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Utility Planning and Decision Making on Grid Facing Investments



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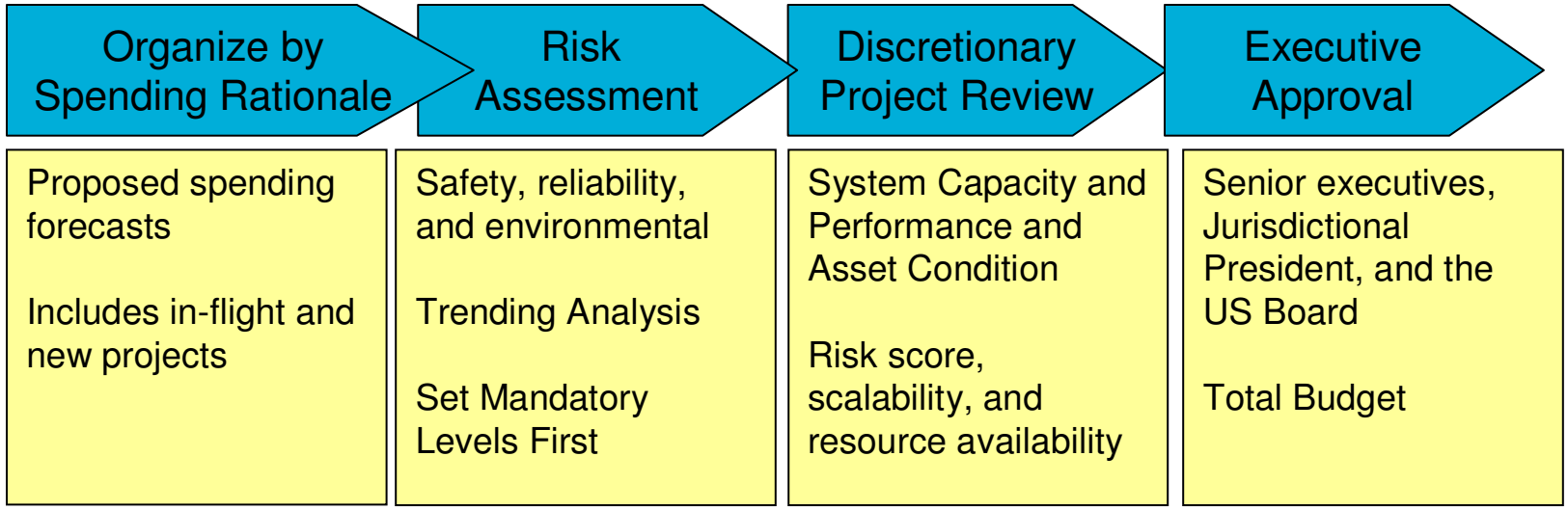
Selecting, and sequencing grid-facing Improvements

SPENDING RATIONALE	DESCRIPTION
Statutory/Regulatory	Regulatory, Governmental, or Contractual obligations (Mandatory)
Damage/Failure	Immediate repair of failed and damaged equipment (Mandatory)
Asset Condition	Purpose is to reduce risk and consequences of unplanned failures
System Capacity and Performance	Reliability, growth/shift in demands
Non-Infrastructure	Very small – radios, general tools (Not IS or facilities)

Development of the Plan

To sustain the safe, reliable and efficient operation of the electric system



- Annual Process
  - September through March for Next Year
- Continuous review and Governance
- Specific approval for every line item

Balancing Reliability Benefits and Costs…
Risk scoring methodology

Purpose	• Create a **single risk score** which can be used to compare the safety, reliability and environmental risks addressed in the capital plan for each of our businesses
How will it be used	• Provide **transparency** within the Lines of Business and to the Executive on the amount of risk being mitigated in each business relative to the capital plan • **Link the return** on investment to the risk eliminated by investing into the business
Relevance	• Previously **no common method** to assess risk across the business • Opportunity for you to **shape**, going forward, the standardised way this should be done • Opportunity to **inform regulatory dialogue** and debate
What this concept is not	• Is not a technical measure of **residual** system risk, i.e. the risk remaining to be mitigated once the proposed projects have been completed

B Risk scoring process will use following principles

1 Determine Impact and likelihood levels

Step 1 – Score project on **impact** in each of the following criteria

Impact	Safety	Reliability	Environment
Very low	(1)	1	(1)
Low	2	2	2
Moderately low	3	3	3
Moderate	4	(4)	4
Moderately high	5	5	5
High	6	6	6
Very high	7	7	7

Any impact of penalties for reliability/ health and environment to be considered when scoring project on impact

Step 2 – Score project on **likelihood** of occurrence in each of the following criteria

Likelihood	Safety	Reliability	Environment
Very low	1	1	1
Low	2	2	2
Moderately low	3	3	3
Moderate	(4)	(4)	4
Moderately high	5	5	(5)
High	6	6	6
Very high	7	7	7

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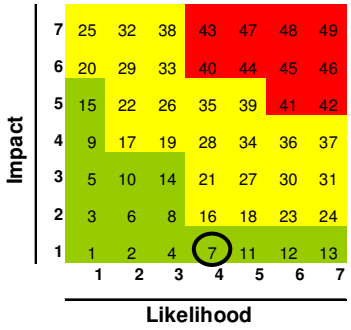
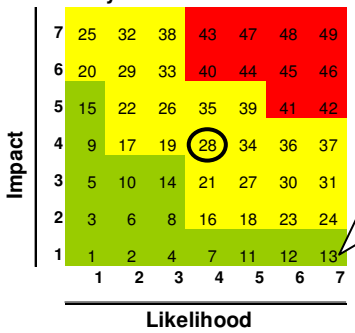
2 Obtain blended risk score* for each criterion

Safety score

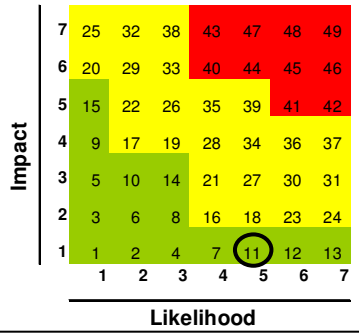


Reliability score*



Scores are ranked based on the expected monetary value of each outcome

Environmental score*



3 Obtain overall risk score

- Overall score is maximum of
  - Safety (7)
  - Environment (11)
  - Reliability (28)
- Maximum score method was selected because:
  - Impact levels are assessed on an exponential scale, hence the highest score outweighs other lower scores (e.g.,Level 7 has a monetary impact > £20Mn and Level 1 has a a monetary impact of <£5k)
  - Aggregating different scores into a simple score is mathematically inaccurate
  - Maximum score ensures that projects with a high score on a single criteria are not ignored
  - Most projects are expected to have a single driver that dominates

* Scores are grouped and colour coded for ease of viewing (40 and above - red, 16-39 - yellow and 15 and below - green)

B1 Impact Matrix – Safety & Environment (1/3)

Score	Financial Impact	Health and Safety	Environment
1	• < £5K • < $10K	• Minor injury requiring First Aid with a quick and complete recovery (£100-200/$200-400) • Minor illness with up to one –week absence. No permanent health consequences (£500/$1000)	• Non-significant Environmental Incident without agency oversight (e.g., minor spillage (e.g., < 5 litres) that does not enter drain or water course, small quantities of hazardous waste left on site, temporary impact to the environment) (£1K- 2K/$2K-4K) or a minor regulatory compliance issue.
2	• £5K-50K • $10K-100K	• Illness with over one week absence but no permanent health consequences (£5K/$10K)	• Significant Environmental Incident usually without agency oversight (e.g., spillage that does not enter drain or water course, fly tipping on National Grid land or site, a release of methane gas under 200 tonnes) (£5K-50K/$10K-100K) or regulatory non-compliance issues that may result in minimal fines.
3	• £50K-250K • $100K-500K	• Injury to member of public requiring medical treatment but no permanent consequences (£50K/$100K)	• Significant Environmental Incident with agency oversight (e.g., minor silt run off to reservoir, discolouration noted around edges, mitigation measures required and some clean up required, a release of more than 200kg of sulphur hexafluoride gas) (£50K-250K/$100K-500K) or a non-compliance issue that results in significant fines and/or actions taken by regulatory authorities (e.g. permit limits for air emissions exceeded).
4	• £250K-1Mn • $500K-2Mn	• Permanently incapacitating injury or illness to employees (Moderate to severe pain for 1 – 4 weeks with possible recurrence of pain for certain activities and some permanent restrictions to leisure or work) (£500K/$1000K) • Injury to member of public requiring extended medical treatment but no permanent consequences	• Significant Environmental Incident with agency oversight (e.g., uncontained release of liquid (e.g silty water or bentonite drilling fluid, petroleum) to a drain or water course that has the potential for enforcement action and which may cause fish or aquatic plants to die) (£250K-1Mn/$500K-2Mn) non-compliance issue that results in significant fines and/or actions taken by regulatory authorities (e.g. permit limits for air emissions exceeded, noise abatement order issued).
5	• £1Mn-5Mn • $2Mn-10Mn	• Permanently incapacitating injury to a member of public or fatality to employee (£4.5Mn/$9Mn)	• Significant Environmental Incident (e.g., several full drums of oil spill contents on to ground and significant quantity enters high quality water course leading to >500 fish killed and damage to river bed requiring remediation and leading to prosecution, damage to environmentally sensitive sites, listed buildings, or damage to a Site of Special Scientific Interest) (£1Mn-5Mn/$2Mn-10Mn) or non-compliance issue results in significant fines and actions taken by regulatory authorities.
6	• £5Mn-20Mn • $10Mn-40Mn	• Fatality to a single member of public/ Multiple fatalities to employees (<4 people) (£20Mn/$40Mn)	• Catastrophic Environmental incident (e.g., contamination of a ground water source leading to prosecution, enforced clean up, and provision of alternative water supply) (£5Mn-20Mn/$10Mn–40Mn) or a non-compliance issue that results in fines and actions taken by regulatory authorities and presents a risk of affecting future business operations.
7	• £20Mn + • $40Mn +	• Multiple public fatalities or Multiple fatality of 5 or more employees (£50 Mn/$100Mn)	

B1 Impact Matrix – Reliability (2/3)

Score	Financial Impact	Reliability – EDx	Reliability – EDx
1	• < £5K • < $10K		
2	• £5K-50K • $10K-100K	• Loss to less than 500 customers • Less than <50K CMI • Loss of 0.5 (13KV) feeder • Loading: 95-100%	• Voltage (P.U.): 0.93-0.95 • MWh:<= 4 • Pocket Frequency:3
3	• £50K-250K • $100K-500K	• Loss to 500-5,000 customers • 50K to 500K CMI • Loss of 0.5-1 (13KV) feeder • Loading: 100-105%	• Voltage (P.U.): 0.92-0.93 • MWh:>4<=8 • Pocket Frequency:4-5
4	• £250K-1Mn • $500K-2Mn	• Loss to 5,000-10,000 customers • 500K to 1M CMI • Loss of 1-3 (13 KV) feeder • Loading: 105-110%	• Voltage (P.U.): 0.90-0.92 • MWh:>8<=16 • Pocket Frequency:6-10
5	• £1Mn-5Mn • $2Mn-10Mn	• Loss to 10,000-25,000 customers • 1M to 5M CMI • Loss of 3-6 (13KV) feeder • Loading: 110-115%	• Voltage (P.U.): 0.87-0.90 • MWh:>16<=40 • Pocket Frequency:10-15
6	• £5Mn-20Mn • $10Mn-40Mn	• Loss to 25,000-50,000 customers • 5M to 20M CMI • Loss of 6-10 (13KV) feeder • Loading: 115-120%	• Voltage (P.U.): 0.85-0.87 • MWh:>40<=80 • Pocket Frequency:16-20
7	• £20Mn + • $40Mn +	• Loss to 50,000 customers • More than 20M CMI • Loss of more than 10 (13KV) feeders • Loading: 120%	• Voltage (P.U.): less than 0.85 • MWh:>80 • Pocket Frequency:>20

Assumed exchange rate: £1=$2. Additional Chart for Reliability – Global IS and shared services, and Reliability – LNG

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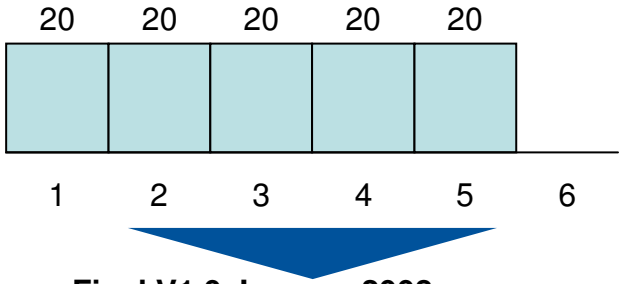
B1 Likelihood Matrix (3 of 5) – Using *time to certain event* or *probability* approach

Resulting likelihood scores after considering the time to a certain impact or the probability of an impact happening next year (assuming a uniform distribution)

Years to certain impact	Likelihood level	Probability of certain impact happening next year
1	7	100%
2	7	50%
3	6	33%
5	6	20%
6	5	17%
10	5	10%
20	4	5%
100	4	1%
200	3	0.5%
500	2	0.2%
1000	2	0.1%
2000	1	0.05%

Example
An event will happen in the next 5 years (on the probability of the event happening next year is 20%)

Probability of an event occurring, %



Guidance to use this table

- Step 1 – Establish the time to a certain impact or the probability of a certain impact happening next year
- Step 2 – Derive the resulting likelihood score from the central column by scrolling across the table above – e.g., if an event will happen in the next 5 years (or the probability of the event happening next year is 20%), the likelihood score is 6

Likelihood score – 6

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B2 The blended score for each outcome is derived from ranking the product of impact (£/$) and likelihood (%)

Blended Impact and Likelihood scores*

Impact \ Likelihood	1	2	3	4	5	6	7
7	25	32	38	43	47	48	49
6	20	29	33	40	44	45	46
5	15	22	26	35	39	41	42
4	9	17	19	28	34	36	37
3	5	10	14	21	27	30	31
2	3	6	8	16	18	23	24
1	1	2	4	7	11	12	13

- Blended scores are derived by ranking expected monetary values of each possible outcome
- Expected monetary value (EMV) for a given outcome is the product of the average monetary impact and the average probability. For example:
  - Impact of 6 and likelihood of 2 gives an expected monetary value of £75,000, derived as product of:
    - Level 6 impact of £12.5 M (average of £5M and £20M)
    - Level 2 average cumulative probability of 0.60% (between 0.2% and 1%)
- All the expected monetary values are ranked from 1 to 49 to give blended scores. For example:
  - The highest EMV of £33.25M is assigned a score of 49 (highest possible score)
  - Likewise, the EMV of £75,000 is assigned a score of 29

Expected monetary value, £

Impact \ Likelihood	Average monetary impact, £	1	2	3	4	5	6	7
7	*35,000,000*	35,000	210,000	612,500	3,937,500	13,125,000	25,375,000	33,250,000
6	*12,500,000*	12,500	75,000	218,750	1,406,250	4,687,500	9,062,500	11,875,000
5	*3,000,000*	3,000	18,000	52,500	337,500	1,125,000	2,175,000	2,850,000
4	*625,000*	625	3,750	10,938	70,313	234,375	453,125	593,750
3	*150,000*	150	900	2,625	16,875	56,250	108,750	142,500
2	*27,500*	28	165	481	3,094	10,313	19,938	26,125
1	*2,500*	3	15	44	281	938	1,813	2,375
	Average likelihood	*0.10%*	*0.60%*	*1.8%*	*11%*	*38%*	*73%*	*95%*

Likelihood

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DPU Policies Influencing Planning and Decision Making

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- Service Quality Metrics
  - Saifi, Saidi, etc
  - Worst Performing Feeders
- DG Interconnections