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Laka digitizes books and magazines from the international movement against nuclear power.

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Laka plays with, amongst others things, its information services, an important role in the Dutch anti-nuclear movement.

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strategy&

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ECN/NRG business case assessment

&

Final report

Amsterdam, 14th July 2016

pwc

Transmittal / Cover letter

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Ministerie van Economische Zaken
For attention of [redacted]
Bezuidenhoutseweg 73
2594 AC Den Haag
Netherlands

Subject: Project ECN Draft Report

Dear [redacted]

We report on ECN (the "Company") and its subsidiary undertakings (together the "Group") in accordance with our Contract dated June 27th and included in appendix. This engagement was performed in accordance with the Standard on Transaction Consulting services, COS 5500N issued by the Dutch professional Institute NBA.
This report has been prepared for the purpose of evaluating ECN's financial situation and viability through a business case analysis and assessment, evaluation of viability of units and assessment of scenarios.

This is a draft report which is the basis for our final discussion with the Ministry and ECN on 13th July. Any amendments resulting from this discussion will need to be reflected. The comments in this draft report are subject to amendment or withdrawal. Our definitive findings and conclusions will be those set out in the final report.

This report is strictly private and confidential. Save as described in the Contract or as expressly agreed by us in writing, we accept no liability (including for negligence) to anyone else but you or for use of this report for any other than the stated purpose and it may not be provided to anyone else.
If you have any questions please contact me at your convenience.

Yours faithfully
PwC Strategy& (Netherlands) B.V.

[redacted]
Partner

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Our scope and process

Our scope

Limited **Extensive**

Due to the very tight timeframe and wide range of activities we had to cover, the depth of our assessment was limited. In two weeks of field work, we focused on the main business case driver across a wide range of ECN and NRG activities. In our previous assessments we focused on NRG and irradiation related activities mainly. We analysed the key differences between ECN's current and previous business cases, viability of the separate parts of ECN and NRG, and various potential future scenarios based on ECN's current business case. Validation activities focused on identifying key risks and analysing key sensitivities relying on secondary information mainly. Our last day of fieldwork was on Monday the 11th of July.

Access to management

None **Good**

In general we have had good access to management and were pro-actively aided in our understanding of the business drivers and ECN and NRG management assumptions that underpin the business case projections. That being said, due to the timeframe of the assignment, we mainly interacted with top management and had limited interactions with employees in the line organization.

Access to information

Limited **Extensive**

Overall, the information provided has given us a reasonable basis to analyse the significant drivers and issues of the business.* We mainly accessed top-level financial reports and did not evaluate detailed business cases. We conducted limited primary research and did not engage with ECN/NRG's customers to validate information. Information was supplied in an online environment. Additional requests for information were granted timely.

Clarity of information

Poor **Good**

The information provided, together with our access to management, has allowed us to gain partial insight and high-level understanding into ECN's financials. It should be noted that forecasts produced by ECN in the past have not always been accurate. It also should be noted that more detailed financials (e.g. cost and revenue per BU) are often unclear due to large numbers of complex financial internal reallocations.

Important scope comments and guidelines for use of this report

Useful information for the interpretation of our Reports is presented in Appendix 2 and 3. Definitions and meaning of PwC qualifications used throughout the report are explained in the Glossary. This is still a draft report, final comments from the client are outstanding.

** = We assume factual correctness of all information provided to us by ECN. However, ECN could not confirm that all information (including that of third parties) is free of material error or omission*

Letter of representation

ECN

Datum 14 juli 2016
Uw kenmerk –
Ons kenmerk OdF16.144

Contact
T +
[redacted]

Postbus 1, 1755 ZG Petten

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Onderwerp Bevestiging bij de conceptrapportage Project Due diligence onderzoek naar ECN

Mijne heren,

Deze bevestiging wordt u verstrekt met betrekking tot het conceptrapport "Draft report" gedateerd 12 juli 2016 ("het conceptrapport") inzake uw due diligence onderzoek naar ECN ("de onderneming"), naar ons beste weten en in stellige overtuiging, en nadat wij relevante zaken hebben besproken met de overige directeuren en functionarissen van de onderneming.

1 De aan u beschikbaar gestelde managementrapportages zijn gebaseerd op de boekhouding van de vennootschap die naar onze mening volledig en accuraat is voor de gehele periode. Wij bevestigen dat deze managementrapportages zijn opgesteld op een consistente basis in vergelijking met de gecontroleerde jaarrekening en de managementrapportages over voorafgaande boekjaren.

2 Ten aanzien van de geprognosticeerde resultaten en kasstroomoverzichten, zoals weergegeven in uw conceptrapport, voor de periode tot en met 2026 bevestigen wij dat de prognoses en projecties zijn gebaseerd op aannames die wij realistisch achten en die rekening houden met reeds aangegane investeringsverplichtingen, werkkapitaalbehoefte etc. De gebudgetteerde resultaten geven per 12 juli 2016 een redelijke inschatting van de verwachte resultaten over genoemde periode.

Hoogachtend,
[redacted]
Managing Director NRG en plv. CEO Stichting ECN

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In two weeks of field work we interviewed key stakeholders and conducted high-level financial and other analyses

Key sources of information and input

Key sources of input

[redacted]

ECN/NRG information

- ***General information ECN/NRG***: annual reports, Meerjarenverkenning ECN & NRG (projections of P&L, consolidated balance sheets and cash flows), previous business case, accountants report
- ***Business case documentation***: description of main assumptions, revenues per client and product type, models supporting current and previous [redacted]usiness case, previous Strategy& assessments, position papers
- ***Credit request documentation:*** materials presented to EZ to support additional credit request, previous credit requests and reviews
- ***External studies***: Berenschot study on future of ECN

Public information

- OECD / NEA reports (e.g. 2015 NEA annual report, 2015-2020 Mo-99 supply report)
- World Nuclear Association
- The Nuclear Threat Initiative (NTI)
- ECN / NRG / Mallinckrodt Company Websites

Documents in ECN Dataroom (1/2)

ID	File name
1	160640 Jaarstukken 2015_NL_210x297_corr.pdf
2	Bijlage 1b - Rapportage Berenschot Toekomstscenario's ECN Duurzaam.pdf
3	Bijlage 1c - Bijlagen bij Rapport Berenschot Toekomstscenario's ECN Duurzaam.pdf
4	DIR16107 - Voortgangsrapportage 1e kwartaal 2016 leningsovereenkomst ECN....pdf
5	ECN Q1 2016.pdf
6	MJV EZ 20160525.pdf
7	Presentatie EZ 20160525.pdf
8	Scenario [redacted] concept - in bewerking 20-06-2016.pptx
9	ECN_Financieel model_MJV 31052016 Going Concern versie 31052016.xlsx
10	Duinlandschap versie 0.2.pptx
11	NH0001_A4_Boekje_v4_los nw nw_Pagina_01-18.pdf
12	20160512_Mail_[redacted]_inzake_additionele_omzet_NTSI_tbv_MJVIAN.pdf
13	20160517_MJV_NRG_2016-2026_obv_JP2016_per_BU_going_excellent_versie_post_V1.xlsx
14	20160523_Omzet_ontwikkeling_MJV_5.8_posities_2016-2026_1,75_indexering_incl_EUR29M_extra_NTSI_business.xlsx
15	20160622_Uitgangspunten_MJV_inclusief_bronvermelding.docx
16	Opzet NRG audit file.docx
17	Aannames scenario 2D_HBU_aangevuld_control.xlsx
18	160420 Capex_en_Opex_van_de_Capex_scenario_2D_2.0_30DEC2014 V 5 april 2016.xlsx
19	160420 samenvatting MPL LE1 tov JP2016 incl overige info.xlsx
20	20160428_Mail_[redacted]_inzake_bevestiging_uitgangspunten_MJV_Nucleair.pdf
21	20160502_Mail_[redacted]_omzet_BK_tbv_MJV.pdf
22	20160504_Omzet_ontwikkeling_MJV_incl_vergelijk_geextrapoleerd_JP2016_5.3_posities_2016-2026_1,75_indexering.xlsx
23	20160512_Akkoordbevinding_op_MJV_door_BU_manager_R&I.pdf
24	Aannames scenario 2D_HBU_aangevuld_control.xlsx
25	Aantallen Staven def.xlsx
26	Capex_en_Opex_van_de_Capex_scenario_2D_2.0_30DEC2014 V 5 april 2016.xlsx

Documents in ECN Dataroom (2/2)

ID	File name
27	GAP RR R&I 06-04-2016.xlsx
28	MJV R&I audit file.xlsx
29	MJV_CS.xlsx
30	NRG Jaarplan 2016 261115.pdf
31	20160524_MJV_NRG_2016-2026_obv_JP2016_per_BU_going_concern_versie_post_V1.xlsx
32	MJV format 20160421 def NRG v4.pptx
33	MJV Stichting ECN RvT Definitief 20160518.pptx
34	Def RWMP projectenlijst tbv 2D update 160407.xlsx
35	20160517_DE MJV (GC v6.0).xlsx
36	20160607_DE IAN (GBP v7.0).xlsx
37	20160616_Toelichting MJV en IAN.docx
38	ECN_financieel_model 2014 25Aug2014 Scenario 2d.xlsm
39	Copy of 01C_Resultaten_2008-2024_NRG_voor_bankcase_updated_V04MAR2014.xlsm
40	Energy en Health Campus.pptx
41	Voorziening RWMP totaal.xlsx
42	Directe en gecontroleerde stopzetting nucleaire activiteiten 29-06-2016 in bewerking.pptx
43	Accountantsverslag 2015 Deloitte.PDF
44	Notitie NTSI 2D naar MJV.docx
45	Brugstaat Bedrijfsresultaat 2D MJV.xlsx
46	Notitie 2D naar MJV.docx
47	Uitsplitsing Moly pq 2014.xlsx
48	20140925_Omzet_verloop_2013-2024_incl_details_bijgewerkt_naar_scenario_2d_update_04MAR2014.xlsx
49	20160524_MJV_NRG_2016-2026_incl_vergelijk_met_Scenario_2D.xlsx
50	Omzet_BK_2015_en_I&D_2014.xlsx
51	Omzet_file_MM_24feb2014_incl_correctie_tbv_geupdate_bankcase.xlsx
52	20160706_Rondrekening Overhead ECN.xlsx

ECN is requesting EZ for additional measures and support based on a substantial downward business case projection

Context

- **In 2014, ECN/NRG faced an urgent need for financing** as a result of continued **operational issues and unplanned shutdown of the nuclear reactor**
- The **Ministry of Economic Affairs granted ECN/NRG an €82Mn loan** to ensure the **long-term continuity of ECN/NRG**
- The **investment scenario** was **more attractive than the discontinue scenario.** This conclusion was robust for key uncertainties – considering financial (e.g., [redacted] in discontinuation costs) and societal impact of discontinuation
- Recently, **ECN revised its business case** substantially downwards, projecting **€83Mn in negative liquidity by 2026** (€152Mn below the original 2014 projection of +€69Mn)
- [redacted]

2016 ECN Request

- **In this context, ECN has drawn several conclusions and is requesting a broad set of additional measures and financial support from the Ministry of Economic Affairs**
- **ECN has concluded** that it **cannot cover the costs and risks associated to the disposal of historic nuclear waste** and **requests EZ to take over the related liability and costs (€110Mn)**, and …
- [redacted]
- [redacted]

In this context, EZ has requested us to assess ECN's business case, viability of the separate parts, and different scenarios

Main project objectives

1. **ECN business case analysis and perspective** – key differences between 2014 ("2D") and 2016 update ("MJV")

2. **High level viability analysis of individual business activities** – ECN Duurzaam, NRG (excl. RWMP)

3. **High-level financial assessment of different scenarios** – incl. discontinuation, legal separation and offensive

Underlying questions

- ***Is continuing with ECN and NRG in the "as-is" state the best option?***
- ***What is the impact of discontinuing activities for the State and other stakeholders?***
- ***What is the impact and risks of separating ECN Duurzaam and NRG?***
- ***What is the impact and risks of transferring historic waste liability (RWMP)?***
- ***What is the high-level feasibility of offensive scenarios?***

ECN's downward projection can largely be justified – it is not likely that ECN can repay the loan even if upsides materialize

2D vs MJV Business Case Analysis

- **ECN's 2016 MJV business case projects a €152Mn lower liquidity vis-à-vis the 2014 2D plan, driven by:**
  - [redacted]
  - [redacted]
  - **RWMP:** costs are expected to increase by [redacted]), are tied to specific measures and the total financial exposure remains highly uncertain due to complexity and limited experience
  - **Other:** positive impact from **business case extension to** [redacted]) and **effects from lower taxes, pensions,** etc. mainly as a result from [redacted]
- [redacted]

Strategy& Analysis

- **We believe the 2016 MJV projection can largely be justified as major adjustments to the business case can be tied to specific root causes** (e.g., RWMP cost, NTSI and Mo-99 client opportunities, ECN Duurzaam)
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
- Illustrative **Strategy& case considers** selected **up/downsides** resulting in [redacted])

NRG standalone appears to be viable but sensitive to key risks – ECN Duurzaam viability requires strategic action

NRG Viability excl. RWMP

- **Considering management's MJV, NRG standalone (excl. RWMP) appears to be viable with EBIT projected to improve** [redacted]
  - [redacted]
- **Each business unit (Irradiation Chain, Consultancy & Services, Research & Innovation) is projected to contribute positively to NRG's overall result**
  - [redacted]
  - [redacted]
    - [redacted]
    - [redacted]

ECN Duurzaam Viability excl. RWMP

- ECN Duurzaam conducts research with a focus on the transition to sustainable energy and lower technology readiness level (TRL) – i.e. early stage research and not viable for direct commercialization
- The **institute is seen as leading in the field of applied sustainable energy research in the Netherlands**, is well-respected in the market and relies on revenues from subsidies and (non)commercial research projects
  - [redacted]
  - [redacted]
    - [redacted]
    - [redacted]

Continuing seems more attractive than discontinuing ECN/ NRG – separation offers limited benefits in current situation

Continue vs. Discontinue

- **Considering management's current MJV, continuation of current activities seems preferred over any discontinuation scenario – even when key uncertainties materialize**
  - In the "Continue as-is" scenario, the total costs tot the State are estimated to be €27Mn (excl. subsidies)
  - The total costs to State in the "Discontinue" scenarios range from €145Mn (Phased stop of NRG) to €274Mn (Direct stop of NRG) – ECN/NRG bankruptcy would result in €219Mn costs to the State
  - Additional costs in discontinuation scenarios are driven by lower NRG free cash flows (to cover RWMP and decommissioning costs), incremental severance costs and penalties due to early termination of contracts
  - In addition to these costs for the State, discontinuation of NRG will have substantial societal impact:
    - Short-to-medium term risk of undersupply situation for medical isotopes
    - Loss of jobs and outflow of specific expertise and knowledge
  - Furthermore, shutting down NRG before Pallas comes on-stream poses substantial risks to the Pallas business case (e.g., discontinuity in supply to NRG customers, outflow of expertise, etc.)

Separation of ECN and NRG

- **Separating ECN Duurzaam and NRG will provide benefits** in terms of governance and transparency, **but does not change business case fundamentals** (e.g., earning capacity, costs, overall risk profile, etc.)
- **Substantial one-off costs would be incurred and additional financing would be required to enable legal separation** (in total estimated at [redacted]
- **Legal separation could be required in case of changes of ECN Duurzaam's strategic direction** – e.g., a potential scenario has been identified whereby ECN Duurzaam's activities are combined with those of other institutes – **and should be made conditional on further detailing and a robust business case**

RWMP transfer could be justified but value is still not proven – offensive scenarios are early stage yet could be promising

Transfer of RWMP

- **The costs associated to the RWMP are inherently uncertain and transferring RWMP does not change business fundamentals:**
  - RWMP transfer would not reduce the risks in the total system but rather allocate it differently
  - Based on the current plan, operational benefits are limited as key activities would remain on site and executed by NRG, commercial and financial benefits may exist but are not proven
- **A transfer could be considered as it may improve access to external financing and/or enable changes to ECN/NRG's strategic direction and should be made conditional to that**
- **RWMP transfer has additional risks and financial implications that should be mitigated**
  - There is risk that transferring the liability could increase costs for the State since there is less incentive for the operator to minimize costs
  - To mitigate financial exposure of the State, RWMP transfer should be accompanied by:
    - Alignment of incentives between the State and ECN/NRG to minimize waste removal cost
    - An agreement under which ECN/NRG's profit is structurally appropriated to the RWMP (e.g., a royalty scheme, fixed annual payment, or dividend charter)
    - Alternatively, current NRG subsidies could be withheld but comes at the expense of nuclear research activities and will impact the Dutch nuclear knowledge infrastructure and Pallas

Offensive Scenarios

- **Offensive scenarios may be promising but are in a (very) early stage of development**
  - Moving up the value chain into Molybdeen processing could be a key enabler for driving full cost recovery price increases – however, involving substantial investment and risks
  - Growing into new technologies should be evaluated as a business development opportunity
  - Developing OLP as a center for applied science and business in Energy & Health is backed-up by local and regional governments – next step is to develop the plan and engage other stakeholders

Context and main conclusions

Appendix 1: Background and introduction

Appendix 2: Business case analysis

Appendix 3: Viability analysis

Appendix 4: Scenario analysis

Appendix 5: Consulting arrangements and disclaimers

ECN consists of a research center for sustainable energy and a group performing nuclear activities (NRG)

ECN activity overview

ECN Duurzame Energie
Sustainable Energy Research Center

- Program Development
- Wind Energy
- Environment & Energy Engineering
- Policy Studies
- Biomass & Energy Efficiency
- Solar Energy

- International institute conducting research on the transition to sustainable energy
- Revenues consists of direct subsidies from EZ and non-commercial and commercial research assignments

NRG (100% ECN Subsidiary)
Nuclear Research & Consultancy Group

- **Research & Innovation (R&I)**
- **Consulting & Services (C&S)**
- **Nuclear Operations (NO)**
- **Irradiation & Solutions (I&S)**

Irradiation chain (BK)

- Operator of the High Flux Reactor in Petten and provider of nuclear research and consultancy services
- Main source of revenue is irradiation, production and sale of medical and industrial isotopes
- Isotopes have a history of pricing below full-cost levels making it challenging to run business sustainably
- High fixed cost business with revenues and reactor uptime driving large uncertainties to the business case
- EZ subsidy NRG projected to remain at €7Mn until 2026, while EU subsidy is projected to fall from €6Mn to €0Mn

Radioactive Waste Management Program (RWMP)
Processing and transport of all historical nuclear waste to COVRA

- RWMP is operated by NRG and financed by ECN
- Main challenge is high uncertainty about future costs

1) Higher other income in 2016 due to the reporting of revenues from project 'Adem' on ECN income statement
Source: ECN Financial Projections, Interviews, Strategy& Analysis

ECN is projecting more negative results and is requesting EZ for additional measures and financial support

[redacted]

- In 2014, ECN/NRG was granted an €82Mn loan from the Ministry of Economic Affairs after facing urgent financing need resulting from operational issues and unplanned reactor shutdown
- [redacted]
- Recently, ECN revised its business case substantially downwards and now projects €83Mn negative liquidity by 2026 – €152Mn below original 2024 projection
- ECN concludes that it cannot cover the costs of historic nuclear waste disposal and requests EZ to take over the related liability and costs (€110Mn), and …
- [redacted]
- [redacted]

Context and main conclusions

Appendix 1: Background and introduction

Appendix 2: Business case analysis

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Appendix 4: Scenario analysis

Appendix 5: Consulting arrangements and disclaimers

We have followed a three-step approach of identifying, explaining and assessing deltas between 2D and the MJV

Process Followed

Identifying deltas

- The August 2014 2D business case approved by the ECN Supervisory Board is used as the basis for the comparison
- Using this business case, we identified the main deltas per business unit

Explaining drivers

- Subsequently, we identified the drivers for the main deltas (e.g. based on qualitative input ECN)

Assessing the business case

- Finally, we assessed whether the deltas accurately represent a changed market or internal dynamics
- Based on this assessment, we created an amended business case for a select number of deltas

ECN's 2016 revised business case projects a €152Mn lower liquidity vis-à-vis 2014 outlook – largely driven by NRG

We have identified the key drivers of the differences between the 2014 and 2016 business case

Based on these projections ECN will not be able to repay its loan – discontinuation is even less attractive

Context and main conclusions

Appendix 1: Background and introduction

Appendix 2: Business case analysis

- ***NRG***
- *ECN Duurzaam*
- *RWMP*

Appendix 3: Viability analysis

Appendix 4: Scenario analysis

Appendix 5: Consulting arrangements and disclaimers

[redacted]

Reduction in Mo-99 revenues is driven by limited volume growth Mallinckrodt and lost new business opportunity

NRG and other players are driving Full Cost Recovery pricing, although government support is still prevalent

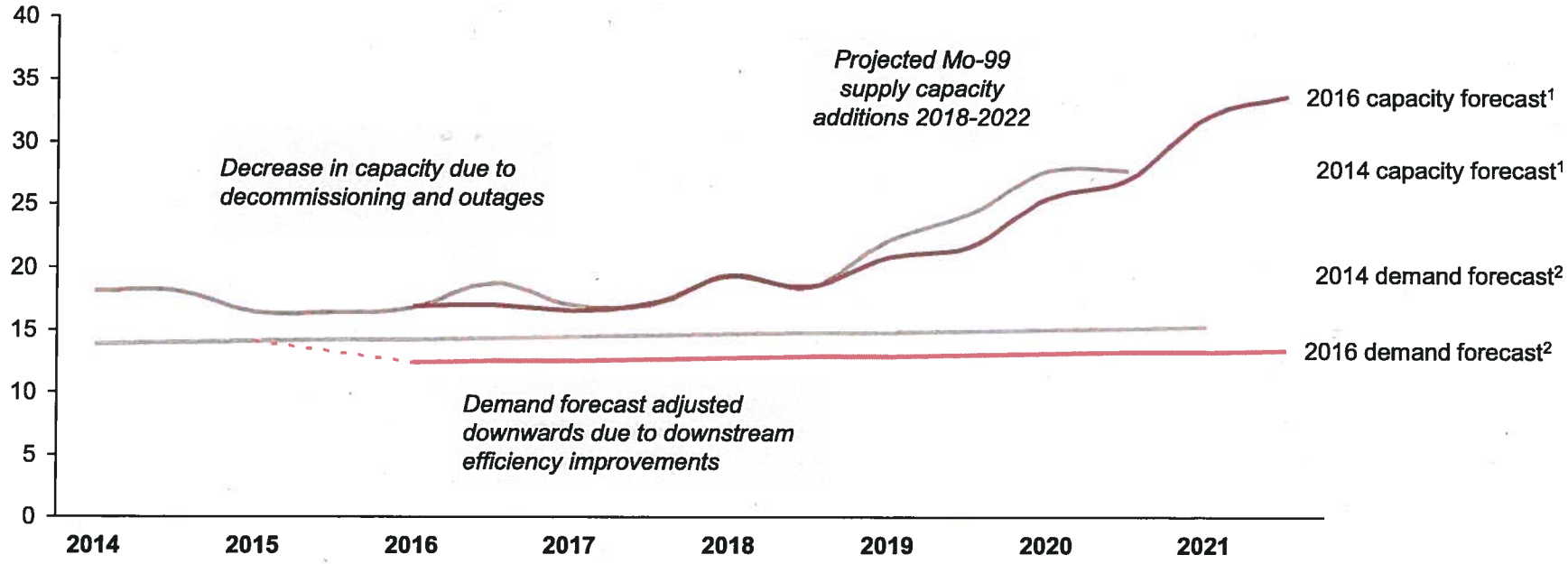
Overview of global Mo-99 irradiators in order of declining capacity

Company (country)	Reactor (capacity[1])	FCR progress[2]	Government support
NRG (Netherlands)	**HFR** (241,800)	Significant progress	• Credit extended after facing urgent financing need resulting from operational issues and unplanned reactor shutdown
SCK-CEN (Belgium)	**BR-2** (210,600)	Significant progress	• Limited support directed at waste management and refurbishment
AECL (Canada)	**NRU** (187,200)	Some progress	• Direct government support, covering all shortfalls of revenues • ***Mo-99 production terminated end-2016***
NECSA (South Africa)	**SAFARI** (130,700)	Fully applied	• None
NCBJ (Poland)	**MARIA** (95,000)	Not started	• Government funds for reactor safety and infrastructure available
ANSTO (Australia)	**OPAL** (75,250)	Fully applied	• Government fully finances construction of additional capacity • ***Capacity doubled from start-2017***
REZ (Czech Rep.)	**LVR-15** (72,500)	Some progress	• None
RIAR (Russia)	**RIAR** (50,000) **KARPOV** (16,800)	Unknown	• None
CNEA (Argentina)	**RA-3** (18,400)	Not started	• Government controlled; direct support for waste management • Capital funding directed at refurbishment and infrastructure

1) Expected available capacity per year (6-day Ci ^{99}Mo)
2) This is an NEA assessment: Irradiators were assigned an indicator that is closest to actual progress made by them, based on information they provided in the NEA self-assessment questionnaire, and as assessed against the NEA reports on the methodologies for full-cost recovery (NEA 2014)
Source: NEA 2014; NEA 2016

As was the case in 2014, price increases beyond 2018 remain challenging with contracts ending and capacity increasing

Market projections 2014 and 2016 in kCi/wk



Susceptible environment to increase price
- Increasing awareness for FCR necessity
- Tight supply-demand balance result

Potentially more challenging environment for achieving full cost recovery – although access to on-site processing remains advantage

1) Weekly capacity based on nameplate capacity and reported production days per reactor; 1 year incremental ramp-up assumed for new reactors; 1 year additional delay assumed for Conventional Research Reactor irradiation programs; 2 year additional delay assumed for all other reactors
2) Weekly demand including 35% Outage Reserve Capacity – required to ensure a reliably supply by providing back-up irradiation and/or processing capacity that can be called upon in the event of an unexpected or extended shutdown – 35% represents low estimate by NEA
Sources: NEA 2014, NEA 2016, Strategy& analysis.

Capacity additions remain uncertain as projected new capacity has been delayed (or cancelled) in the past

Projected Mo-99 supply capacity additions – excluding projects that were cancelled

Name	Location	Potential capacity[3]	Est. start (2016)[4]	Est. start (2014)[4]	Project status (December 2015)
FRM-II	Germany	67,200	2019[1]	2018[1]	• Advanced; dependent upon conversion of processors to LEU targets
MURR/ Northstar	USA	39,000/ +117,000	2018[1]/ 2019[1]	2017[1]/ 2019[1]	• Reactor capacity and irradiation facilities in place • Transition to enriched targets started in 2016
Northstar	USA	156,000	2020[2]	2020[2]	• Design finalized in 2016
MURR/ GA	USA	218,400	2021[2]	N/A	• Design complete
Korea	South Korea	17,200	2021[1]	N/A	• Construction permit in review at regulatory body
RA-10	Argentina	120,000	2021[1]	2020[1]	• Construction starts in 2016
SHINE	USA	200,000	2022[2]	2019[2]	• Construction not yet started
Jules Horowitz	France	153,600	2022[1]	2021[1]	• Under construction

1) 1 year delay added to NEA estimation for conventional research reactors
2) 2 year delay added to NEA estimation for non-conventional reactors
3) Expected available capacity per year (6-day Ci ^{99}Mo)
4) Represents estimated first year of full production, respectively as estimated in 2016 and in 2014
Source: Strategy& expert input, NEA 2016

Context and main conclusions

Appendix 1: Background and introduction

Appendix 2: Business case analysis

- *NRG*
- ***ECN Duurzaam***
- *RWMP*

Appendix 3: Viability analysis

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[redacted]

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- *NRG*
- *ECN Duurzaam*
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There are several factors driving uncertainty in the costs associated with historic waste disposal

Historic Waste Context

- NRG is dealing with 85 waste streams in total
- 35 of those streams relate to historic waste that was created since the start of the nuclear facility in 1961 (until the decision was made that waste needs to be stored elsewhere)
- This historic waste is stored on site in Petten which originally was indented to be the final destination of the waste
- The 85 waste streams have different contents which require different treatment and handling (e.g. special machines and tools to be created)
- Given the uniqueness of the content there is very limited or no information about expected cost

Impact

Solutions are tailor-made and unique

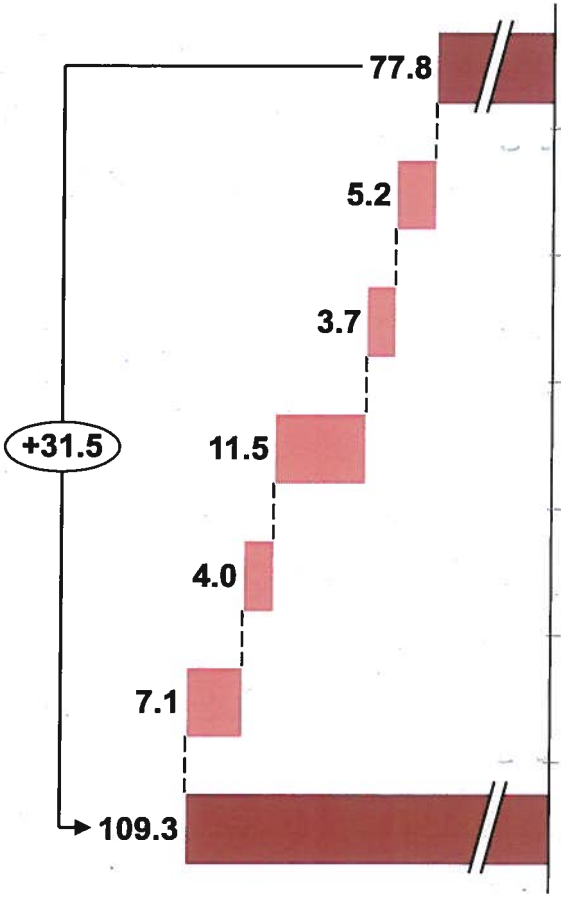
Expert opinions are often the only estimate available

Certainty around the cost is only reached after completion

Source: ECN – Project RAP kostenontwikkeling, Stand van zaken per 12 mei 2014, Specificatie voorziening RWMP, ACIE080414-01 Jaarverslag NRG - 2013 CONCEPT, ACIE080414-03 concept Jaarrekening 2013 ECN - for merge, Interviews, Strategy& Analysis

RWMP costs estimates increased by €32Mn since 2014 and remain uncertain due to complexity and lack of experience

RWMP cost estimate evolution and drivers €Mn



2014-2024 (2D)	
2013 project delay	When 2D was set up, it was not yet clear that 2013 projects had been delayed – cost shifted to 2014
RAP	Higher proportion of high radioactive content waste than estimated
RAP-alpha	More RAP-Alpha than expected, separate hot cell needed for treatment
LFR decommissioning	Costs of current decommissioning of LFR adjusted upwards
Other	More customised processes are necessary than initially anticipated, (e.g. €2.8Mn for "harsvaten")
2014-2026 (MJV)	

Note: projections do not include decommissioning, except LFR
Source: ECN Business Case August 2014, Current MJV, MJV Presentation to EZ, Strategy& analysis

Current RMWP provision of €107Mn largely consists of RAP and decommissioning costs

Breakdown of RWMP liabilities

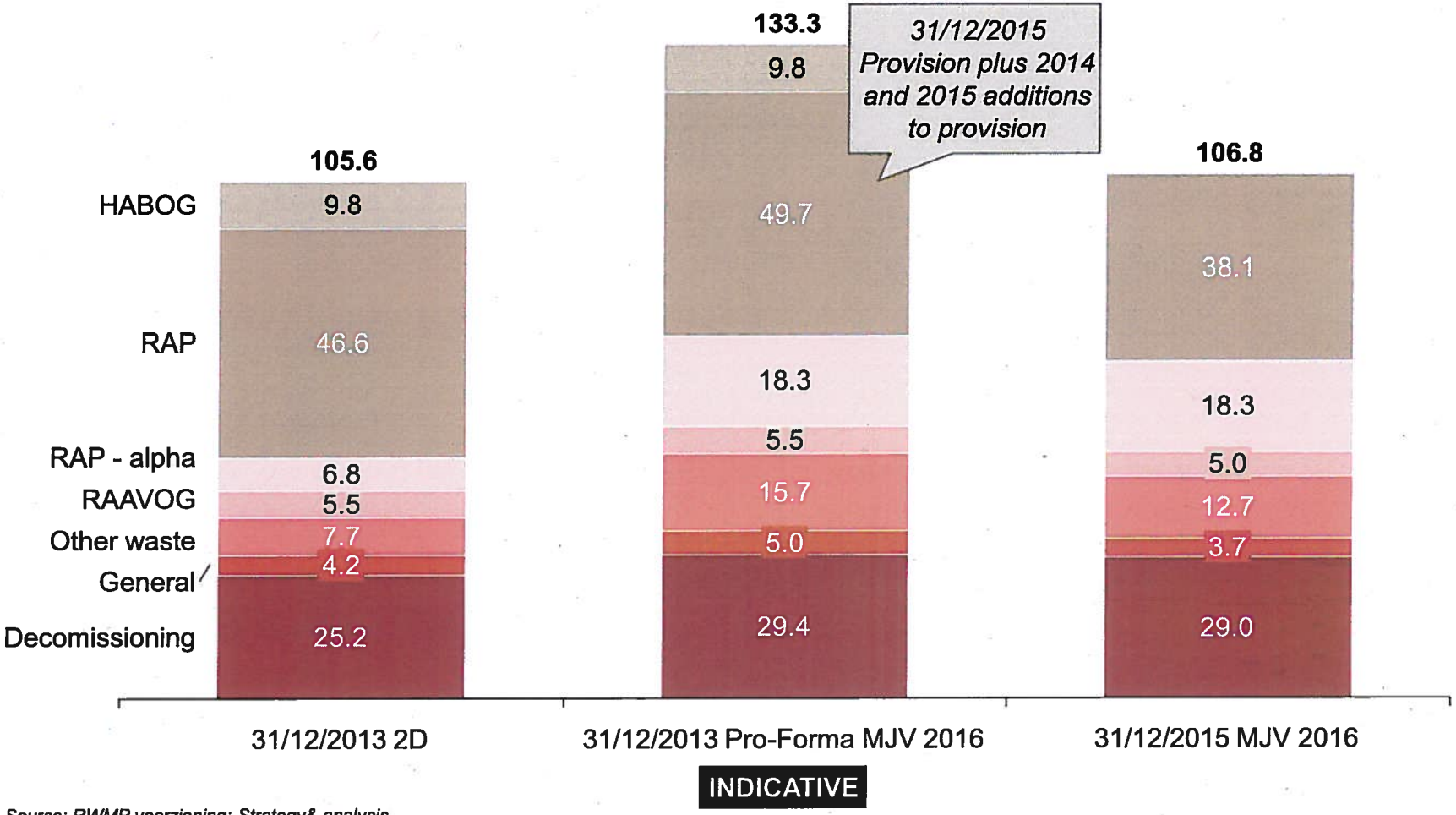
BASED ON ECN INPUT

RWMP provision in €Mn		Details and key uncertainties	Level of uncertainty
106.8			
38.1	RAP	• [redacted] barrels of historic waste to be relocated to COVRA; composition mostly unknown • Main uncertainties in – Fraction of high radioactive waste – Ability to reduce volume; storage/transportation costs; development of WTU	◑
18.3	RAP - alpha	• [redacted] barrels of waste potentially emit alpha radiation • Alpha-proof cell will be built in Decontamination and Waste Treatment Facility • Project is in very early stage, creating uncertainty about development of costs	◕
5.0	RAAVOG	• Historic waste flows to be relocated to COVRA not part of RAP	
12.7	Other waste	• Various streams of historic waste & waste associated with new production • Large uncertainty due to high degree of customization needed	●
3.7	General	• General provision with respect to historic waste	
29.0	Decomissioning	• Decommissioning of LFR ongoing, other expectations based on various reports • Main uncertainties in – Approach is not yet proven – Possibility of asbestos contamination	◕
31/12/2015			

Source: Voorziening RWMP totaal, Management Interviews, Strategy& analysis

Back-up: evolution of RWMP provision

RMWP provision development as identified end-2013 and comparison with MJV, €Mn



Source: RWMP voorziening; Strategy& analysis

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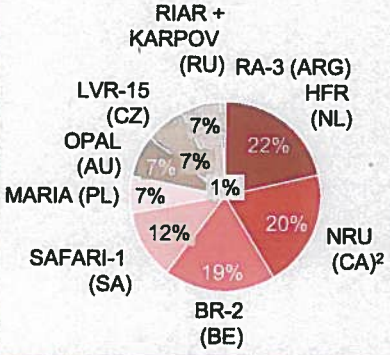
NRG is a key player in the global Mo-99 value chain with onsite access to Molybdenum Processing Facilities

Mo-99 Value Chain

Reactor
Target irradiation

6-7 days

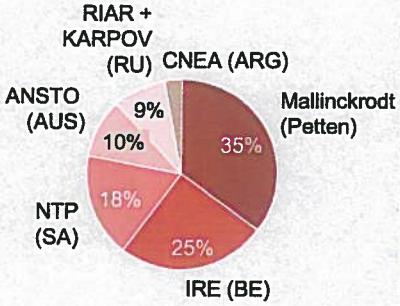
Few players[1)]



Molybdenum Processing Facility (MPF) *Mo-99 extraction and purification*

1 day

Very few players



Generator Manufacturer
Preparation of the Tc-99m generator

2 days

Several players

- Mallinckrodt
- Lantheus
- GE Healthcare
- IBA
- Fuji
- Etc.

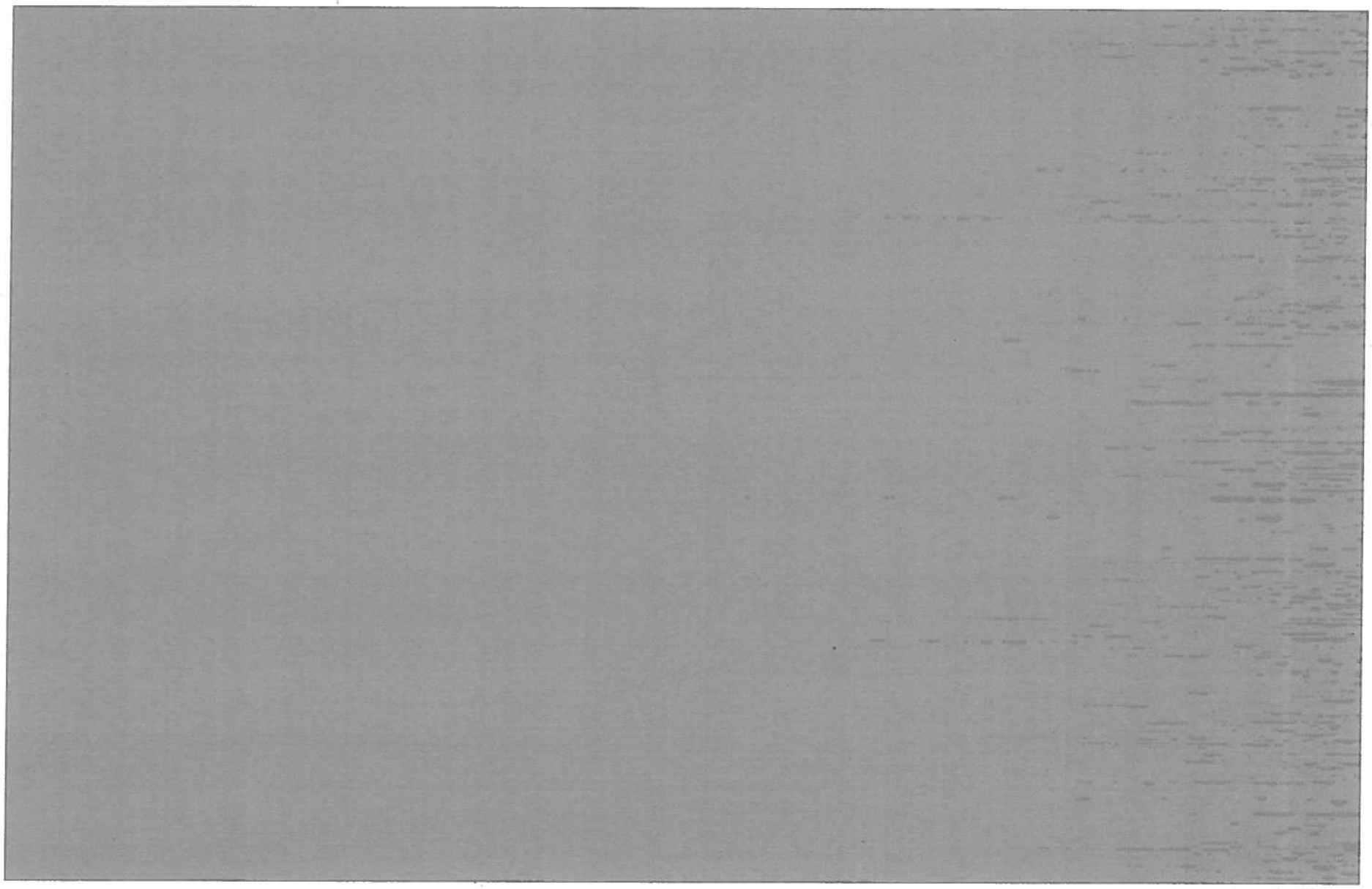
Hospital/Radio pharmacy
Prepare and use Tc-99m dose for patient use

12-14 days

Several thousand players

- Faculty hospitals
- Cancer centers
- Regional Polyclinics
- Outpatient radio pharmacies

1) M0-99 Capacity per week (6-day Ci) for Major current 99Mo producing reactors as reported by NEA
2) NRU will be decommissioned end 2016
Source: NEA 2016



Bron: Current MJV, NRG projections, Strategy& analyse

- NRG receives subsidies from EZ (~€7Mn p.a.) as well as from the EU (~€7Mn p.a.) to stimulate and support nuclear research

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ECN Duurzaam is a recognized research institute and is currently evaluating potential future scenarios

ECN Duurzaam business model

- ECN Duurzame Energie is an international institute that conducts research on the transition to sustainable energy, focussed on projects with low TRL (i.e. not viable for direct commercialization)
- The company is seen as leading in the field of applied sustainable energy research in the Netherlands and is well-respected in the market[1]
- ECN has two main sources of funding
  - **Subsidized research:** Part of revenues consists of direct subsidies from EZ, which are required to cover the high level of fixed costs. The level of these subsidies is determined by the biennial Innovation Contract
  - **(Non-)Commercial research:** Other revenues depend on the win rate of assignments tendered by the TKIs and commercial companies and are important to achieve the required utilization rate

Focus of current Strategy& assessment is on continuing current activities, alternative scenarios not in scope

ECN/Berenschot Future outlook

ECN/Berenschot see three options for the future organization[1)]:

1. National knowledge and advice center

- Mainly focussed on driving technological innovations towards high technological readiness levels – i.e. closer to the market than currently
- Activities will depend on market demand and likely to be more limited than current portfolio

2. National Institute for sustainable energy

- Berenschot sees an opportunity for ECN Duurzaam to transform into a broad national research and development center that bundles a wide range of applied research in the field of sustainable energy
- Large scale would need to be achieved by clustering existing research institutes

3. No centralized research center (termination)

- In this scenario, no center for research and innovation would exists in the Netherlands
- A third party would take over the policy study activities of ECN Duurzaam

1) Berenschot, 2016 "Toekomstscenarios ECN Duurzaam"
Sources: ECN MJV, Berenschot report, Strategy& Analysis

BASED ON STATUS QUO SCENARIO IN WHICH FULL RESEARCH PORTFOLIO IS

- Subsidies have decreased with ~50% since 2008
- ECN has not been able to compensate this decline in public funds with alternative sources of revenue

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We have evaluated six scenarios that address four key questions

Scenarios to be evaluated vis-à-vis MJV

Scenario		Description
B	Continue As-is	• Continue current scope of activities • Continue current organizational set up • ECN (consolidated) to cover RWMP liability
Di	Separate ECN/NRG incl. RWMP	• Continue current scope of activities[1)] • Separate ECN Duurzaam and NRG • Transfer RWMP to NRG
Dii	Separate ECN/NRG, excl. RWMP	• Continue current scope of activities[1)] • Separate ECN Duurzaam and NRG • Transfer RWMP to State fund
C	Discontinue NRG (Phased or Direct)	• Continue current scope of activities Duurzaam • Terminate (directly or phase) NRG activities • Transfer RWMP liability to state fund
A	Discontinue ECN overall	• Terminate all ECN/NRG activities (file for bankruptcy) • Transfer RWMP liability to state fund
E i,ii,iii	Offensive growth scenarios	I. Move up the value chain II. Operate new technologies III. Redevelop OLP into Dutch Isotope Valley

Underlying questions

- **What is the impact of discontinuation of activities?**
- **What is the impact of separating ECN's various legal entities?**
- **What is the impact of creating a standalone RWMP entity?**
- **What is the high-level feasibility of offensive scenarios?**

1) Variations possible (locating ECN Duurzaam outside OLP, Sale of NRG research/consultancy)
Source: Proposal

Continuation seems the most beneficial scenario in terms of cost incurred by the state and protection of societal benefits

	Scenario	State costs[1] (2016-2026, €Mn)	Subsidy[2] (2016-2016, €Mn)	Third party cost	Pros	Cons
Continuation scenarios	B Continue As-is	27	318: 118 NRG, 200 ECN Duurzaam	• Third party obligations are paid in all scenarios before government debt is paid off • HFR de-commissioning – Covered by Euratom – Amount not specified – Applicable in all scenarios (timing difference)	• Protect societal benefits (e.g. security of supply, jobs, knowhow)	
Continuation scenarios	D i Separate ECN/NRG, incl. RWMP	32	318: 118 NRG, 200 ECN Duurzaam		• Protect societal benefits • Improved governance (focus, cost transparency)	*Applicable to Di and Dii* • Significant costs of legal separation
Continuation scenarios	D ii Separate ECN/NRG, excl. RWMP	32	318: 118 NRG, 200 ECN Duurzaam		*In addition to Scenario Di* • Improved financing access (NRG)	*Applicable to Dii* • Adverse incentives on historic wast removal and higher risk profile NRG
Discontinuation	C Discontinue NRG	145-274: Direct, Phase-out	200-273: 73 NRG Phase out, 200 ECN Duurzaam		• Releases State of business risk associated to NRG	*Applicable to C* • Negative EBIT projected for ECN Duurzaam
Discontinuation	A Discontinue ECN overall	219	0		• Releases State of business risk associated to NRG/ECN Duurzaam	*Applicable to B and C* • Loss of societal benefits • Adverse incentives on historic waste removal and higher risk profile NRG • Potentially higher RWMP cost if know-how is lost

(1) Includes net effect of current cash plus projected free cash flows over the (remaining) period (and in case of scenario B and C a liquidation value of the company), the RWMP payments (minus available Escrow funds), the net effect of interest income and part of the government loan (in case not repaid) and discontinuation cost (e.g. Contract penalties, Decommissioning terrain/ buildings, Severance payments etc.). VPB tax is seen as an income to the State
(2) Includes EZ and EC subsidies in full
Source: ECN, Strategy& analysis

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- ***Discontinuation vs. Continuation***
- *Separation of entities*
- *Transfer of RWMP*
- *Offensive scenarios*

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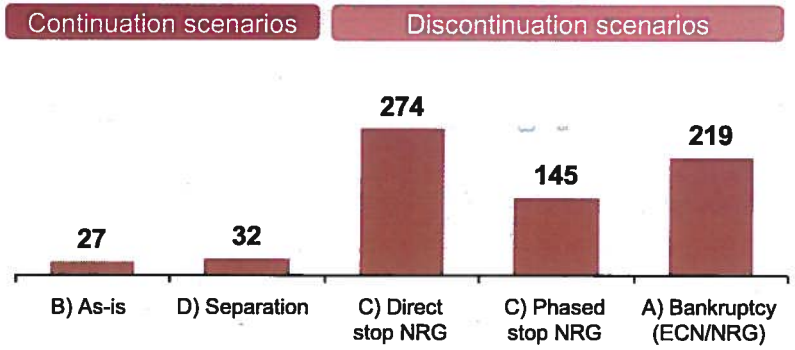
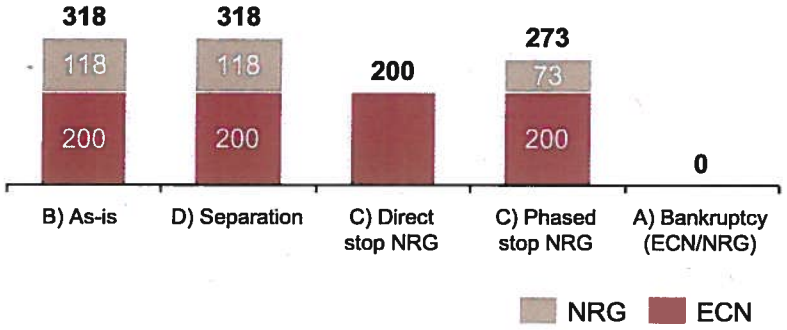
The state will incur lowest costs in case of continuation

State costs 2016-2026 period[1)], €Mn



Subsidies 2016-2026 period[2)], €Mn



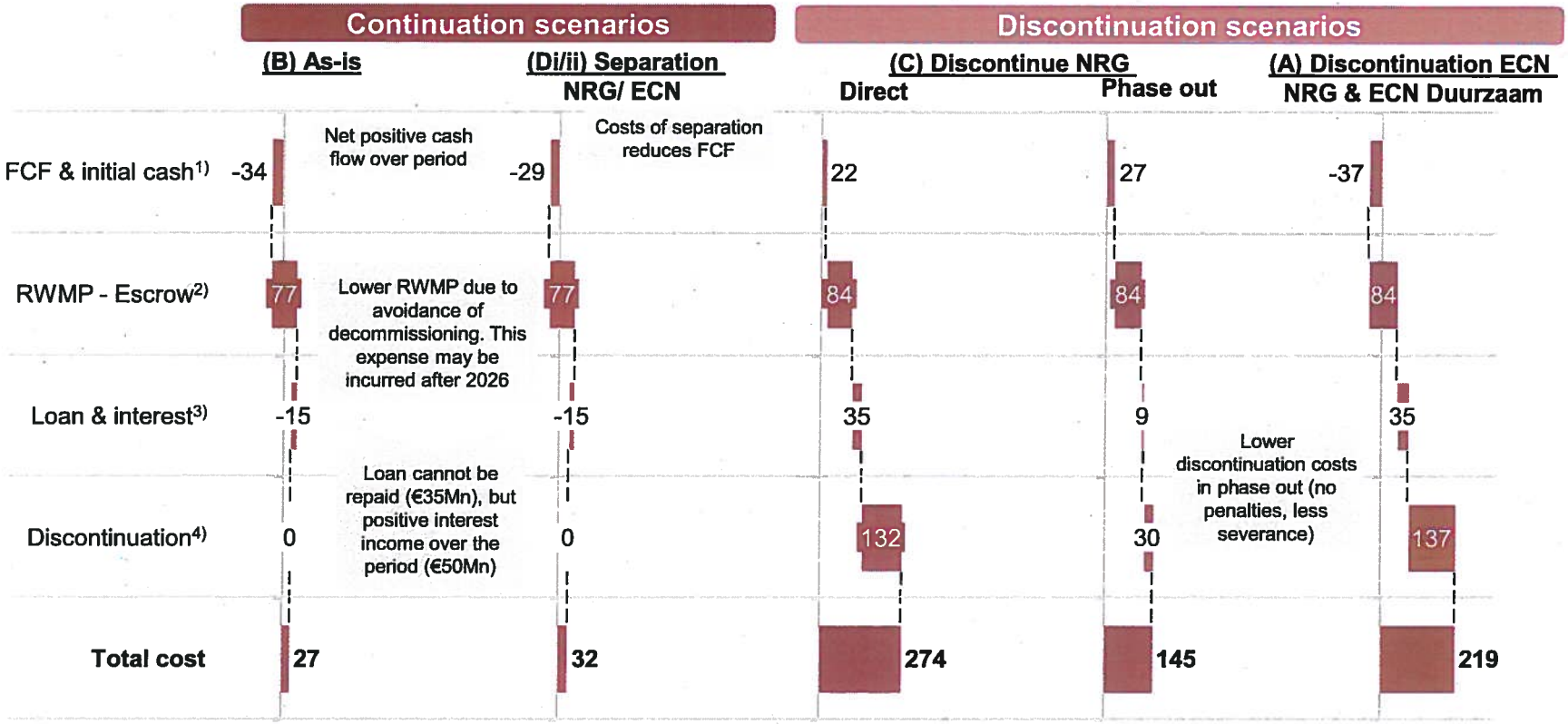
Considerations

- In case ECN has insufficient funds to cover its third party obligations, we assume these costs fall on the State as only equity holder in ECN
- Interest and VPB payments to the state are seen as an income to the State and have been deduced from total cost. (E.g. the negative liquidity position of ECN is -€83Mn in 2026, but the net costs to the State are €27Mn after deducting interest and tax income)
- In Scenario B (As-is) and D (Separation), ECN is able to pay off all third party obligations, interest and taxes. However, insufficient funds remain to repay the State loan in full resulting in net costs to the State
- The discontinuation scenarios are less favorable, due to:
  - Missing out on positive cash flow
  - Higher RWMP cost (due to decommissioning of €30Mn)
  - Additional discontinuation costs, e.g. to continue operations (e.g. security), severance payments and contract penalties
- Overall, discontinuation costs appear largely unavoidable and NRG's estimates and assumptions seem reasonable
- However, uncertainties remain, mainly related to RWMP, decommissioning costs and liquidation value of assets
- Subsidies are higher in continuation scenarios, yet not considered as a cost to the state since subsidies are used to fund specific research

Note: State cost analysis does not consider a potential minimum solvency requirement by ANVS. Such minimum solvency requirement may result in a higher capital injection required, and higher costs to the State
(1) In Bankruptcy scenario (B), the costs are incurred immediately 2) Includes EZ and EC subsidies in full
Source: Current MJV, Management Interviews, Bankruptcy scenarios ECN, Strategy& analysis

Continuing activities is least costly due to positive NRG cash flow, lower RWMP and avoidance of discontinuation costs

State cost per scenario 2016-2026 period, €Mn



Note: State cost analysis does not consider a potential minimum solvency requirement by ANVS. Such minimum solvency requirement may result in a higher capital injection required, and higher costs to the State

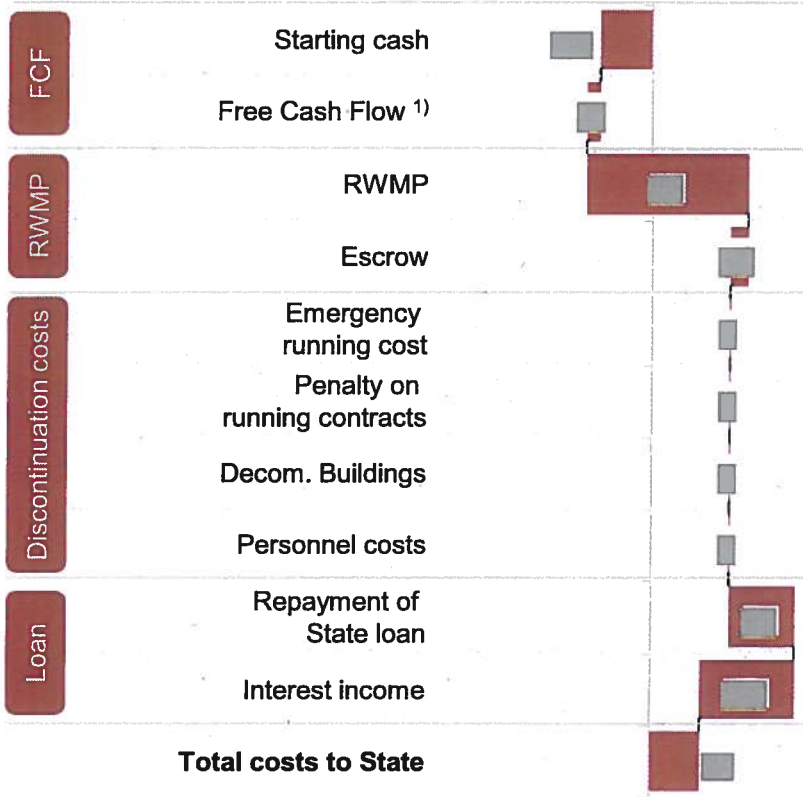
1) FCF = Free cash flow over the (remaining) period + Initial cash position (or liquidation value in case of scenario B and C). Liquidation value is Current assets + cash (ex. Escrow, Work in progress) minus Short term debt, other liabilities (2) RWMP minus Escrow (i.e. ECN liquidity to be used to cover cost of historic waste removal)

(3) Loss of loan, after deduction of interest income (4) Discontinuation cost = Contract penalties, Decommissioning terrain/ buildings (ex HFR), Employee costs (severance, WW/UWV), HFR emergency running costs.

Source: Current MJV, Management Interviews, Bankruptcy scenarios ECN, Strategy& analysis

Backup: Breakdown of state costs Continue As-is scenario

State costs: Scenario B - Continue As-is
2016-2026 period, €Mn (not all cost incurred immediately)



Description

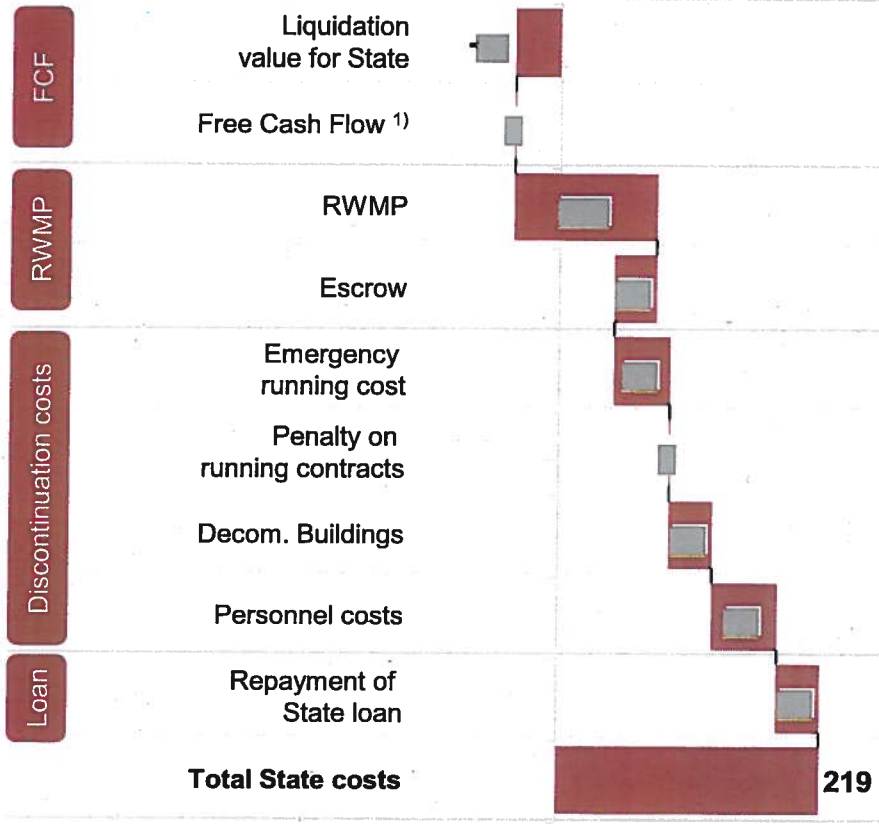
- No liquidation
- Net effect of operational and financial cash flows, excluding RWMP payments, excluding VPB tax payments
- RWMP liability, excluding decommissioning costs of [redacted] (not needed in case of discontinuation)
- Escrow used for RWMP costs
- Necessary safety and security costs no longer covered by operations, including emergency staffing of HFR
- Penalties on running contracts with Mo-99 customers
- Decommissioning of buildings and infrastructure, including [redacted] overrun buffer
- Severance payments and WW/UWV payments
- ECN will not be able to repay the loan by the end of the period
- State does receive interest income over the period

Total costs scenario D are [redacted] higher due to additional cost of separation (estimated [redacted], we use [redacted]n to be conservative)

Note: State cost analysis does not consider a potential minimum solvency requirement by ANVS. Such minimum solvency requirement may result in a higher capital injection required, and higher costs to the State
1) Changes in NWC set equal to zero as changes in NWC cancel out with changes in liquidation value
Source: Current MJV, Management Interviews, Bankruptcy scenarios ECN, Strategy& analysis

Backup: Breakdown of state costs Bankruptcy scenario

State costs: Scenario A - Bankruptcy ECN in 2016
2016-2026, €Mn



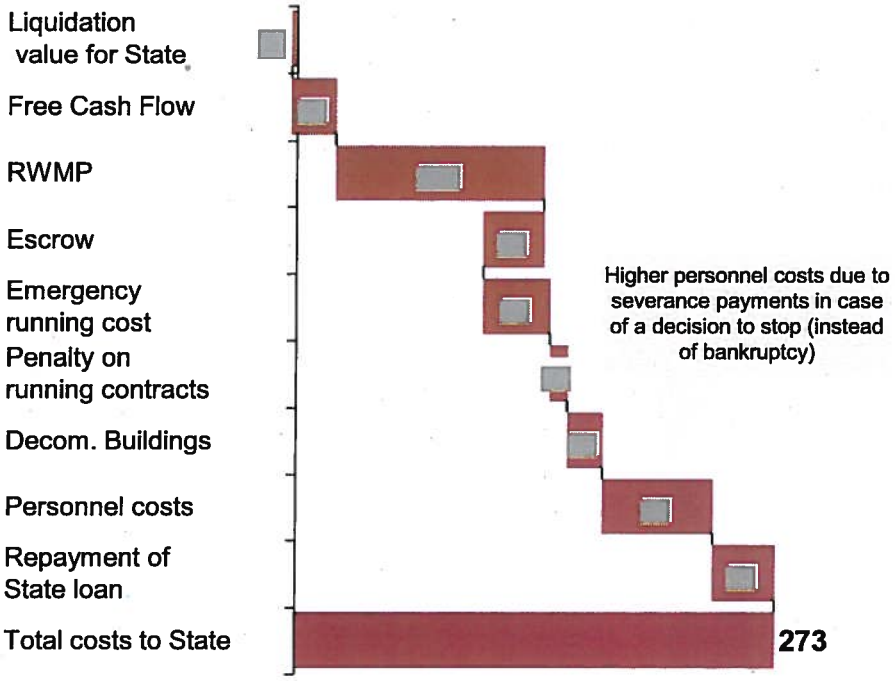
Description

- Current assets and cash (ex. Escrow and ongoing work) used to pay off short term debt and other liabilities (ex. RWMP)
- Cumulative EBITDA minus investments and change in NWC, including pension payments and interest, ex. RWMP costs
- RWMP liability, increased with indexation for inflation
- Available Escrow for RWMP costs
- Necessary safety and security costs no longer covered by operations, including emergency staffing of HFR
- Penalties on running contracts with Mo-99 customers
- Decommissioning of buildings and infrastructure, including €10Mn overrun buffer
- WW/UWV payments
- ECN will not be able to repay the loan (and State receives no interest payments over the period)

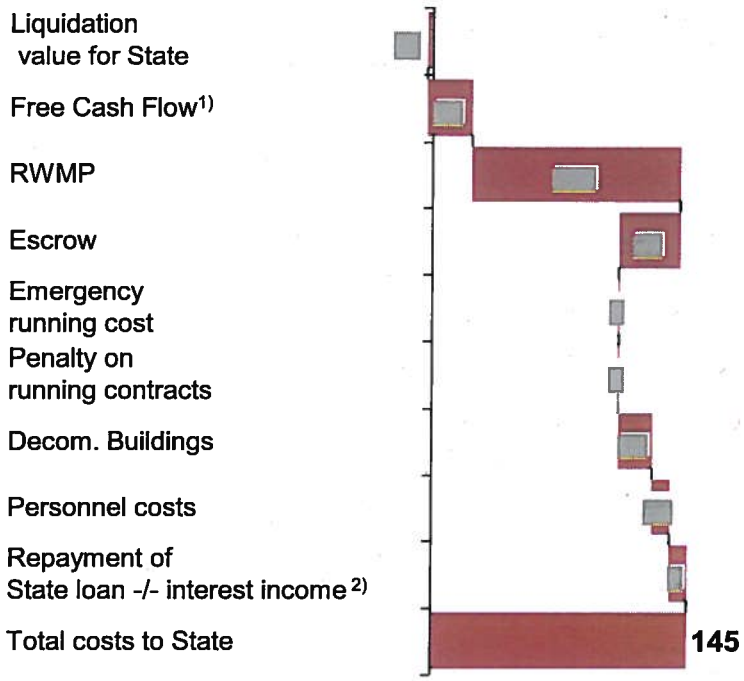
Note: State cost analysis does not consider a potential minimum solvency requirement by ANVS. Such minimum solvency requirement may result in a higher capital injection required, and higher costs to the State
1) Changes in NWC set equal to zero as changes in NWC cancel out with changes in liquidation value
Source: Current MJV, Management Interviews, Bankruptcy scenarios ECN, Strategy& analysis

Backup: Breakdown of state costs NRG discontinuation scenarios (direct and phase out)

State costs: Scenario C – Discontinue NRG
(Direct in 2016) 2016-2026, €Mn



State costs: Scenario C – Discontinue NRG
(Phased until 2022) 2016-2026, €Mn



Note 1: Phase out scenario means activities run until 2022, in order to fulfil running contracts, finalize running research, reduce severance pay costs, and buy time to set-up alternative production capacity to avoid risk of insufficient supply of medical isotopes.
Note 2: State cost analysis does not consider a potential minimum solvency requirement by ANVS. Such minimum solvency requirement may result in a higher capital injection required, and higher costs to the State
1) Including significant interest and pension payments during phase out period. Corrected for VPB tax (seen as income to state)
(2) €26Mn in interest payments made from ECN to the State from 2016 to 2021
Source: Strategy& analysis, management interviews, ECN input (Scenario Faillissement, Directe en gecontroleerde stopzetting NRG)

Discontinuation of NRG and/or ECN Duurzaam has a negative societal impact

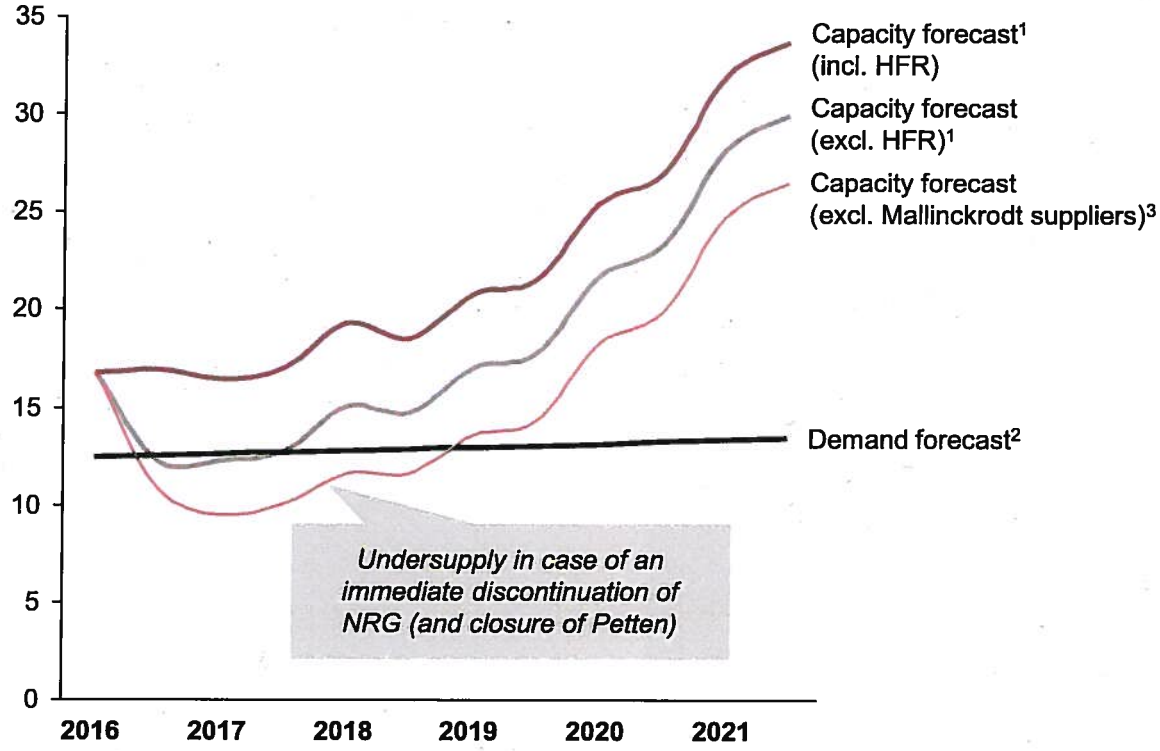
Societal impact – Discontinuation of NRG/ECN Duurzaam

		Applicable in case of discontinuation of: NRG	ECN Duurzaam
Insufficient supply of medical isotopes	• Medical isotopes are a crucial part of modern health care (e.g. treatment of cancer patients) • Discontinuation of HFR activities can lead to substantial shortages in the market, resulting in increased dependency on reactors outside the Netherlands and potentially a supply shortage for Dutch hospitals (leading to increased wait times or cancellation of treatments for patients)	✓	✗
Unemployment / Migration of jobs	• NRG and ECN Duurzaam provide substantial direct and indirect employment opportunities for workers with specific qualifications (research, operations and maintenance, services, etc.)	✓ *402 FTE[1)]*	✓ *435 FTE[1)]*
Loss of specific and valuable know-how	• NRG and ECN Duurzaam contribute substantially to the build-up of nuclear know-how as well as in the area of sustainability ("brain drain")	✓	✓
Loss of non-commercial research	• NRG and ECN support technology research that does not serve commercial purposes and contributes to and collaborates in international research programs • Discontinuation of NRG may impede Dutch participation in nuclear research	✓	✓
Complex waste issues	• Discontinuation of activities can threaten a smooth resolution of waste issues as it is better to resolve these issues in a going concern (e.g. due to retention of expertise)	✓	✗
Risk to Pallas	• Pallas is projected to start in ~2026. A discontinuation of NRG before 2026 may result in current NRG customer base switching to other suppliers, potentially harming the business case for Pallas	✓	✗

1) Direct FTE only

Discontinuation of NRG would risk a global shortage in medical isotopes until ~2020

Market projections Mo-99 irradiation in kCi/wk



- Shutting down HFR pushes down global capacity below demand for Mo-99 in the short run, thereby threatening the supply of Mo-99
- In addition, the processing facility operated by Mallinckrodt at the same site would also probably have to shut down at least temporarily
- As this facility also processes Mo-99 from other sites, the shortage would be exacerbated

1) Weekly capacity based on nameplate capacity and reported production days per reactor; 1 year incremental ramp-up assumed for new reactors; 1 year additional delay assumed for non-Conventional Research Reactor irradiation programs
2) Weekly demand including 35% Outage Reserve Capacity – required to ensure a reliably supply by providing back-up irradiation and/or processing capacity that can be called upon in the event of an unexpected or extended shutdown – 35% represents low estimate by NEA
3) Mallinckrodt supply defined as European capacity minus processing capacity of IRE, i.e. all capacity of which output can no longer be utilized by a processor
Sources: NEA 2014, NEA 2016, Strategy& analysis.

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- *Transfer of RWMP*
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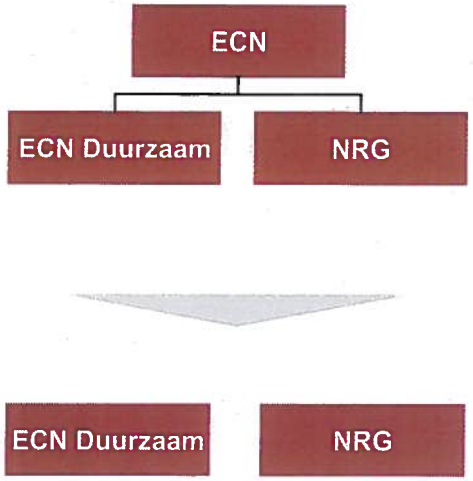
Separation of ECN and NRG does not change fundamentals of the business – it may enable alternative scenarios

Separation of entities



- ECN Duurzaam and NRG to operate as separate legal entities
- Both entities continue to operate from Petten with each its own governance and financing structures

Legal separation is likely to provide managerial benefits only… … as this will not change underlying business fundamentals

- Activities are different in nature and operational synergies appear to be limited whilst overhead and infrastructure costs are shared
- Separation may improve financial transparency and enable greater management focus – effects not quantified and likely to be limited
- Based on the plans presented to us, we believe the benefits are likely to be relatively small since underlying business fundamentals do not change (i.e., earning capacity, cost structure, risk profile, etc.)
- Current structure does not prevent ECN Duurzaam to move activities to another location – which would expose NRG to €3Mn-€6Mn in extra costs – nor does it prevent collaboration with other institutes

In addition, substantial one-off costs would be incurred and additional financing would be required to enable legal separation

- The costs of separation are estimated at [redacted]
- Further costs will be made to increase solvency of NRG to acceptable levels (not quantified) and in case of relocation of ECN Duurzaam [redacted]
- [redacted]

However, legal separation could be considered in case of changes of ECN Duurzaam's strategic direction

- A potential scenario has been identified whereby ECN Duurzaam's activities are consolidated in a National Research Institute for which legal separation could be a key enabler – such scenario requires further detailing and a business case before this can be evaluated

1) Based on Berenschot report
2) Based on expert interview (PWC Debt advisory)
3) This excludes other overhead (IT) and one-off costs (moving/decommissioning) that may potentially incur
Source: Rapportage Berenschot Toekomstscenarios ECN Duurzaam, PWC debt advisory, Strategy& analyse

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- ***Transfer of RWMP***
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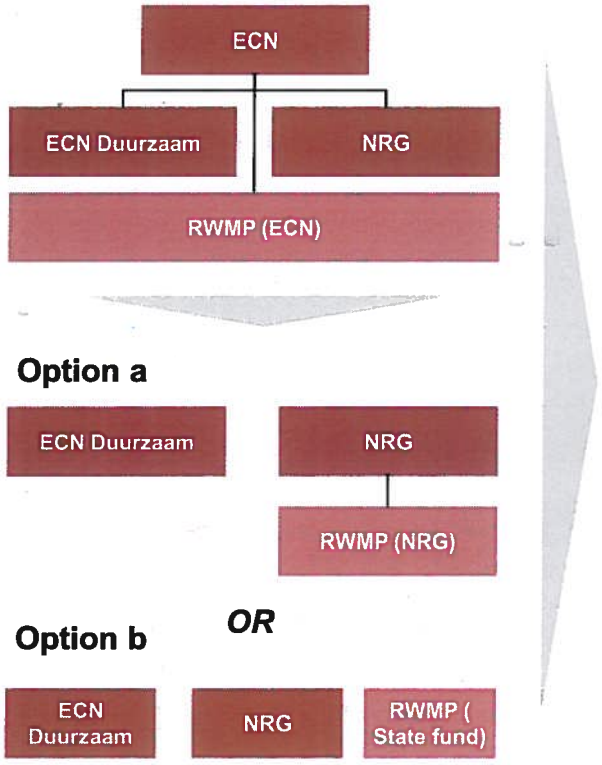
A transfer of RWMP provides better access to financing limited additional benefits, yet introduces risk

Transfer of RWMP liability



Transferring RWMP does not change business fundamentals

- RWMP transfer would not reduce risks but rather allocate it differently
- Based on the current plan, operational benefits are limited by the extent that key activities would remain on site and executed by NRG

A transfer could be considered as it may improve access to external financing and/or enable changes to ECN/NRG's strategic direction

- A reallocation of risk releases ECN Duurzaam (option a & b) and NRG (option b) of significant uncertainty and would improve financial ratios – this could improve access to commercial financing, qualification for tenders and enable identified offensive scenarios
- The State could cover RWMP related liabilities conditional on ECN/NRG securing commercial financing, and/or on further detailing and robust business case of offensive scenarios

RWMP transfer may have financial implications that should be mitigated

- There is risk that transferring the liability could increase costs for the State since there is less incentive for the operator to minimize costs – third party take-over may translate in upfront risk premium or extra costs (e.g., in case of bankruptcy)
- To mitigate financial exposure of the State, RWMP transfer should be accompanied by:
  - I. Alignment of incentives between RWMP and NRG to minimize waste removal cost
  - II. An agreement under which NRG's profit is structurally appropriated to the RWMP, e.g. a royalty scheme, fixed annual payment, or dividend charter
  - III. Alternatively, subsidies could be withheld to compensate for these costs

Context and main conclusions

Appendix 1: Background and introduction

Appendix 2: Business case analysis

Appendix 3: Viability analysis

Appendix 4: Scenario analysis

- *Discontinuation vs. Continuation*
- *Separation of entities*
- *Transfer of RWMP*
- ***Offensive scenarios***

Appendix 5: Consulting arrangements and disclaimers

Alternative growth scenarios provide potential upside for NRG, yet are early stage and require further investigation

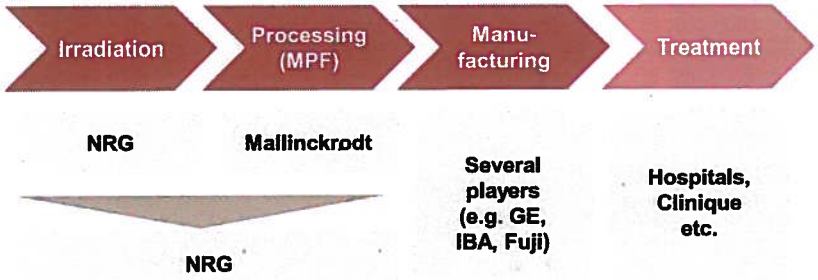
High-level evaluation of alternative growth scenarios

Scenario	Description	Maturity of idea	Evaluation
(i) Value chain extension	• NRG extends into MPF processing: – Acquisition of Mallinckrodt (Petten), or – Set up own MPF processes • Additional revenues ~€70Mn (estimate)	*Early stage* • No contact yet with target • Alternative approaches (other than through acquisition) not fully evaluated • No detailed business case	+ Stronger value chain position enhances ability for FCR + NRG is well positioned to capture synergies (e.g. on-site located) + Potentially profitable activity - New set of capabilities required (e.g. M&A, MPF) - Potential loss of customers
(ii) New technologies	• NRG as a platform to grow into new technologies • [redacted]	*Early stage* • Project team ramped up • Technology in experimental phase	+ Potential to diversify portfolio - Uncertainty given experimental stage of technology - Long term play (benefits as of 2020-2025)
(iii) Development of OLP	• Develop OLP as a centre for applied science and business in Energy & Health • Campus with research, business, leisure facilities – close to Amsterdam & the sea • Investment ~€70Mn (estimate)	*Early stage* • Stakeholders interviews yielded interest, resulted in follow-up research currently • Future dream vision has been defined	+ Potential flywheel for NRG's core business + Other stakeholder commitment and investment to date - Non-core business - fragmentation of mgt. attention - Competition from similar initiatives

Source: Energy & Health Campus Petten (4 mei 2016), ECN Management interview, Strategy& analyse

Moving up the value chain into Molybdenum processing has potential benefits but the plan needs further detailing

Opportunity



- Two options for NRG to enter processing:
  - A. Acquiring Mallinckrodt's MPF assets in Petten
  - B. Setting up its own Molybdeen processing facility in Petten
- Acquisition means a running start; Setting up own processes likely delays the potential benefits
  - Time to set-up MPF
  - Time to acquire (manufacturing) clients
- Additional sales potential of ~€70Mn (estimate)

Strategy& Evaluation

We recognize potential benefits ...

- Expected situation of oversupply of irradiation capacity will shift power balance in favor of MPFs
- A combination of irradiation and MPF activities will improve ability for capturing full costs of irradiation
- Entering MPF provides synergy potential (e.g. reducing handovers in value chain)

...Yet also see that risks will be involved

- Entering MPF will require a different capability set
  - M&A, integration capabilities
  - Different client
- NRG will concentrate risk in the Mo-99 chain and becomes more vulnerable for substitutes
- Potential loss of sales from clients who compete in MPF (e.g. IRE)

NRG to further detail out the business case (required investment, potential benefits, quantification or risks)

Source: ECN Interviews

Context and main conclusions

Appendix 1: Background and introduction

Appendix 2: Business case analysis

Appendix 3: Viability analysis

Appendix 4: Scenario analysis

Appendix 5: Consulting arrangements and disclaimers

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ENGAGEMENT LETTER

[redacted]

Ministerie van Economische Zaken
Bezuidenhoutseweg 73
2594 AC Den Haag
Netherlands

Amsterdam, 27 Juni 2016

Betreft: Offerte aanvraag voor oordeel financiële situatie en levensvatbaarheid ECN

Geachte [redacted]

In vervolg op onze contacten en naar aanleiding van uw offerte aanvraag d.d. 17 juni 2016 en nadere toelichting tot en met vandaag 27 juni 2016, sturen wij u hierbij ons voorstel voor het analyseren van de meerjarenverkenning 2016-2026, oordelen over levensvatbaarheid van afzonderlijke activiteiten van ECN en beoordelen van verschillende toekomstscenario's voor ECN. Het voorstel behandelt achtereenvolgens ons begrip van de situatie en de vraag, de voorgestelde projectaanpak en timing, en het voorgestelde team en budget. Wij bespreken dit voorstel graag met u, waarna wij eventuele wijzigingen zo snel mogelijk doorvoeren.

1. ONS BEGRIP VAN DE SITUATIE EN DE VRAAG

In oktober 2014 is in het kader van het herstelplan voor de HFR een lening van €80mln verstrekt aan ECN voor financiering van de totale bedrijfsvoering van ECN en NRG. Inmiddels is €35mln van de lening uitgekeerd, eind september zou een volgende tranche overgemaakt moeten worden. Deze lening was gebaseerd op een business case waarin kosten voor het opruimen van het nucleair afval betaald werden uit de opbrengsten, onder meer die van de verkoop van medische isotopen.

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Recentelijk heeft ECN echter aangegeven dat de voorspellingen van de business case niet gehaald gaan worden. Uit de herijking van de business case volgt dat de kosten van het RWMP (Radioactive Waste Management Program) niet meer gefinancierd kunnen worden uit de inkomsten wat tot een negatieve (cumulatieve) kasstroom tot 2026 leidt. Deze verslechtering wordt met name gedreven door hoger dan voorziene kosten voor het nucleair afval. Echter, ook aan de opbrengstenkant vallen resultaten tegen. Als gevolg hiervan heeft ECN in een herziene financiële projectie bij EZ aangegeven behoefte te hebben aan vergaande financiële ondersteuning.

Binnen EZ is inmiddels twijfel gerezen over of doorgaan op de huidige weg de beste optie is. Zowel stoppen met de gehele operatie als het voortzetten of opsplitsen van de verschillende onderdelen worden als serieuze opties gezien. In voorbereiding op een beslissing over de toekomst van ECN is Strategy& gevraagd een oordeel te vellen over de financiële situatie, levensvatbaarheid en toekomstscenario's voor ECN aan de hand van de volgende drie onderwerpen:

1. Analyse en beoordeling van de Meerjarenverkenning 2016-2026:
   - Vergelijking van huidige situatie met de uitgangspunten van de business case op basis waarvan de lening oorspronkelijk verstrekt is
   - Evaluatie van de belangrijkste verschillen, onderliggende drijvers en mate waarin veranderingen in het verdienmodel mogelijk structureel kunnen zijn
   - Oordeel over aannames naar de toekomst toe en verwachte financiële ontwikkeling tot 2026 (inclusief voornaamste risico's en sensitiviteitsanalyse t.a.v. belangrijkste aannames)
2. Hoog over beoordeling van de levensvatbaarheid van de afzonderlijke ECN onderdelen: duurzame activiteiten, exploitatie van de HFR, het nucleaire onderzoek, consultancy activiteiten en het RWMP op basis van beschikbare data en informatie (bijvoorbeeld op basis van recent uitgevoerd onderzoek naar de toekomst van ECN)
3. Evaluatie van financiële consequenties en voornaamste risico's (voor de Staat en ECN) in een aantal scenario's afgezet tegen projecties van de Meerjarenverkenning 2016-2026, te weten:
   A. Faillissement ECN/NRG: stopzetten alle bedrijfsactiviteiten (incl. Duurzaam)
   B. Doorstart alle activiteiten ECN/NRG (in huidige vorm, met aanpassing lening)

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Onderstaande scenario's voor NRG en RWMP (ECN Duurzaam wordt afgesplitst en verzelfstandigd)

C. Stopzetting nucleaire activiteiten (direct of gefaseerd)

D. Doorstart NRG:

i. Inclusief RWMP (overheveling radioactief afval naar NRG)

ii. Exclusief RWMP (RWMP wordt verzelfstandigd)

Onderstaand scenario en varianten dienen in de context gezien te worden van voorzieningszekerheid van medische isotopen en ontwikkelingen Pallas

E. Mogelijke offensieve scenario's zelfstandig NRG

i. Uitbreiding activiteiten naar verwerking Molybdeen (opschuiven in keten; bestralen en verwerken, overname activiteiten Mallinckrodt)

ii. NRG als (mogelijk) toekomstig exploitant van Pallas (2024) en/of andere technologieën

iii. Herontwikkeling OLP (Dutch Isotope Valley) – Pallas en/of andere technologieën dienen als aanjager voor innovatie en nieuwe bedrijvigheid

Belangrijke aspecten die bij deze evaluatie meegenomen dienen te worden, zijn onder andere:

Voor scenario C:

- Kosten van directe uitbedrijf name vs. afbouwscenario
- Maatschappelijke risico's voorzieningszekerheid medische isotopen
- Effecten op Pallas, en vrij komen geld Pallas
- Kosten bemensing HFR na stopzetting

Voor scenario D:

- Effect op kostenstructuur NRG als ECN Duurzaam onderzoek locatie Petten verlaat
- Levensvatbaarheid NRG inclusief RWMP (juridische mogelijkheden)
- Levensvatbaarheid NRG excl. RWMP
- Levensvatbaarheid NRG zonder onderzoeksubsidie (met evt. verkoop onderzoek/consultancy tak) en/of zonder aanvullende programmasubsidie
- Levensvatbaarheid verzelfstandigd RWMP incl. opties om deel kosten RWMP te dekken met royalties of dividend van een afgesplitst NRG

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Voor scenario E.1 (enige scenario dat mogelijk door te rekenen is; andere scenario's kennen veel onzekerheden en afhankelijkheden):

- Doorrekening kosten overbrugging NRG
- Kosten/investeringen die in scenario's gedaan moeten worden voor toekomstig business model NRG

II. VOORGESTELDE PROJECTAANPAK EN TIMING

Het concept eindrapport dient 7 juli gereed te zijn, waarna mogelijke aanpassingen uiterlijk op 12 juli verwerkt dienen te zijn. Wij houden rekening met de review door de Auditdienst van het Rijk en zullen zorgdragen voor een goede overdraagbaarheid van het eind rapport (PowerPoint) en relevante onderleggers. Ook zullen wij beschikbaar zijn voor het beantwoorden van eventuele vragen. Wij verwachten in deze periode geen verdere verdiepingswerkzaamheden uit te hoeven voeren tenzij expliciet anders is overeengekomen. Daarnaast vragen wij binnen een week na 12 juli bevestiging van EZ dat we onze opdracht hebben vervuld.

Gezien de korte doorlooptijd (iets meer dan twee weken) is ons voorstel om het onderzoek in de komende weken vooral te richten op de financiële consequenties en risico's met betrekking tot NRG, de exploitatie van de Hoge Flux reactor en de afvoer van het nucleaire afval. De overige activiteiten (ECN Duurzaam, nucleair onderzoek en consultancy) zullen wij in eerste instantie meer op hoofdlijnen benaderen en op basis van beschikbare recente rapportages. Wat betreft de scenario's stellen wij voor om in dit stadium de nadruk te leggen op de uitwerking van scenario's A tot en met D. We zullen een eerste beeld creëren van de kansrijkheid en succesfactoren van enkele offensieve scenario's voor de toekomst van NRG als genoemd bij scenario E. Dit zal een eerste inzicht geven, maar geen complete strategische evaluatie van de alternatieven omvatten (gegeven de zeer korte tijdslijn). In een eventueel vervolgtraject zou deze evaluatie wel kunnen plaatsvinden, bijvoorbeeld in augustus.

De kwaliteit en mate van diepgang van onze evaluatie zal in grote mate afhankelijk zijn van beschikbaarheid van data en belangrijkste personen in de organisatie van ECN en NRG.

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Wij gaan ervan uit dat de verstrekte data en informatie uit interviews accuraat en compleet is. Wij zullen nauw samenwerken met ECN/NRG en zullen zo snel mogelijk aangeven indien kritieke data of informatie niet beschikbaar is of van onvoldoende kwaliteit is voor een adequate beoordeling. Wij stellen voor om aan het einde van de eerste week de bevindingen en mogelijke moeilijkheden te bespreken. Graag benadrukken wij dat zelfs met een diepgaande evaluatie er ontwikkelingen kunnen zijn waardoor mogelijke uitkomsten in de toekomst anders zullen zijn dan verwacht en dat ons advies aanbevelingen bevat, maar EZ en/of ECN Directie de verantwoordelijkheid dragen voor mogelijke beslissingen.

In de afgelopen jaren heeft Strategy& meerdere malen een uitgebreide evaluatie gedaan van de business case voor de investering in zowel de bestaande als de nieuw geplande Hoge Flux Reactor Pallas. In het kader van deze opdracht zullen we onze specifieke kennis met betrekking tot de nucleaire activiteiten van NRG gebruiken. Daarnaast zullen we onze uitgebreide sector en markt kennis op het gebied van duurzame energie inzetten.

Wij stellen voor om zo snel mogelijk te starten en de werkzaamheden tot 12 juli in te delen op basis van een aantal belangrijke meetings:

1. Kick-off (eind deze week, gezamenlijk met EZ en ECN/NRG) om:
   a. Helder beeld te krijgen op de huidige situatie en toekomstperspectief
   b. Scope, prioriteiten, verwachtingen en tijdslijnen helder af te stemmen
   c. Data verzoek, beschikbaarheid en verantwoordelijkheden te bespreken – inclusief review van beschikbare data die vooraf gedeeld dient te worden
2. Gesprekken met ECN/NRG (bijv. maandag 27 en donderdag 30 juni)
3. Terugkoppeling eerste bevindingen (vrijdag 1 juli) om huidige status meerjarenplan vs. oorspronkelijke projecties en initiële evaluatie levensvatbaarheid ECN onderdelen te bespreken, en focus en prioriteiten voor verdere verdiepingsslag (bijvoorbeeld met betrekking tot scenario's) af te stemmen
4. Bespreking concept rapport (donderdag 7 juli) om voorlopige conclusies te bespreken en belangrijkste openstaande vragen en aanpassingen te inventariseren
5. Bespreking eind rapport (dinsdag 12 juli) om conclusies en aanbevelingen te bespreken en vervolgstappen te identificeren

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Overzicht belangrijkste bijeenkomsten (EZ, ECN/NRG)

Datum	Gesprek/verslag	Locatie
Nu	Debrief van de bevindingen stap en [illegible]	NVT
Eind deze week	Kick-off eerste met EZ/NRG	Den Haag
Maandag 27 juni (voorlopig)	Eerste interviewronde NRG	Petten
Donderdag 30 juni (voorlopig)	Tweede ronde gesprekken NRG	Petten
Vrijdag 1 juli	Debrief eerste bevindingen met EZ (actief op [illegible])	Tafelbeeld
Donderdag 7 juli	Presentatie draft eindrapport	Den Haag
Dinsdag 12 juli	Presentatie eindrapport	Tafelbeeld

[redacted]

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[redacted]

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[redacted]

Wij zijn ons bewust van het belang van deze opdracht voor de Staat, ECN/NRG en zouden het bijzonder op prijs stellen het Ministerie hierbij te mogen ondersteunen. Graag ontvangen wij ter bevestiging deze overeenkomst en de bijlage met wijzigingen aan de ARVODI-2014 ondertekend retour.

Met vriendelijke groet,

[redacted]

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Bijlage: Algemene Voorwaarden van PwC
Appendix: voorgestelde aanpassingen op Arvodi-2014

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Bevestiging van de Overeenkomst

Ik heb kennis genomen van de voorwaarden van de Overeenkomst gedateerd 20 januari 2016 en ga namens het Ministerie van Economische Zaken akkoord met de voorwaarden van deze Overeenkomst en verklaar dat ik hiertoe door Ministerie van Economische Zaken ben gemachtigd.

Handtekening:

Naam en functie: [redacted]

Namens: Ministerie van Economische Zaken

Datum: _____

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[redacted]

Scope and process: supplementary information

Scope and scope exclusions agreed in the engagement letter	This report presents the preliminary outcome of the work we agreed to perform in accordance with the engagement letter. This report contains our understanding of the current business case and the main drivers of changes with respect to the historical business case, as well as a view on the high-level viability of the separate parts of ECN. This report also includes a preliminary high-level evaluation of the expected consequences of the scenarios outlined in the engagement. Significant scope amendments, if any are presented in the following paragraph.
Amendments to the agreed scope	There were no significant amendments to the scope agreed in the engagement letter.
Last day of fieldwork	The fieldwork for this preliminary report started on 27th June 2016 was completed on 11th July 2016. This report does not incorporate the effects, if any of events and circumstances which may have occurred or information which may have come to light subsequent to that date.
Due diligence process	Our initial work was performed over a 11 day period commencing 27 June 2016. We visited the head office of ECN on four occasions and had access to a number of key management people. These are outlined in page 4 of this report. ECN made their historic and current business cases available to us, together with a set of supporting documents mainly consisting of top-level financials and market reports.

Guidelines for the use and interpretation of our Reports

Guide for the correct interpretation of the "Our scope and process" pages in the report

- Our summary observations aim to communicate those matters which we believe are important when evaluating the findings of our work. They are directional indicators and are not absolute measures. Whilst inevitably subjective these observations set the overall context and framework against which the views expressed in our report should be assessed. The four main areas we assess are: 1) scope, 2) access to management, 3) access to information and 4) the clarity of information.
  - Our scope typically ranges from "limited" to "extensive". Our scope describes the period covered and gives an overall insight in the areas covered. Full detail of the scope is provided in Appendix 1 of the engagement letter.
  - Access to management typically ranges from "none" (e.g. no access due diligence) to "good" (e.g. open, direct, unsupervised access to all necessary members of management). Our assessment is based upon the transaction process, the level of direct access we were granted to the relevant members of management, as well as our observations as to the openness of the lines of communication.
  - Access to information typically ranges from "limited" (e.g. only the information memorandum, perhaps supplemented with some supporting schedules) to "extensive" (e.g. access to all the relevant data, supporting management schedules, and relevant specialists). Our assessment is based upon the extent to which we actually received the information and had the necessary communications during the course of our work.
- The clarity of information typically ranges from "poor" (e.g. no ability to ascertain the performance drivers of the business) to "good" (e.g. there is a substantial amount of robust and relevant information that provides meaningful insight about the most significant risks, trends, and issues of the Target). This assessment is based upon our judgement as to how access to management and access to information facilitate our understanding of the Target.

Basis of our work

- Our work was carried out on the basis that the information is reliable, accurate and complete in all material respects. Unless explicitly stated in our report, we did not verify or check the information with respect to accuracy or completeness. Our work constitutes neither an audit in accordance with any set of generally accepted auditing standards nor a review in accordance with a set of generally accepted review standards globally, regionally, or by individual territory. Accordingly, we do not express an opinion or any form of assurance with respect to any financial statements, information regarding the Target, or technical accounting advice included in our report.
- We make no representations regarding the sufficiency of our work either for the purposes for which our report was requested or otherwise. The sufficiency of the work we perform remains the sole responsibility of the addressee of our report as are any decisions with respect to the proposed transaction.
- Had we been requested to perform an audit or additional work, additional matters might have come to our attention which might be of importance to you.

Guidelines for the use and interpretation of our Reports (cont'd)

Access to our report

- Our report is supplied on the understanding that it is solely for the use of the client, or those persons who have signed release or reliance letters, and only in connection with the proposed transaction.
- Our report may be shared with your professional advisors solely for the purpose of assisting you in connection with the proposed transaction provided they have accepted the terms as stated in the Contract (Appendix 1). Financing banks may share the report with their professional advisors solely for the purpose of advising them in connection with the transaction under the conditions of the release or reliance letter.
- You shall not provide our report, or a copy or part thereof, to any third party, including financing banks, or refer to us or the Services without our prior written consent, which we may at our discretion withhold or allow subject to the third party accepting our terms and conditions as outlined in a separate release or reliance letter.
- Where an investment bank acts as an adviser, it may only use our report for the purpose of advising you. If the investment bank wishes to use the report for its evaluation as to whether to provide debt finance for or underwrite the acquisition, it may only do so if it has previously signed our reliance letter.
- Except where otherwise stated in the Contract, the release or reliance letters or unless required by law, no report, in draft or final form, provided by us, or a copy or part thereof, should be given to any third party nor should we or our services be referred to without our prior written consent which we may at our discretion grant, withhold or grant subject to conditions.
- Our report is specifically written for identified user(s) with whom we have agreed the scope of work or to whom we have explained the nature and extent of our work. We will therefore not accept any responsibility or liability to any unauthorized reader of our report.

Glossary

2D	Business case developed August 2014
^{99}Mo	Molybdenum-99 (radioactive isotope)
^{99m}Tc	Technetium-99m (metastable radioactive isotope)
BEE	Biomass & Energy Efficiency
BK	Bestralings Keten
BU	Business Unit
C&S	Consulting & Services
CAGR	Compound annual growth rate
COVRA	Central Organization for Radioactive Waste
EBIT	Earnings before interest and tax
EBITDA	Earnings before interest, tax, depreciation and amortisation
ECN	Energy research Center Netherlands
EDF	Électricité de France
EEE	Environment & Energy Engineering
EZS	Economische Zaken Subsidies
FCR	Full Cost Recovery
I&S	Irradiation & Solutions
LOI	Letter of Intent
LTO	License to Operate
LWR	Light Water Reactor
MJV	Meerjarenverkenning
NO	Nuclear Operations
NRG	Nuclear Research & consultancy Group
NTSI	Nuclear Technology Solutions for Industry
OLP	Onderzoeks Locatie Petten
PD	Program Development
PS	Policy studies
R&I	Research & Innovation
RAAVOG	Radioactief Afval Afvoer- en Ontmanteling Gebouwen
RAP	Radioactive Waste Plan
RWMP	Radioactive Waste Management Program
SE	Solar energy
VPB	Vennootschapsbelasting (corporate tax)
WE	Wind energy

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