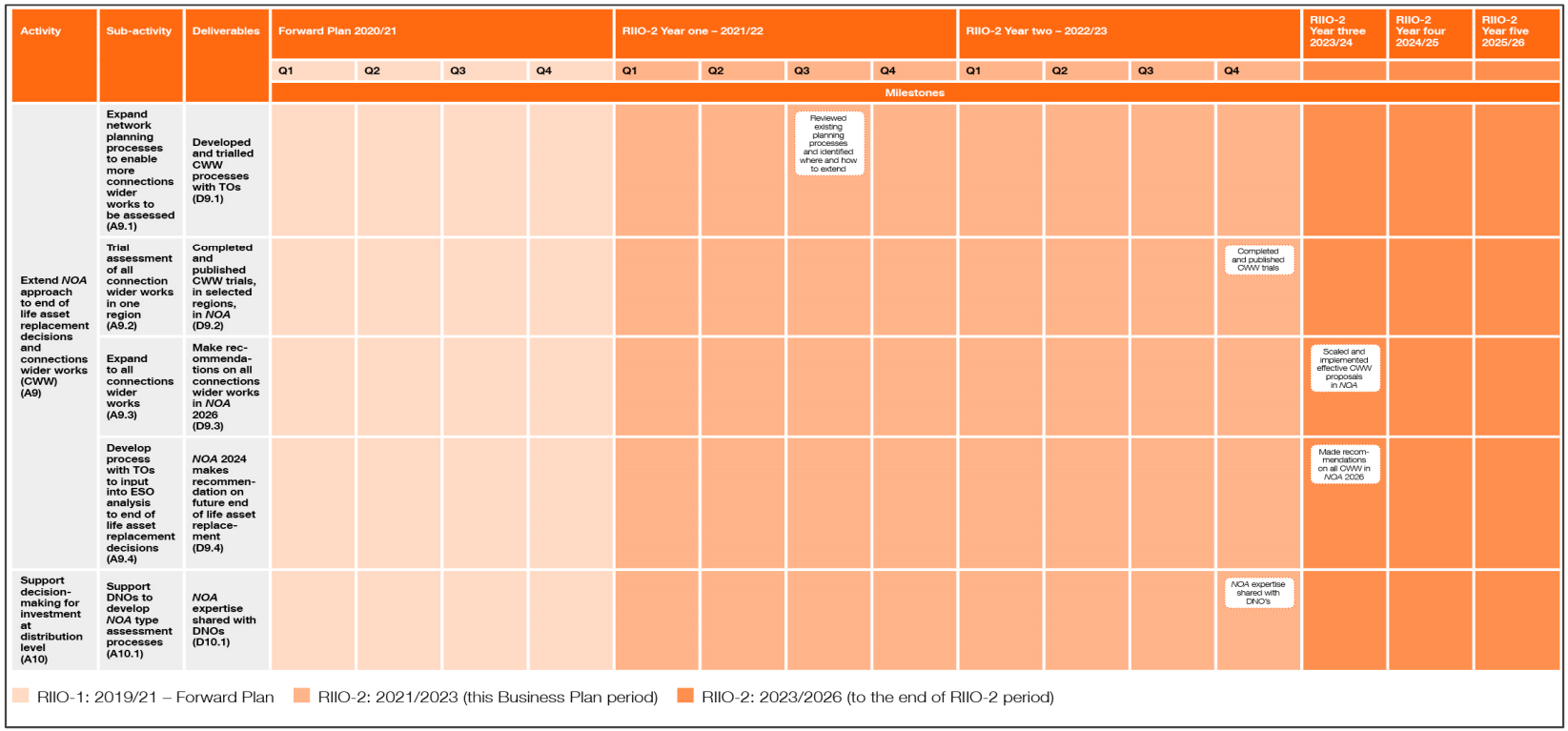


6.3 Theme 3

Section 6.2.3.1 – Network development: Enhance *NOA* roadmap



Section 6.2.3.2 – Network development: Extending *NOA* to end of life asset replacement decisions and connections wider works roadmap



Section 6.2.3.4 – Network development: Enhance our analytical capabilities to support these activities roadmap

Activity	Sub-activity	Deliverables	Forward Plan 2020/21				RIIO-2 Year one – 2021/22				RIIO-2 Year two – 2022/23				RIIO-2 Year three 2023/24	RIIO-2 Year four 2024/25	RIIO-2 Year five 2025/26
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
			Milestones														
Enhance Analytical Capabilities (A11)	Refresh and integrate economic assessment (EA) tools to support future network modelling needs (A11.1)	Improved identification of when is the most economical time to invest and the most efficient solution (D11.1)					Started economic assessment EA tool refresh (D11.1.1)		Gathered requirements and designed EA tool (D11.1.2)				Developed and tested EA tool (D11.1.3)	Implemented EA tool (D11.1.4)		Started EA tool refresh (D11.1.5)	
	Implement probabilistic modelling (A11.2)	Improved identification of network needs (D11.2)				Identified up to 3 new areas for further evaluation	Gathered requirements and designed probabilistic modelling (PM) model (D11.2.1)			Developed and tested PM model (D11.2.2)				Implemented PM model (D11.2.3)		Developed and implemented online portal (D11.2.4)	
	Build voltage assessment techniques into an optimisation tool (A11.3)	Improved assessment of voltage requirements, and ability to look across a range of network needs at the same time (D11.3)								Started full voltage optimization (VO) tool development (D11.3.1)		Gathered requirements and designed VO tool (D11.3.2)		Developed and tested VO tool (D11.3.3)	Implemented VO tool and identified further enhancements (D11.3.4)		
	Build stability assessment techniques into an optimisation tool (A11.4)	Improved assessment of stablility requirements across the network (D11.4)										Started full stability assessment (SA) tool development (D11.4.1)		Gathered requirements and designed SA tool (D11.4.2)	Developed and tested SA tool (D11.4.3)	Implemented SA tool (D11.4.4)	

RIIO-1: 2019/21 – Forward Plan RIIO-2: 2021/2023 (this Business Plan period) RIIO-2: 2023/2026 (to the end of RIIO-2 period)

Section 6.3 – Review of the SQSS roadmap

Activity	Sub-activity	Deliverables	Forward Plan 2020/21				RIIO-2 Year one – 2021/22				RIIO-2 Year two – 2022/23				RIIO-2 Year three 2023/24	RIIO-2 Year four 2024/25	RIIO-2 Year five 2025/26
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
			Milestones														
Review SQSS (A12)	Scope project, building on the BEIS recommendations (A12.1)	Review fully scoped and target issues agreed (D12.1)						Scoped review and target issues identified (D12.1.1)		Validated and agreed scope and target issues with stakeholders (D12.1.2)							
	Identify solutions (A12.2)	Potential solutions identified and direction established (D12.2)														Identified potential solutions and direction established (D12.2.1)	
	Implement changes (A12.3)	Key changes to SQSS made or in progress (D12.3)															Reported to Ofgem SQSS proposed changes and agreed implementation plan; implemented ESO-related changes (D12.3.1)

RIIO-1: 2019/21 – Forward Plan RIIO-2: 2021/2023 (this Business Plan period) RIIO-2: 2023/2026 (to the end of RIIO-2 period)

6.4 Theme 4

Section 7.2 – Leading the debate: providing energy analysis and market insights to drive the energy transition roadmap

Activity	Sub-activity	Deliverables	Forward Plan 2020/21				RIIO-2 Year one – 2021/22				RIIO-2 Year two – 2022/23				RIIO-2 Year three 2023/24	RIIO-2 Year four 2024/25	RIIO-2 Year five 2025/26
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
			Milestones														
Leading the debate (A13)	*FES*: Bridging the gap to net zero (A13.4)	Produced evidence based recomm-endations to support development of energy policy (D13.4)							Established broader industry engagement and events to inform policy development (D13.4.1)	Published deeper whole energy system related insight reports (D13.4.2)			Established broader industry engagement and events to inform policy development (D13.4.1)	Published deeper whole energy system related insight reports (D13.4.2)	Established broader industry engagement and events to inform policy development (D13.4.1) Published deeper whole energy system related insight reports (D13.4.2)	Established broader industry engagement and events to inform policy development (D13.4.1) Published deeper whole energy system related insight reports (D13.4.2)	Established broader industry engagement and events to inform policy development (D13.4.1) Published deeper whole energy system related insight reports (D13.4.2)
	FES: Integrating with other networks (A13.5)	Replaced electricity demand model, within Whole system/ net-zero modelling (D13.5.1)							Completed electricity demand modelling requirements gathering and design work (D13.5.1)			Developed and tested electricity demand model (D13.5.1)		Implement and integrate model (D13.5.1) Develop and share data reports and insights to facilitate development of regional *FES* (D13.5.1)			
		Developed new energy demand model (D13.5.2)								Completed review of available energy data and established stakeholder modelling requirements (D13.5.2)	Developed new longer term energy demand model plan, including pilots and full scale development (D13.5.2)		Built, tested and validated model (D13.5.2)	Implement model covering annual profiles and vectors including transport (D13.5.2)			

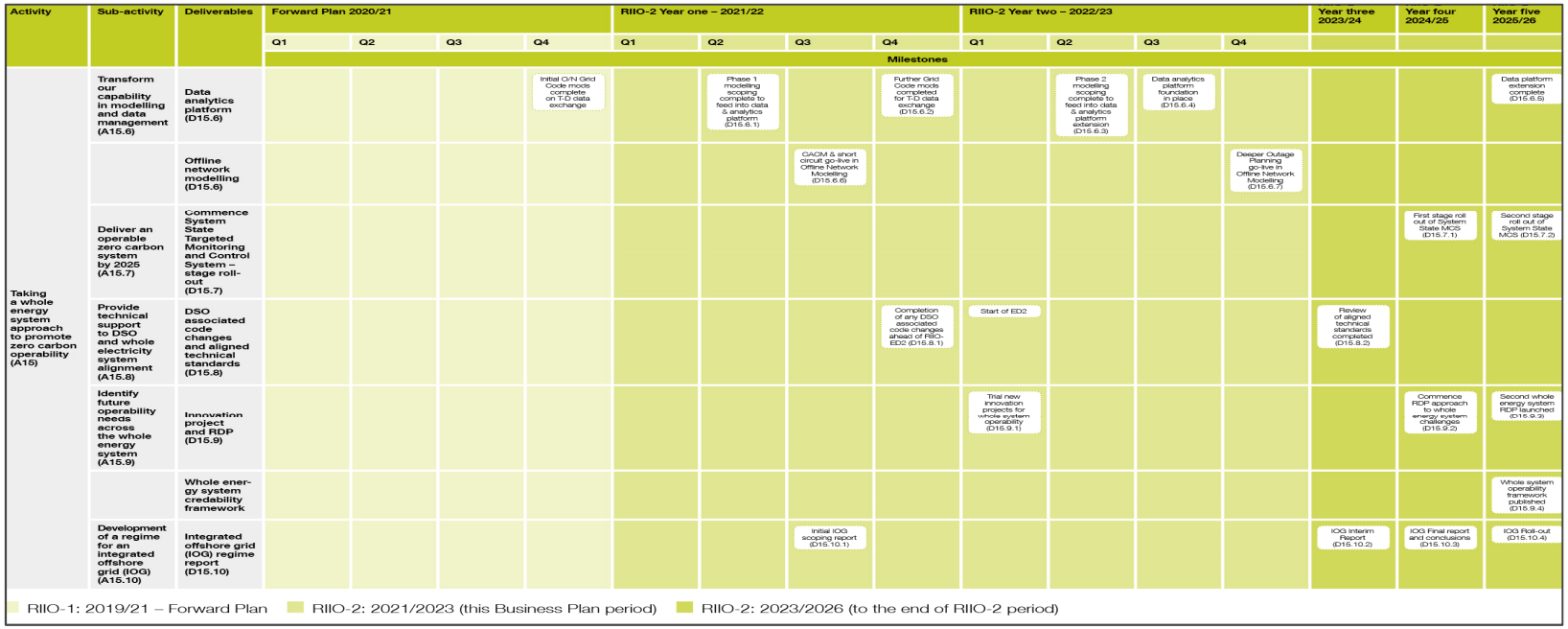
RIIO-1: 2019/21 – Forward Plan RIIO-2: 2021/2023 (this Business Plan period) RIIO-2: 2023/2026 (to the end of RIIO-2 period)

Section 7.3 – Taking a whole electricity system approach to connections roadmap

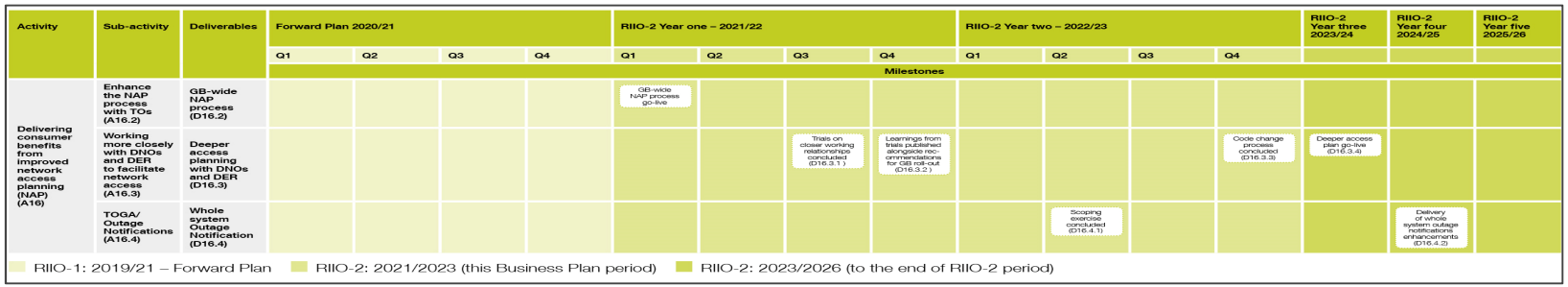
Activity	Sub-activity	Deliverables	Forward Plan 2020/21				RIIO-2 Year one – 2021/22				RIIO-2 Year two – 2022/23				Year three 2023/24	Year four 2024/25	Year five 2025/26
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
			Milestones														
Taking a whole electricity system approach to connections (A14)	Further enhance the customer connection experience, including broader support for smaller parties (A14.3)	Enhanced customer connection experience (D14.3)						Establish dedicated DER account management function (D14.3.1)				First whole electricity system connections seminar (D14.3.2)		Whole electricity system connections seminar (D14.3.3)	2 x Whole electricity system connections seminar (D14.3.3)	3 x Whole electricity system connections seminar (D14.3.3)	4 x Whole electricity system connections seminar (D14.3.3)
	Facilitate development of a custom-er connec-tions hub (A14.4)	Customer connections hub (D14.4)												Phase 1 of connections hub implement-ed including on-line account managements D14.4.1			Phase 2 of connection hub concluded (D14.4.2)

RIIO-1: 2019/21 – Forward Plan RIIO-2: 2021/2023 (this Business Plan period) RIIO-2: 2023/2026 (to the end of RIIO-2 period)

Section 7.4 – Taking a whole electricity system approach to promote zero carbon operability roadmap

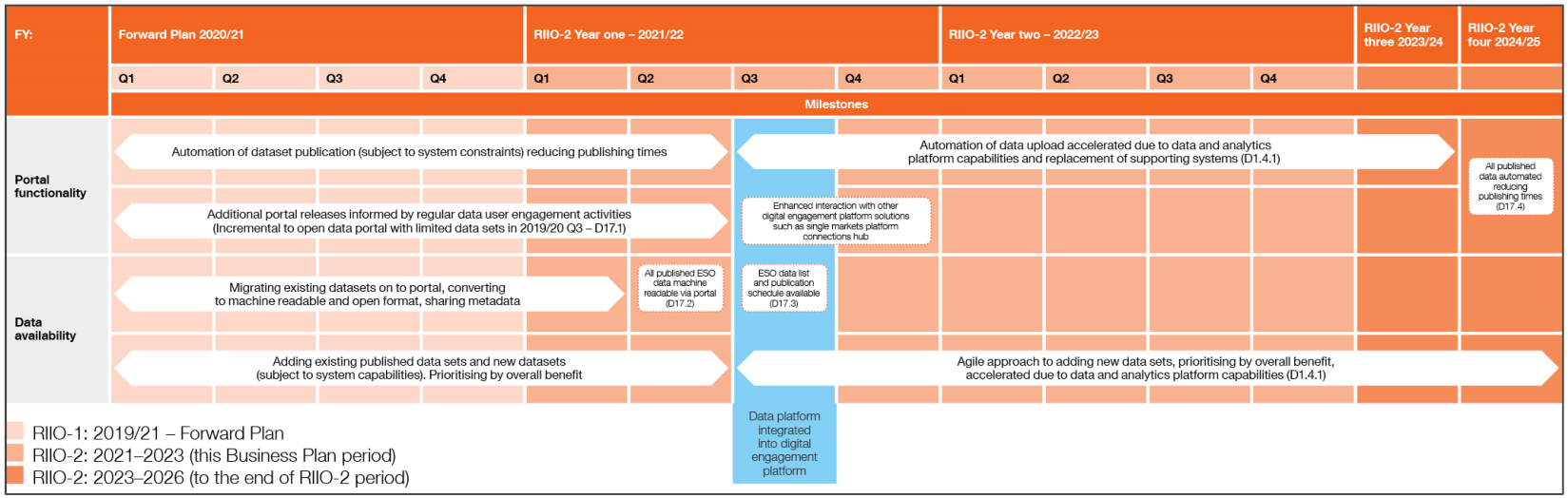


Section 7.5 – Delivering consumer benefits from improved network access planning roadmap



6.5 Open Data

Section 8 – Digitalisation and open data unlocking zero carbon system operation and markets roadmap



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