WG Adequacy #15

27 January 2023

Agenda

- Welcome
- Minutes of Meeting WG Adequacy #14
- CRM Functioning Rules: Feedback received during Public consultation
- Capacity Contract : expected changes
- CO2 threshold [Cabinet]
- Update hurdle rate methodology [Professor Boudt]
- Next meetings

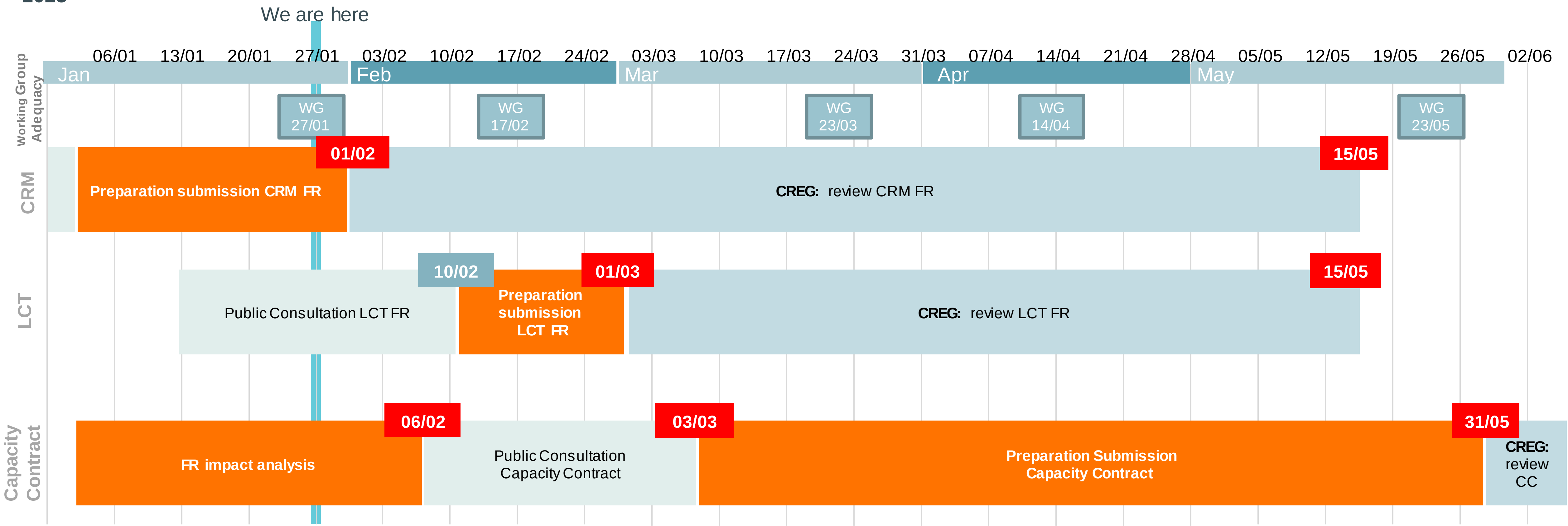
Minutes of Meetings

Minutes of Meeting

- **WG Adequacy #14 – 16.12.2022 : To be approved**
- *The MoM were sent on 20.01.2023. No comments were received.*

CRM Functioning Rules: Feedback received during Public consultation

2023


We are here
06/01 13/01 20/01 27/01 03/02 10/02 17/02 24/02 03/03 10/03 17/03 24/03 31/03 07/04 14/04 21/04 28/04 05/05 12/05 19/05 26/05 02/06
Jan
Feb
Mar
Apr
May
Working Group Adequacy
WG 27/01
WG 17/02
WG 23/03
WG 14/04
WG 23/05
CRM
Preparation submission CRM FR
01/02
CREG: review CRM FR
15/05
LCT
Public Consultation LCT FR
10/02
Preparation submission LCT FR
01/03
CREG: review LCT FR
15/05
Capacity Contract
FR impact analysis
06/02
Public Consultation Capacity Contract
03/03
Preparation Submission Capacity Contract
31/05
CREG: review CC

Elia received non-confidential feedback from 5 market parties

Elia also received fully and partly confidential feedback from 2 market parties

- Five market parties sent in non-confidential responses:
  - CENTRICA
  - FEBEG
  - FEBELIEC
  - FLUVIUS
  - ZANDVLIET POWER
- Elia received one fully confidential response, and one partly confidential response.

As part of the public consultation process, clarifications on the evolution of the derating factor are requested

- FEBEG has requested to include a formula in the updated definition of the Derating Factor for Energy Constrained CMUs to clarify the weighting.
  - Elia agrees with this suggestion and proposes to include the following formula to the definition of Derating Factor (CMU,t) for energy constrained CMUs:

$$Derating\ Factor\,(CMU,t) = \frac{\left[\frac{Contracted\ Capacity\ 1}{Derating\ Factor\ 1} x\ Derating\ Factor\ 1 + \frac{Contracted\ Capacity\ 2}{Derating\ Factor\ 2} x\ Derating\ Factor\ 2 + \ldots\right]}{\frac{Contracted\ Capacity\ 1}{Derating\ Factor\ 1} + \frac{Contracted\ Capacity\ 2}{Derating\ Factor\ 2} + \ldots}$$

  - Elia will check the correct use of this formula and related weighing in all relevant sections of the rules.
- FEBEG notes that in the formula of the Secondary Market Remaining Eligible Volume (SMREV), the Total Contracted Capacity should be divided by the Derating Factor (CMU,t) instead of the Last Published Derating Factor.
  - Elia agrees and will update the formula accordingly:
  - $SMREV(CMU,TP,tnotif) = Max(0; \left[Remaining\ Maximum\ Capacity_{min}(CMU,TP,t_{notif}) - \left[\frac{Total\ Contracted\ Capacity_{max}(CMU,TP,tnotif)}{\mathbf{Derating\ Factor(CMU,TP,tnotif)}}\right] - Optoutvolume_{max}(CMU,TP,tnotif)\right] x\ Last\ published\ Derating\ Factor(CMU,TP,tnotif))$

Clarifications are requested on the process to evolve from "Additional" to "Existing" CMU

- FEBEG asks about the process/timings
  - ELIA will clarify in the Functioning Rules that the Capacity Provider will initiate the process
  - ELIA will clarify in the Functioning Rules the **requirements** to fulfill → Provide extra information per Additional Delivery Point that becomes Existing
  - ELIA will clarify in the Functioning Rules the **timings** to be respected → Submit necessary information by PQ file submission deadline (15/6) earlier that year in order to guarantee evolution to Existing CMU in time before the start of the Delivery Period

- FEBEG asks how the NRP will be determined
  - The idea is that the historical method can be used to determine the NRP of the DPs that become Existing
  - ELIA intends to keep the requirement to have a least 14 calendar days of data, but will include flexibility w.r.t. the period used – i.e. not necessarily ending 5 WDs before the end of the month before the PQ file submission date

Comments are made on the contribution of volumes towards adequacy

- FEBEG asks for possibility to do opt-out OUT in case of too high NRP
- FEBEG and Zandvliet Power are of the opinion that opt-outs of DSM are better classified as OUT instead of IN
- The DSOs ask for the possibility to freely choose a bid volume in any CRM Auction, as is the case in the LCT Auction

  - ELIA will review the opt-out classification rules
  - However, ELIA would like to remind that:
    - The NRP methodology has been reviewed in order to improve the accuracy. Moreover, opt-out is possible and concessions have been made in the availability monitoring framework such that market parties can announce unavailability
    - The LCT context is different from the CRM auction context: in the LCT only the remaining adequacy gap will be contracted, whereas the CRM is market-wide. This is why in the CRM all volumes have to be assessed towards adequacy contribution and hence why we need opt-out in the CRM and cannot allow free choice of bid volume (lowering the bid volume can only be done via opt-outs made upfront)

Comments are made on the clarifications on the elements of the quarterly report

- FEBEG indicates that the modifications increase the administrative burden of Capacity Providers
  - Elia wishes to highlight that it did not add any new elements to the content of the quarterly report
  - Rather, the proposal is a clarifications in order to avoid misunderstandings of the Functioning Rules at the upcoming $t_{control\ 1}$

- FEBEG furthermore expresses its concerns about the compliance check Elia will perform
  - It is vital that Elia can properly assess a project’s evolution based on the elements of the quarterly report
  - From the first version of the Functioning Rules, Elia already had to possibility to ask questions in case of missing/unclear information
  - As such, the modifications are clarifications to that principle
  - Elia will already give informal feedback based on the quarterly reports of February in order to prepare Capacity Providers for the first moment of control

Market parties suggest to change the AMT Price from a fixed value to a more dynamic parameter

- FEBEG and Zandvliet Power argue that, similar to the proposal for the Strike Price indexation, the AMT Price should vary monthly to take into account price evolutions
  - Elia wishes to stress that the surpassing of the AMT Price does not automatically mean that the Availability Monitoring is enforced
    - The selection of AMT Moments for actual monitoring happens based on a methodology that is not disclosed publically
    - Elia evidently aims to select AMT Moments that are relevant for adequacy
  - Elia will look into a more dynamic design for the AMT Price, but notes that:
    - The AMT Price is calculated shortly before the start of the Delivery Period, and as such is deemed as a solid indicator
    - A fixed AMT Price has the advantage of clarity and simplicity

Overview of feedback received during the Public Consultation on CRM Functioning Rules on Payback Obligation

- Several market actors (FEBEG, Zandvliet Power) can support the proposal on updated indexation mechanism made by Elia.

- FEBEG & Zandvliet Power ask to exclude negative prices when considering the variable component in the indexation whereas Febeliec would like to see all prices considered allowing the strike price to evolve in both directions.
  - Given the feedback provided, Elia is of the opinion that the indexed strike price should take into account market prices & evolution and should indeed be allowed to evolve in both directions.

- FEBEG & Zandvliet Power ask to foresee the possibility to adapt the formula in the future if not fit for purpose anymore.
  - Elia refers to the RD Methodology in which such possibility is foreseen and does not see the need to insert such clause in the rules.

- Febeliec is in favor of an Payback exemption for DSM whereas Centrica would still like to discuss it. FEBEG considers that such exemption could be considered if a retroactive application of the updated indexation mechanism is foreseen.
  - Given the provided feedback, Elia would still like to propose such exemption for DSM (see next slides).

Overview of feedback received during the Public Consultation on CRM Functioning Rules on retroactivity

- FEBEG & Zandvliet Power are in favor of a retroactive application of the update fo the indexation mechanism for existing contracts.

- Centrica is against a retroactive application of the updated Payback Obligation principles proposed by Elia.

- Febeliec is globally against a retroactive application of the updated Payback Obligation principles proposed by Elia but understands that it might be problematic for some existing contracts.
  - As an alternative, Febeliec proposes that a neutral party (e.g. CREG) assesses on an ad hoc basis whether the payback obligation 'as is' would lead to missing money issues for them.

Proposal Elia on the update of the indexation mechanism of the strike price and on the Payback exemption for DSM

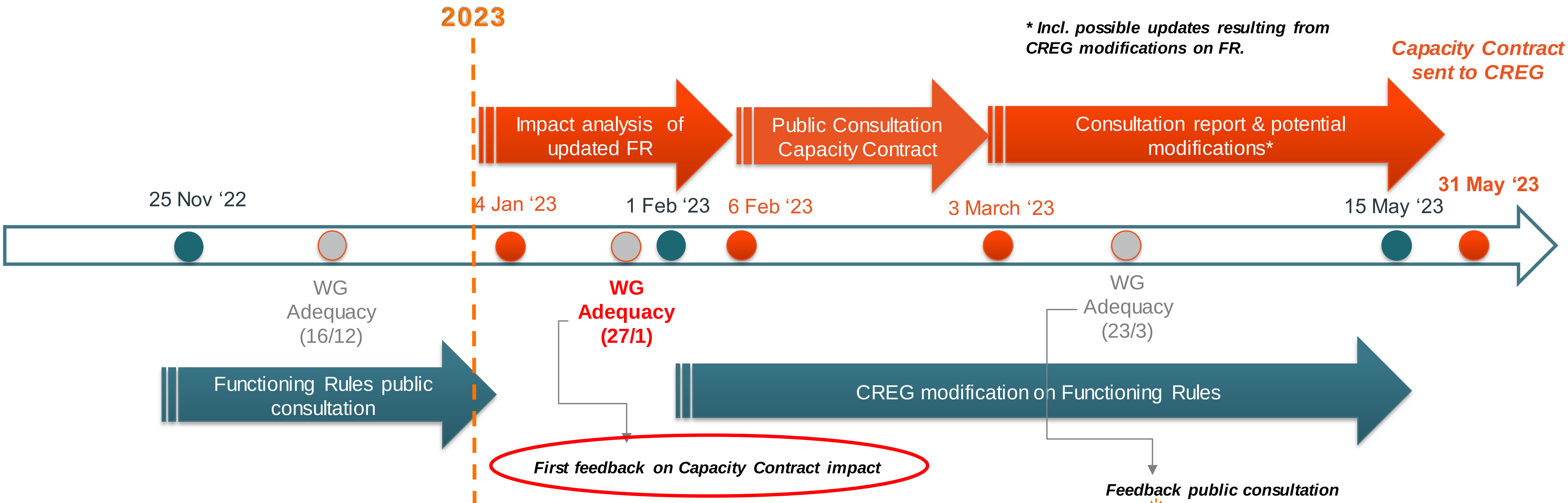
- Update of the indexation mechanism:
    - The current mechanism does not fulfill the main requirement of the Payback Obligation – capture windfall profits - (nor for past or future contracts).
    - The proposed update of the mechanism presented repeatedly in WG fulfills the requirements of the Payback Obligation :
        - ➢ **Technology neutrality** : being DA based, the strike price will follow the trend of the energy market.
        - ➢ **Proportional :** the updated mechanism still ensures the **occurrence of Payback Obligation events** and does not prevent the capture of excessive revenues.
- DSM Payback exemption:
    - The current Payback Obligation mechanism does not seem to fit sufficiently the case of DSM (working with a DMP as non-daily schedule unit) : Elia thinks that DSM does not capture excessive revenues despite of having to payback.
    - From that perspective, Elia believes that proposing a Payback exemption for DSM would be justified and proportional.
- Retroactivity: the principle of retroactivity is (and always was) foreseen in the rules (§§ 10-11), Elia does not see why a different position should be adopted with respect to a retroactive application of the latest version of the rules.
    - Considering all the elements raised above, Elia proposes to apply the above retroactively.
- Way forward : the Regulatory Framework (E-law/RD) has to be amended in order to cope with the proposed Functioning Rules changes.

Capacity Contract : expected changes

Reminder on CRM 2023 Capacity Contract timeline

Context:

- Analysis of the impact of the updated Functioning Rules V3 on the Capacity Contract for the 2023 Auction right after the public consultation on the FR (until 04/01/2023).



Scope of the public consultation on the capacity contract

- The public consultation track on the capacity contract will cover **both the LCT contract and the CRM contract.**
- A **separate LCT capacity contract and CRM capacity contract template** will be submitted to CREG.
- For the **LCT contract:**
    - The terms and conditions of the CRM capacity contract will apply to the LCT Contract.
    - Minor changes will be included to make the link with the LCT regulatory framework & LCT design.
- For the **CRM contract**, Functioning Rules V3 will only lead to minor changes (cf. next slide).
    - Most changes will apply retroactively to already signed capacity contracts as these relate to optimizations in the settlement procedure or alignment with the most recent version of the Functioning Rules, subject to confirmation by the CREG in its approval decision.

General overview of the required changes to the capacity contract

The table below presents an overview of the **main expected changes** for both the CRM capacity contract and the LCT capacity contract.

Update for CRM Capacity Contract (driven by Functioning Rules V3 & contract implementation)	Update for LCT contract
Minor changes: • Align with **updated references** in the FR V3. • Further **align between the 3 languages**.	Minor changes to make the link with the **LCT regulatory framework.**
Update settlement process to align with implementation, updated secondary market signing process & smart testing procedure (see next slide).	Include additional contractual parameter "**existing DSR**".
For MY contracts, allow a decrease of contracted capacities over the years (cf. **degradation parameter**).	Include **"switch" clause**: in case of MY contract, the LCT contract is transformed in CRM contract as of the 2nd delivery period.

- All changes to the CRM Capacity Contract automatically apply to the LCT Capacity Contract as well.
- An exhaustive overview of all changes will be included in the public consultation on the capacity contracts.

The settlement procedure is further fine-tuned in view of changes to the Functioning Rules & implementation of the operational procedures

Following main updates on the settlement procedure are proposed (non-exhaustive overview) :

- **Align with timings of contract signature for Secondary Market transactions:**
  - Align settlement process with ultimate timings for the validation of the Secondary Market transactions, leading to a recalculation of the monthly remuneration (cf. monthly settlement) at a later timing than foreseen in current version of the contract.

- **Align with implementation of the operational procedures**
  - Include reference to CRM IT Interface where relevant.
  - Further streamline the operational procedures (e.g. align deadlines, etc.)

- **Availability monitoring - smart testing**:
  - Elia is currently working on the details of the smart testing procedure with the aim to focus the availability monitoring and testing on moments that were most relevant for security of supply (cf. request market parties).
  - These moments might be identified only after the deadline for the delivery report related to a certain month M (deadline is 15/M+2).
  - Elia would like to foresee the possibility in the contract that AMT moments can be selected and settled after the standard settlement process related to month M.

All changes to the CRM Capacity Contract automatically apply to the LCT Capacity Contract as well.

CO2 threshold

What has to be achieved in S1 2023?

LCT:

- The adaptation of the E-Law is ongoing (Council of State)
- Discussions with E.C are ongoing
- Timing: Decision/approval in June 2023

CCMD:

- The adaptation of the E-Law is ongoing (consultation with the Regions)
- Timing: June 2023

What has to be achieved in S1 2023?

CRM – Evolution of the design:

- Based on feedback from market parties
- Work in progress with CdS:
  - ✓Payback obligation (Indexation, DSR Exemption, Retroactivity)
  - ✓IPC Derogation
  - ✓Investment Files
- Timing: Q1 2023

CRM – CO_2 trajectories

- Additional analyses by Compass Lexecon
- Timing: Auction Y-4, DP 2028-2029

Update hurdle rate methodology

Foresighting the economic viability of investments in electricity capacity

Kris Boudt

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Ghent University, Vrije Universiteit Brussel/Amsterdam

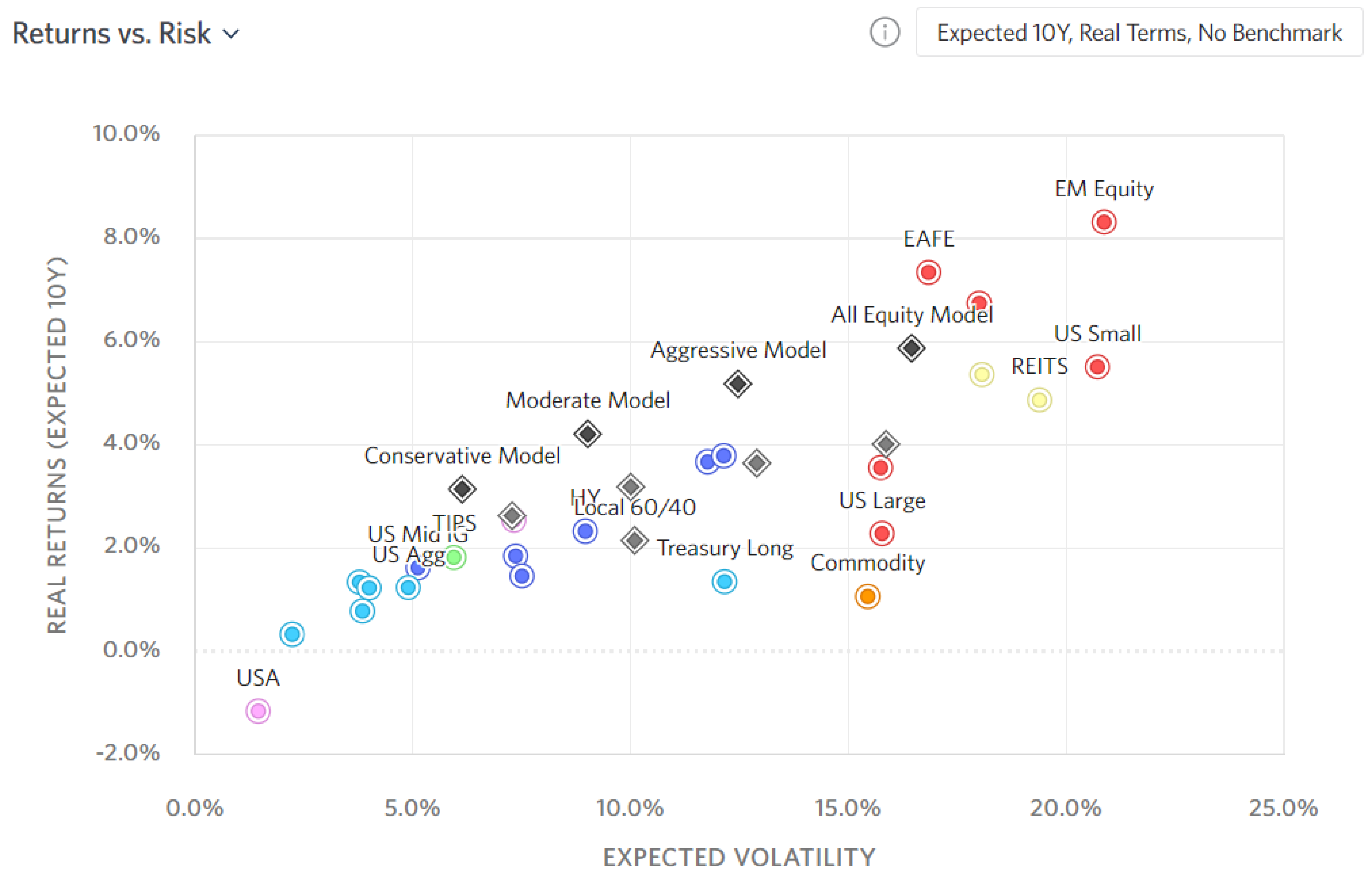
This version: 27/01/2023

Introduction

- The foresight we are seeking: How much and which electricity capacity can we expect to be available in the coming 10 years?

- This requires a systematic approach to predict future actions by investors who evaluate the investment considering that:
  - The return on their investment is unknown: Risk that the return deviates from the expected return in a non-normal way
  - Investors have risk aversion
  - As for any investment: the expected return needs to be high enough to compensate for the risk

Risk-return trade-off for listed equity investments



https://interactive.researchaffiliates.com/asset-allocation

Application to capacity investment decisions

- Very specific risk factors. The approach to determine the expected return and risk is simulation-based

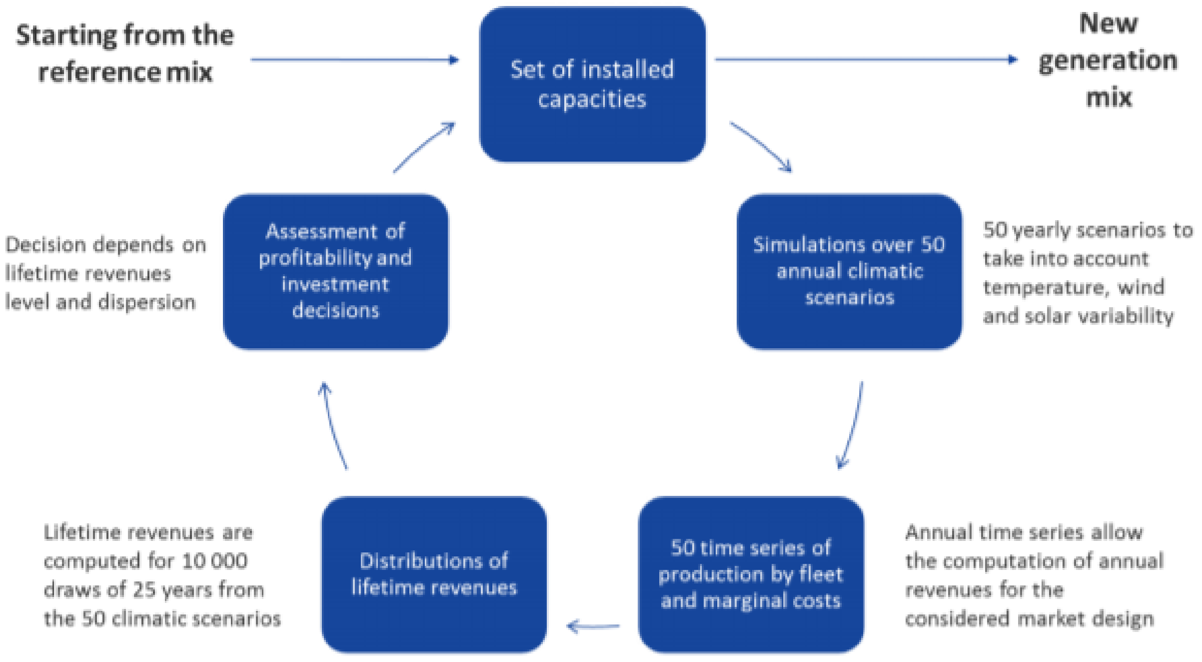


Figure 14: Generation mix adjustment with regard to investors' behavior

Artelys | OPTIMIZATION SOLUTIONS

France-Germany Study

Energy transition and capacity mechanisms

Application to capacity investment decisions

ACER Decision on the Methodology for calculating the value of lost load, the cost of new entry, and the reliability standard: Annex I

Methodology for calculating the value of lost load, the cost of new entry and the reliability standard

in accordance with Article 23(6) of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity

2 October 2020

Article 14. WACC

1. The entity calculating CONE shall determine the WACC to use to calculate the EAC of the reference technologies, according to Article 15.

2. The WACC calculated by the entity calculating CONE should be applicable in its territory for a rational private investor investing in the reference technology. It shall represent the minimum rate of return required by fund providers (shareholders and/or creditors) to finance investment in the reference technology in the considered geographic area and shall be based on transparent market data.

3. Where relevant and upon availability of robust data, the entity calculating CONE shall calculate a different WACC for each reference technology (or specific group of reference technologies) in order to account for differences in risks (taking into account hedging opportunities expected to be available).

→ Determine the "minimum rate of return required by investors for each technology" : by definition you then know whether an investment will take place. This is also called **the hurdle rate approach**.

Hurdle rate approach

- As implicit in ACER: Investment happens when expected return exceeds the hurdle rate

- Remainder of the presentation
  - How to compute returns under the simulation-based approach
  - Calibration of the hurdle rate
    - Accounting for within-scenario uncertainty: (non-normal) variability in returns
    - Accounting for across-scenario uncertainty: model risk and policy risk
    - Accounting for heterogeneity across technologies (capex, FOM, lifetime, position in the merit order, etc.)

Calculation of investment returns

Input: Distribution of inframarginal rents

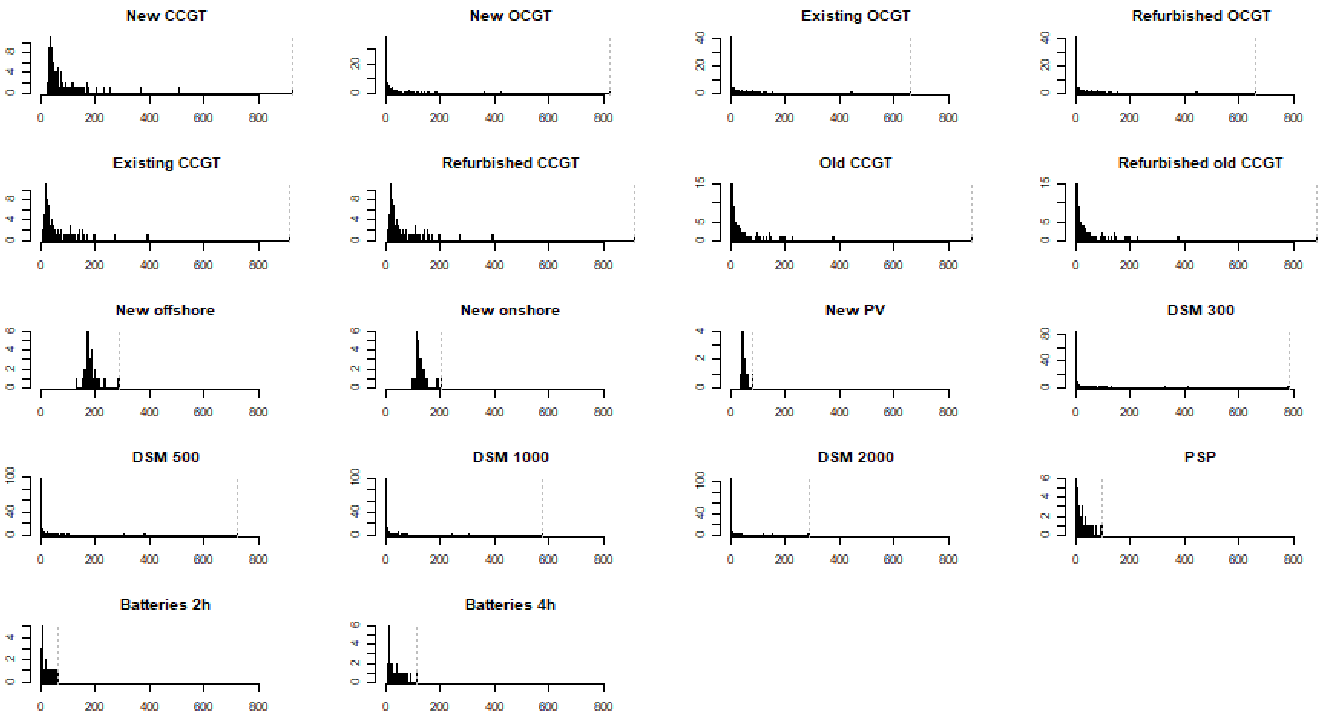
	tech-scenario-1	tech-scenario-2	tech-scenario-3	tech-scenario-4	tech-scenario-5	tech-scenario-6	tech-scenario-7	tech-scenario-8	tech-scenario-9	tech-scenario-10	tech-scenario-11
year_1	48.77	9.79	10.26	10.26	32.63	32.63	20.61	20.61	27.19	186.30	129.34
year_2	37.11	0.20	0.10	0.10	22.13	22.13	5.84	5.84	17.51	134.18	96.13
year_3	38.28	5.86	4.65	4.65	21.74	21.74	12.44	12.44	15.23	183.27	126.02
year_4	76.21	30.56	24.87	24.87	64.46	64.46	47.43	47.43	35.64	183.85	127.86
year_5	33.34	1.21	0.96	0.96	18.76	18.76	5.60	5.60	14.58	185.57	129.11
year_6	59.16	12.67	9.53	9.53	42.84	42.84	23.64	23.64	35.77	183.80	126.79
year_7	51.51	4.80	2.91	2.91	33.95	33.95	18.73	18.73	24.25	185.03	131.04
year_8	91.87	50.54	48.61	48.61	75.55	75.55	56.79	56.79	42.74	182.95	134.53
year_9	34.35	3.99	0.65	0.65	20.86	20.86	7.51	7.51	18.02	179.29	126.85

Showing 1 to 9 of 199 entries, 108 total columns

Per scenario, per technology: 199 annual values of inframarginal rents, each of them is as likely

Various scenarios: One is taken as the reference scenario. The others are used in a sensitivity analysis (What if…)

Input: Distribution of inframarginal rents + cost assumptions



	CAPEX	FOM	lifeTime
New CCGT_SCENARIO1	600	25	20
New OCGT_SCENARIO1	400	20	20
Existing OCGT_SCENARIO1	0	20	3
Refurbished OCGT_SCENARIO1	80	40	15
Existing CCGT_SCENARIO1	0	30	3
Refurbished CCGT_SCENARIO1	100	30	15
Old CCGT_SCENARIO1	0	30	3
Refurbished old CCGT_SCENARIO1	100	30	15
Coal CCS_SCENARIO1	3300	70	20
New offshore_SCENARIO1	2300	80	15
New onshore_SCENARIO1	1000	50	15
New PV_SCENARIO1	600	25	15
DSM300 4h_SCENARIO1	0	50	3
DSM 300_SCENARIO1	0	50	3
DSM 500_SCENARIO1	0	50	3
DSM 1000_SCENARIO1	0	50	3
DSM 2000_SCENARIO1	0	50	3
PSP_SCENARIO1	900	30	25
Batteries 2h_SCENARIO1	400	15	15
Batteries 4h_SCENARIO1	750	15	15

This means a significant variability: large spread between lowest and highest, even within one scenario.
One should look at this in relative terms! Compare it with the costs (capex, FOM, lifetime) → Return analysis

Simulation

- At time 0 the initial investment is made such that it covers all (current and future) predetermined costs. This is a negative cash flow.
- Each year there is a draw from the inframarginal rent distribution. Cashflows from one simulated lifetime path:

```
> cf
 [1] -964.52017   38.52602   18.49963   20.88086   44.26119  245.50346   18.49963   74.94790
 [9]   20.88086   16.68237   21.68922   37.69616   32.99484   32.99484   74.94790   74.94790
[17]   28.47951   15.95761  376.21678   33.02961   36.37327
> irr(cf)
[1] 0.02396121
```

The internal rate of return on investment equals then the discount rate for which the net present value of the project is zero

- This is only one out of the many possible cashflow streams and thus returns.

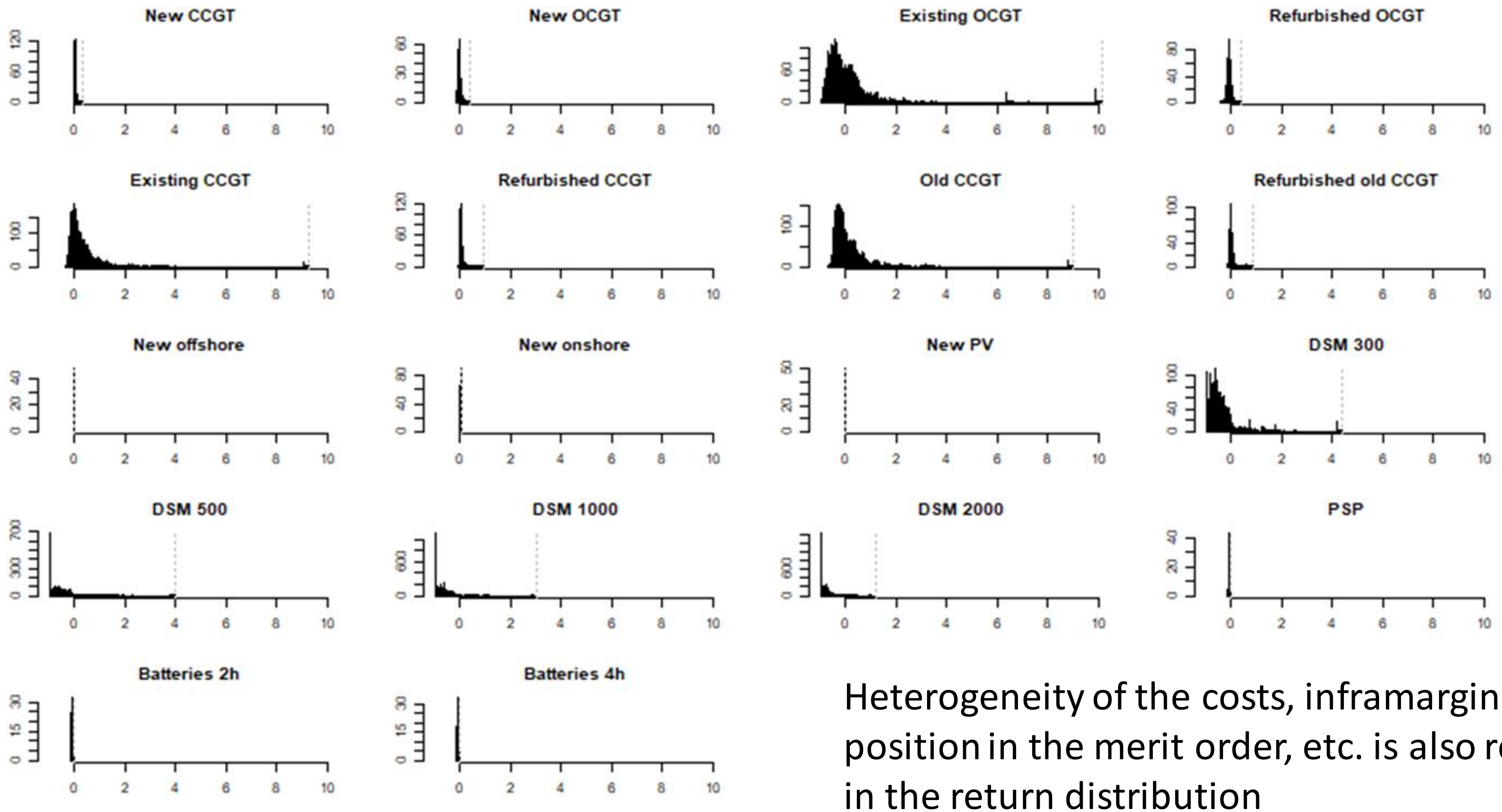
Simulating returns

```
> cf
 [1] -964.520170   28.479505   22.628814    9.207786   22.127214   22.127214  245.503458
 [8]   20.928579   44.261192   21.473876   37.696158   20.880856   15.957609   16.885917
[15]   27.088762   33.781777  245.503458   33.029612   37.696158   33.029612   20.928579
> irr(cf)
[1] -0.0004992439


> cf
 [1] -964.520170   20.880856   22.628814   20.880856    9.207786  376.216779   16.838954
 [8]   16.682368   20.928579   21.689215   15.957609   18.100224   10.795694   21.689215
[15]   21.473876   33.781777   20.400115   17.908569   38.526023   16.838954   44.261192
> irr(cf)
[1] -0.02268799

> cf
 [1] -964.520170   21.323410   20.182304   20.880856   21.689215   28.479505   28.479505
 [8]   10.795694    9.838166   20.182304   22.127214   21.689215   22.127214   18.499628
[15]   16.885917   16.682368   28.479505   21.689215   44.261192   16.838954   20.880856
> irr(cf)
[1] -0.06494057
```

Output: Distribution of a large number of simulated returns: $R_1, R_2, \ldots, R_N$ (N=10'000)



Heterogeneity of the costs, inframarginal rents, position in the merit order, etc. is also reflected in the return distribution

Calculation of expected return and risk

- We can then directly compute the expected return as the average return across these N simulations:

$$\mu = \frac{1}{N}\sum_{i=1}^{N} R_i$$

- Similarly we can compute risk statistics such as probability of negative returns and the standard deviation

$$P(R < 0) = \frac{1}{N}\sum_{i=1}^{N} I[R_i < 0]$$

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N} (R_i - \mu)^2}$$

Expected return and risk under the base scenario

	mean	sd	P(R<0)
New CCGT	0.02	0.03	0.30
New OCGT	-0.04	0.05	0.83
Existing OCGT	-0.01	1.05	0.64
Refurbished OCGT	-0.10	0.07	0.90
Existing CCGT	0.30	0.82	0.35
Refurbished CCGT	0.04	0.08	0.28
Old CCGT	0.06	0.83	0.62
Refurbished old CCGT	-0.01	0.08	0.69
New offshore	-0.03	0.00	1.00
New onshore	0.01	0.00	0.01
New PV	-0.04	0.00	1.00
DSM 300	-0.46	0.53	0.93
DSM 500	-0.52	0.50	0.95
DSM 1000	-0.59	0.43	0.95
DSM 2000	-0.72	0.28	0.97
PSP	-0.10	0.01	1.00
Batteries 2h	-0.12	0.02	1.00
Batteries 4h	-0.11	0.02	1.00

- Heterogeneity of the costs, inframarginal rents, position in the merit order, etc. is also reflected in the return distribution
- Very different expected return and risk across technologies

Investors also take the possibility of alternative scenarios into account

Table 8 Impact of change from base scenario to a scenario of adequacy

	base E[R]	Adeq	base P(R<0)	Adeq
New CCGT	0.02	-0.02	0.30	0.78
New OCGT	-0.04	-0.09	0.83	0.95
Existing OCGT	-0.01	-0.27	0.64	0.82
Refurbished OCGT	-0.10	-0.15	0.90	0.97
Existing CCGT	0.30	0.02	0.35	0.65
Refurbished CCGT	0.04	-0.02	0.28	0.78
Old CCGT	0.06	-0.18	0.62	0.83
Refurbished old CCGT	-0.01	-0.07	0.69	0.87
New offshore	-0.03	-0.04	1.00	1.00
New onshore	0.01	0.00	0.01	0.27
New PV	-0.04	-0.05	1.00	1.00
DSM 300	-0.46	-0.59	0.93	0.95
DSM 500	-0.52	-0.65	0.95	0.96
DSM 1000	-0.59	-0.69	0.95	0.96
DSM 2000	-0.72	-0.79	0.97	0.98
PSP	-0.10	-0.11	1.00	1.00
Batteries 2h	-0.12	-0.14	1.00	1.00
Batteries 4h	-0.11	-0.13	1.00	1.00

- Change in scenario leads to different expected return and risk
- Change in scenario is possible because of model risk and policy risk
- When change in scenario has adverse effect on expected return and risk, this increases the perceived investment risk and thus increases the minimum required return of investors (i.e., the hurdle rate)

Calibration of hurdle rate

Determinants of the hurdle rate

- We start from the hurdle rate for a reference utilities and energy firms.
- Real, pre-tax as in ACER
- An important driver are the macro-economic conditions:
  - Interest rates on risk-free investment
  - Equity market premium
  - Expected inflation
  - Tax rates
- They are linked as they express the opportunity cost for an investor.

1. The following paragraphs set out non-binding guidelines to calculate a WACC value. The proposed methodology calculates the real WACC based on the following formula:

$$WACC = \frac{1 + \left[CoE \cdot \frac{1-g}{1-t} + CoD \cdot g\right]}{1+i} - 1$$

where:

- CoE represents the cost of equity, as defined in paragraph (2);
- CoD represents the cost of debt, as defined in paragraph (7);
- g represents the gearing, as defined in paragraph (9);
- t corresponds to tax rate, as defined in paragraph (10);
- i represents the long-term inflation rate of the Euro zone.

2. The cost of equity can be expressed as:

$$CoE = r_f + \beta \cdot ERP + CRP$$

where:

- r_f represents the nominal risk-free rate, as defined in paragraph (3);
- ERP corresponds to the equity risk premium, as defined in paragraph (4);
- β is the equity beta, as defined in paragraph (5);
- CRP corresponds to the country risk premium, as defined in paragraph (6).

Source: ACER Decision on the Methodology for calculating the value of lost load, cone, and reliability standard.

General WACC for utilities and energy firms

	Values used in the public consultation	Values used in the update of the report
rf	1,4%	2,1%
ERM	6,01%	5,94%
CRP	~ 0	
beta	0,83	
CoE	6,69%	7,10%
CoD	5%	
g	44%	
Tax rate	25%	
Nominal WACC	7,197%	7,502%
Expected Inflation	2,2%	2,7%
Real WACC	4,89%	4,68%

- Change in macro-economic conditions changes the opportunity costs (investors can invest elsewhere at different conditions) leading to different WACC values

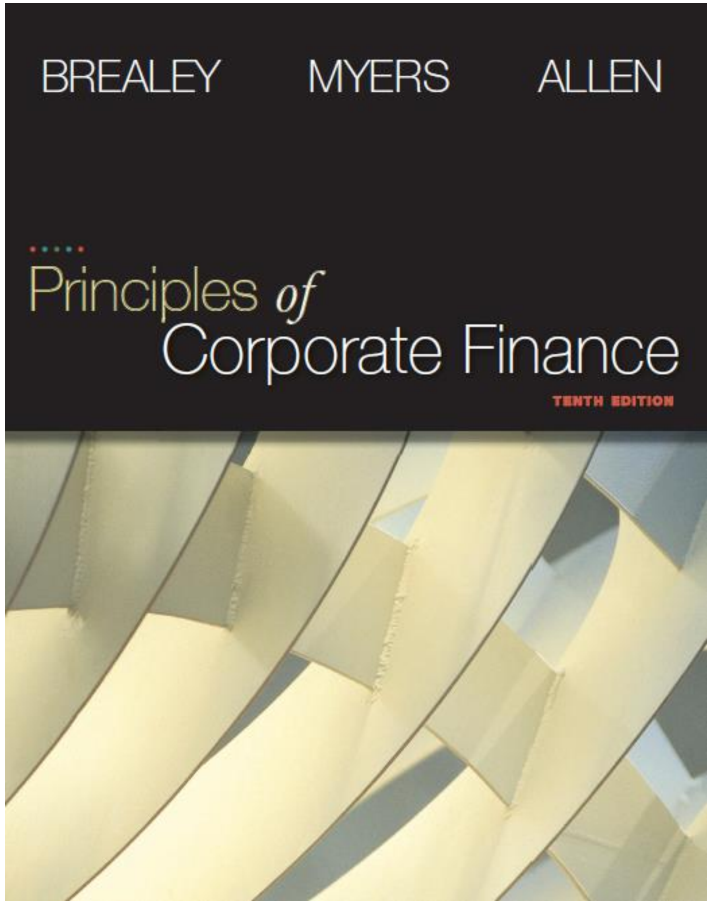
For all investments in electricity capacity (>3 years, EOM) we need to add a premium

Perfect Pitch and the Cost of Capital

The true cost of capital depends on project risk, not on the company undertaking the project. So why is so much time spent estimating the company cost of capital?

There are two reasons. First, many (maybe most) projects can be treated as average risk, that is, neither more nor less risky than the average of the company's other assets. For these projects the company cost of capital is the right discount rate. Second, the company cost of capital is a useful starting point for setting discount rates for unusually risky or safe projects. It is easier to add to, or subtract from, the company cost of capital than to estimate each project's cost of capital from scratch.

There is a good musical analogy here. Most of us, lacking perfect pitch, need a well-defined reference point, like middle C, before we can sing on key. But anyone who can carry a tune gets *relative* pitches right. Businesspeople have good intuition about *relative* risks, at least in industries they are used to, but not about absolute risk or required rates of return. Therefore, they set a companywide cost of capital as a benchmark. This is not the right discount rate for everything the company does, but adjustments can be made for more or less risky ventures.



➔ Hurdle rate = Reference hurdle rate + Project-related adjustments

For all investments in electricity capacity (>3 years, EOM) we need to add a premium

Chapter 4

Investor-Specific Cost of Capital and Renewable Energy Investment Decisions*

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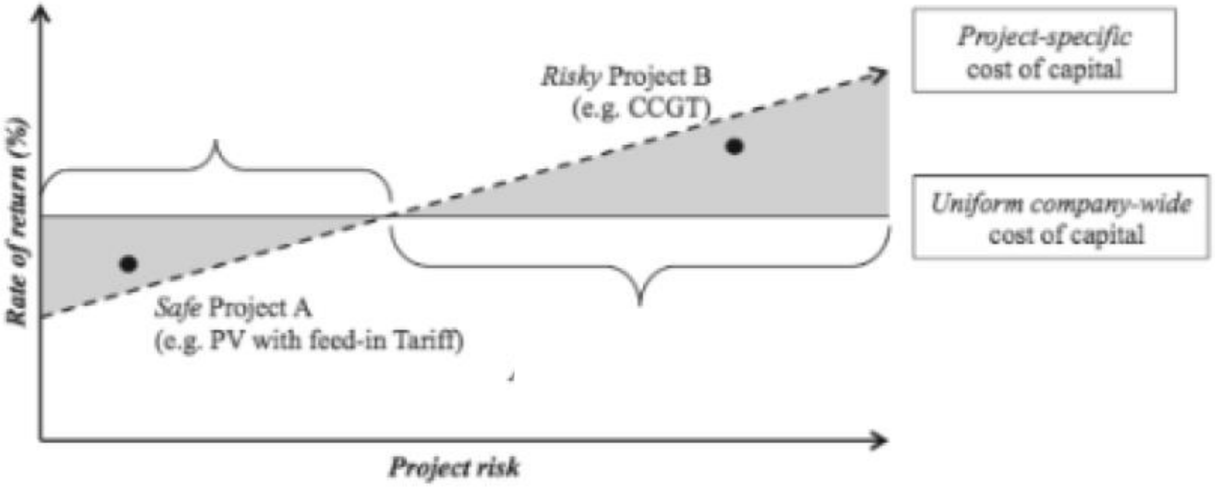

Fig. 4.6: Investment errors through the application of a uniform company-wide cost of capital.

Source: Adapted from Titman and Martin, 2008.

If we ignore the premium, we would be over-predicting investments in risky projects: Actual risk and hurdle rate of risky project being much higher than average company risk.

For all investments in electricity capacity (>3 years, EOM) we need to add a premium

Table 4.1: Cost of capital assumptions for different investor groups.

	Cost of Capital Level	Rationale
Utilities	High single digit to double digit range	• Previous activities in high risk/high return fossil generation result in medium to high WACCs. • Access to high return investments, high opportunity cost of capital.

sector. Eurelectric (2013) estimated an average WACC of 8.2% for leading European utility companies in 2012; Fig. 4.4 illustrates their WACC and "return on capital employed" (ROCE),[7] showing that WACCs in recent years hovered around 8%. Hence, the *real* investor-specific cost of capital remained in the upper single digit area. If we consider an additional hurdle premium of 5% or more on the WACC, as is common in many industries, renewables such as PV with moderate IRRs will struggle to meet such valuation hurdles.

Premium (nominal) of at least 5% for projects investing in capacity for the energy only market, > 3 years

In real terms, using an expected inflation of 2.2%, this leads to 2,74% as premium.

Hurdle rate formula for a specific technology

- Hurdle rates of a project ≠ hurdle rates of a company
- The difference between is called the hurdle premium

Company hurdle rate (WACC*)

Project hurdle rate

Hurdle rate of a technology = WACC* + hurdle premium of a technology

Calibration of hurdle rate premium

- Project premium
  - [Minimum of 2,74%] due to specific nature of the investment in capacity in EOM with lifetime of at least 3 years (for all technologies)
  - Project characteristics: lifetime, gearing ratio, possibility for hedging (reduces the premium), merit order, alignment with policy objectives
  - Variability of returns in the reference scenario (related to costs, lifetime, merit order, (in)adequate, price limit, non-normality…)
  - Sensitivity to alternative scenarios (what if…: model and policy risk: not all increases, also decreases - hedging opportunities)

Table 16 Summary statistics of investments studied

	E[R] base	hurdle
New offshore	-0.033	0.076
New onshore	0.006	0.076
New PV	-0.043	0.076
Existing CCGT	0.298	0.084
Old CCGT	0.060	0.084
PSP	-0.098	0.084
Batteries 2h	-0.120	0.084
Batteries 4h	-0.108	0.084
Existing OCGT	-0.007	0.089
DSM 300	-0.460	0.089
DSM 500	-0.522	0.091
Refurbished CCGT	0.035	0.094
Refurbished old CCGT	-0.013	0.094
DSM 1000	-0.592	0.096
DSM 2000	-0.718	0.096
New CCGT	0.017	0.099
Refurbished OCGT	-0.095	0.104
New OCGT	-0.045	0.114

Investment decision: Expected return under the base scenario higher than the hurdle rate?

Note: Columns correspond to (i) technology, (ii) expected return under base scenario, (iii) lifetime of the investment (in years), (iv) capex (€/kW/y) (v) probability of zero inframarginal rents in a year, (vi) standard deviation of the return, (vii) expected return when returns are capped at 25%, (viii) expected return when lifetime is reduced to 10 years, (ix) expected return under adequacy scenario, (x) expected return when 25% higher FOM, (xi) proposed hurdle premium, (xii) proposed hurdle rate. * For DSM the CAPEX was taken as annualized and included in the FOM (50 €/kW/y).

Table 16 Summary statistics of investments studied

	E[R] base	lifetime	capex	P(IR=0)	sd	hurdle
New offshore	-0.033	15	2300	0.000	0.003	0.076
New onshore	0.006	15	1000	0.000	0.003	0.076
New PV	-0.043	15	600	0.000	0.003	0.076
Existing CCGT	0.298	3	0	0.000	0.819	0.084
Old CCGT	0.060	3	0	0.000	0.829	0.084
PSP	-0.098	25	900	0.000	0.013	0.084
Batteries 2h	-0.120	15	400	0.000	0.020	0.084
Batteries 4h	-0.108	15	750	0.000	0.018	0.084
Existing OCGT	-0.007	3	0	0.040	1.046	0.089
DSM 300	-0.460	3	0	0.166	0.529	0.089
DSM 500	-0.522	3	0	0.377	0.503	0.091
Refurbished CCGT	0.035	15	100	0.000	0.076	0.094
Refurbished old CCGT	-0.013	15	100	0.000	0.081	0.094
DSM 1000	-0.592	3	0	0.482	0.428	0.096
DSM 2000	-0.718	3	0	0.523	0.275	0.096
New CCGT	0.017	20	600	0.000	0.029	0.099
Refurbished OCGT	-0.095	15	80	0.040	0.068	0.104
New OCGT	-0.045	20	400	0.020	0.052	0.114

Heterogeneity in lifetime, capex, risk under the base scenario

Note: Columns correspond to (i) technology, (ii) expected return under base scenario, (iii) lifetime of the investment (in years), (iv) capex (€/kW/y) (v) probability of zero inframarginal rents in a year, (vi) standard deviation of the return, (vii) expected return when returns are capped at 25%, (viii) expected return when lifetime is reduced to 10 years, (ix) expected return under adequacy scenario, (x) expected return when 25% higher FOM, (xi) proposed hurdle premium, (xii) proposed hurdle rate. * For DSM the CAPEX was taken as annualized and included in the FOM (50 €/kW/y).

Table 16 Summary statistics of investments studied

	E[R] base	E[R] 25%	E[R] 10yr	E[R] adeq	E[R] FOM	premium	hurdle
New offshore	-0.033	-0.033	-0.068	-0.036	-0.042	0.027	0.076
New onshore	0.006	0.006	-0.026	0.002	-0.007	0.027	0.076
New PV	-0.043	-0.043	-0.073	-0.046	-0.053	0.027	0.076
Existing CCGT	0.298	0.083	0.298	0.024	0.142	0.035	0.084
Old CCGT	0.060	-0.096	0.060	-0.184	-0.064	0.035	0.084
PSP	-0.098	-0.098	-0.109	-0.114	-0.104	0.035	0.084
Batteries 2h	-0.120	-0.120	-0.131	-0.144	-0.128	0.035	0.084
Batteries 4h	-0.108	-0.108	-0.144	-0.128	-0.113	0.035	0.084
Existing OCGT	-0.007	-0.202	-0.007	-0.274	-0.130	0.040	0.089
DSM 300	-0.460	-0.508	-0.460	-0.594	-0.519	0.040	0.089
DSM 500	-0.522	-0.563	-0.522	-0.646	-0.574	0.043	0.091
Refurbished CCGT	0.035	0.031	0.022	-0.023	0.008	0.045	0.094
Refurbished old CCGT	-0.013	-0.016	-0.015	-0.070	-0.037	0.045	0.094
DSM 1000	-0.592	-0.619	-0.592	-0.691	-0.635	0.048	0.096
DSM 2000	-0.718	-0.723	-0.718	-0.790	-0.746	0.048	0.096
New CCGT	0.017	0.016	-0.029	-0.018	0.005	0.050	0.099
Refurbished OCGT	-0.095	-0.095	-0.060	-0.149	-0.115	0.055	0.104
New OCGT	-0.045	-0.045	-0.070	-0.089	-0.056	0.065	0.114

Heterogeneity in terms of sensitivity of expected returns to alternative scenarios

Note: Columns correspond to (i) technology, (ii) expected return under base scenario, (iii) lifetime of the investment (in years), (iv) capex (€/kW/y) (v) probability of zero inframarginal rents in a year, (vi) standard deviation of the return, (vii) expected return when returns are capped at 25%, (viii) expected return when lifetime is reduced to 10 years, (ix) expected return under adequacy scenario, (x) expected return when 25% higher FOM, (xi) proposed hurdle premium, (xii) proposed hurdle rate. * For DSM the CAPEX was taken as annualized and included in the FOM (50 €/kW/y).

Conclusion

- We developed a solution to the need of a calibration for an investment rule that adjusts to changing market conditions (both macro and energy market) and takes heterogeneity across technologies into account
- Transparent: Economic viability when E[R] >= hurdle rate
- Base scenario allows to compute the E[R]. Combination of base and alternative scenarios allows to rank the different technologies and obtain corresponding hurdle premiums
- The update of this year confirms the systematic nature of the analysis
  - Rules have not changed
  - Distribution of inframarginal rents, costs, macro-economic conditions, etc. have changes as the world has changed, hence different hurdle rates
- Scalability of systematic approach. Possibility to include CRM in the system.

Next meetings

Foreseen timeslots for next meetings

- Friday 17th February 2023 **am**
- NEW Thursday 23th March 2023 **am**
- NEW Friday 14th April 2023 **am**
- NEW Tuesday 23th May 2023 **am**
- NEW Friday 16th June 2023 **am**

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Thank you !