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Overcompensation assessment in relation to the 2013 Flemish green certificates scheme

Prepared for the Vlaams Energie- en Klimaatagentschap

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1 Introduction

1.1 In the late 1990s and early 2000s, EU member states committed to increase the share of renewable energy sources ('RES') in their gross energy consumption.[1] As a result, the EU introduced legislation, such as Directive 2001/77/EC,[2] whereby EU member states adopted indicative targets for the share of electricity from renewable energy sources ('RES-E') in their gross electricity consumption that they could achieve by 2010. Belgium aimed to increase the share of RES-E in its electricity consumption from 1.1% in 1997 to 6.0% in 2010.[3]

1.2 Given the high cost of renewable electricity relative to electricity generated from non-renewable sources at the time (such as coal, natural gas and nuclear energy), the Directive allowed for subsidies to encourage investments in RES-E.[4] Specifically, the Directive incentivised member states to design their own renewable electricity support schemes, including green certificates schemes, with the aim of increasing the share of RES-E in line with EU and national targets, while also limiting the cost to consumers.

1A The functioning of green certificates schemes

1.3 Under a green certificates support mechanism, generators are awarded a certain number of green certificates depending on their production. The green certificates are then purchased by market participants as part of their legal obligation to include a certain amount of RES-generated electricity in their mix. Market participants that fail to meet their obligations are also typically fined to ensure compliance. Policymakers sometimes also guarantee minimum prices for green certificates, thereby ensuring that RES-E generators earn at least a minimum level of revenue for a given quantity of electricity produced.

1.4 The level of support awarded to RES-E producers under a green certificates scheme depends primarily on:

- the length of the period of support;
- the number of certificates awarded to the generator per unit of electricity produced; and

[1] Council Resolution of 8 June 1998 on renewable sources of energy, OJ C 198, 24.6.1998.
[2] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, OJ L 233, 27.10.2001.
[3] Ibid., Annex.
[4] Ibid., paras 12–16 and Article 4.

- the value of the certificates, which is often defined as a minimum value with a penalty applicable if market participants do not purchase a sufficient number of certificates.

1.5 The objective of any RES-E support scheme is to allow generators to earn sufficient revenues to meet the costs of producing electricity. Usually, European regulators calculate a technology-specific levelised cost of electricity ('LCOE'), in line with the European Commission's recommended approach.[5]

1.6 The LCOE represents the price per unit of electricity generated that covers the present value of the costs of producing electricity over a plant's lifetime. In other words, it is the price of electricity that a generator should be paid over the plant's lifetime in order to recoup the costs of producing electricity, including capital investment costs, operating costs and a reasonable rate of return.[6]

1.7 A RES-E producer benefiting from a green certificates scheme generates revenues through:

- selling its electricity production to buyers;
- selling green certificates awarded for RES-E generation to market participants.

1.8 A well-calibrated green certificates scheme that seeks to appropriately compensate investors should ensure that the combination of the revenues derived from the sale of electricity and those derived from green certificates is equal to a plant's LCOE. To do this, regulators usually start by determining the LCOE of RES-E generators, before calibrating the correct level of support by subtracting forecast revenues derived from electricity sales from the LCOE.[7]

1.9 As it would not be practical to assess the LCOE of every single individual plant applying for support under a green certificates scheme to derive the appropriate level of support, policymakers often rely on 'reference plants' or 'reference projects'. This methodology has been accepted by the European

[5] European Commission (2013), 'Commission staff working document—European Commission guidance for the design of renewables support schemes accompanying the document Communication from the Commission—Delivering the internal market in electricity and making the most of public interventions', 5 November, pp. 19–20.
[6] Fraunhofer ISI (2014), 'D5.2: Best practice design features for RES-E support schemes and best practice methodologies to determine remuneration levels', September. For those RES-E technologies that have low and/or predictable operating costs (such as solar PV plants or windfarms), regulators can calculate a LCOE over the plant's lifetime with reasonable accuracy. However, it is more difficult to accurately estimate the LCOE for those technologies that have higher operating costs, including fuel costs (e.g. biogas or biomass plants), as the calculation requires the evolution of such costs to be forecast over the plant's lifetime.
[7] Ibid., p. 30; European Commission (2013), op. cit., p. 20.

Commission in a number of decisions relating to RES-E support schemes.[8] The reference plant is a hypothetical project for which the LCOE is calculated by regulators using standard technological and cost parameters. Regulators expect that the level of support derived for a reference plant will be appropriate for most generators within a class of projects, which is often defined as those projects using the same technology as a reference project.[9]

1B The Flemish green certificates schemes

1.10 In Belgium, the Flemish region introduced such a support mechanism in the form of a green certificates (*groene stroom certificaten* or *GSC*) scheme, open to RES-E producers, on 1 January 2002.[10] Under this scheme, RES-E generators would be awarded one green certificate per MWh of electricity produced.[11] The initial scheme did not stipulate a minimum price of green certificates.[12]

1.11 The scheme was subsequently modified by the Flemish authorities through the introduction of a minimum price of €450 for green certificates awarded to solar photovoltaic (‘solar PV’) producers from 1 January 2006.[13] In the remainder of this report, we refer to the scheme that was notified in 2001, and subsequently modified, as outlined in the Commission’s 2006 decision, as the ‘pre-2013 scheme’.[14]

1.12 In the early 2010s, the Flemish authorities significantly amended the support scheme for those RES-E plants built after 1 January 2013 (the ‘2013

[8] Since the early 2000s, this methodology has been and is still widely used to derive the appropriate level of support for generators in the context of RES-E support schemes. Examples of decisions where the Commission has accepted this methodology are: European Commission (2006), ‘State aid NN 162/A/2003 and State aid N 317/A/2006 – Austria—Support of electricity production from renewable sources under the Austrian Green Electricity Act (feed-in tariffs)’, 4 July, paras 19 and 69; and European Commission (2005), ‘State aid no. N 602/2004 – DK—‘Support to environmentally friendly electricity production’, pp. 7–9 and 12. The Commission has also accepted this methodology in the context of the notification by Belgium of the current Flemish green certificates scheme, where the level of support was calculated using ‘typical parameters’. See European Commission (2018), ‘State Aid SA.46013 (2017/N) – Belgium—Green electricity certificates and CHP certificates in Flanders’, 16 February, para. 20 and tables 1 and 2.

[9] Within a given technology category (e.g. solar PV or windfarms), regulators can also determine sub-categories for which different LCOEs can be calculated (for example, based on generation capacity). This is in line with the approach followed by the Flemish authorities in the context of the current green certificates scheme. See European Commission (2018), ‘State Aid SA.46013 (2017/N) – Belgium—Green electricity certificates and CHP certificates in Flanders’, 16 February, tables 1 and 2.

[10] Belgian Government (2006), ‘Fourth national communication on climate change under the United Nations Framework Convention on Climate Change’, p. 47.

[11] European Commission (2001), ‘Steunmaatregel nr. N 550/2000 – België—Groenestroomcertificaten’, 25 July, p. 2.

[12] The Flemish support scheme was notified to the European Commission in 2001. At the time, the Commission considered that the support scheme did not constitute state aid. For further details, see European Commission (2001), ‘Steunmaatregel nr. N 550/2000 – België—Groenestroomcertificaten’, 25 July.

[13] Decreet houdende algemene bepalingen betreffende het energiebeleid (aangehaald als het Energiedecreet), 8 May 2009 (hereinafter, ‘the 2009 Energy Decree’), Article 7.1.6, §1.

[14] The European Commission approved the modification of the scheme on a ‘no aid’ basis. See European Commission (2006), ‘Steunmaatregel N 254/2006 – België—Fotovoltaïsche panelen’, 24 October.

scheme').[15] The main changes introduced by the authorities for the 2013 scheme relative to the pre-2013 scheme are as follows:

- the minimum certificate price is the same for all technologies;
- the number of certificates awarded to generators depends on the RES-E generator's technology and capacity (kW);
- the appropriate level of support is updated frequently (at least annually) for newly built plants, and the level of support awarded to existing solar PV and windfarms is updated (*actualiseren*) frequently over the support period.

1.13 The Commission considered that the 2013 scheme constituted state aid.[16] Therefore, the Commission assessed the compatibility of the 2013 scheme with the Guidelines on State aid for environmental protection and energy 2014-2020 ('EEAG'), and concluded that the 2013 scheme was compatible with the relevant state aid rules.[17]

1.14 New Guidelines on State aid for climate, environmental protection and energy (the 'CEEAG') were introduced in early 2022.[18] The CEEAG stipulates that 'Member States amend, where necessary, existing (…) aid schemes in order to bring them into line with these guidelines no later than 31 December 2023'.[19] As a result, it needs to be checked that the payments expected to be received by RES-E producers in exchange for their certificates will not lead to overcompensation (i.e. that producers will not achieve an 'excessive' profit).

1.15 While the Commission, in its 2018 decision, assessed whether the 2013 scheme was proportionate, it did not do so for the pre-2013 scheme. Following the introduction of the CEEAG, the Flemish authorities are required to assess whether the pre-2013 scheme leads to any overcompensation, and if so, to eliminate it in order to bring both schemes into line with state aid rules.

1.16 In this context, the Vlaams Energie- en Klimaatagentschap ('VEKA', or 'the agency')[20] asked us to undertake an independent assessment of whether the

[15] Belgium notified this scheme to the Commission in 2017. For further details, see European Commission (2018), 'State Aid SA.46013 (2017/N) – Belgium—Green electricity certificates and CHP certificates in Flanders', 16 February.
[16] Ibid., para. 65.
[17] Communication from the Commission – Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01), OJ C 200, 28.6.2014; and European Commission (2018), 'State Aid SA.46013 (2017/N) – Belgium—Green electricity certificates and CHP certificates in Flanders', 16 February, section 4.
[18] Communication from the Commission – Guidelines on State aid for climate, environmental protection and energy 2022 (2022/C 80/01), OJ C 80, 18.2.2022, para. 108, read in conjunction with paras 51–53.
[19] Ibid., para. 468(a).
[20] VEKA acts as the regulator described in section 1A in relation to the green energy certificate scheme.

pre-2013 scheme would overcompensate specific generators, in order to help the Flemish authorities ensure that any overcompensation is eliminated. We have outlined the approach that we followed for this assessment as well as the results from our analysis of the pre-2013 scheme in a separate report.[21] As set out in our report on the pre-2013 scheme, we found that the pre-2013 scheme overcompensated solar PV plants.

1.17 As explained above, the Commission approved the 2013 scheme in a decision in 2018, finding that the scheme was in line with State aid rules, and in particular, that it would not overcompensate generators.[22] In this report, we assess whether this finding still holds after nearly 10 years of the implementation of the 2013 scheme. In particular, in this report, we undertake an independent review of the 2013 scheme, analysing the risk of overcompensation, given the functioning of the support scheme.

1C Structure of the report

1.18 This report is structured as follows:

- in section 2, we examine whether the green certificates prices underpinning the 2013 schemes for solar PV producers, windfarms and biomass and biogas plants were estimated appropriately, and hence whether the generators are likely to be overcompensated;
- in section 3, we provide our overall conclusions.

[21] Oxera (2022), 'Overcompensation assessment in relation to the pre-2013 Flemish green certificates scheme', 9 June.
[22] European Commission (2018), op. cit., 16 February, section 4.

2 Overcompensation assessment in relation to the 2013 scheme

2.1 In this section, we describe the functioning of the 2013 support scheme, and analyse the risk of overcompensation in light of the scheme's features. Specifically, we start by describing the scheme in section 2A. Based on the functioning of the scheme, we assess the risk of overcompensation for solar PV plants and windfarms (in section 2B) in addition to biofuel plants (in section 2C), accounting for the specific characteristics of these technologies.

2A Description of the 2013 scheme

2.2 As set out in the 2009 Energy Decree, under the 2013 scheme, the minimum price per green certificate no longer depends on a generator's technology or commissioning date: instead, it is fixed at €93 per certificate.[23] This holds for all technologies that receive green certificates. If market participants fail to meet their obligation to purchase a sufficient number of green certificates, they are fined €100 per missing certificate.[24]

2.3 While the minimum certificate price is the same for all technologies, the number of certificates awarded per unit of electricity generated differs. This is determined through the calculation of a 'banding factor.' The banding factor is then multiplied by the amount of electricity produced (expressed in multiples of 1,000kWh, i.e. in MWh) to determine the number of certificates to be awarded to the generator.[25]

2.4 Banding factors are technology-specific: they are calculated based on the unprofitable top (the OT) of each type of technology, based on the reference projects defined by VEKA.[26] The method for calculating the banding factors is described in Box 2.1 below. We note that, by law, banding factors are capped: the Flemish government can impose maximum values for certain parameters of the OT calculation or for the overall banding factor. In any case, the banding factor cannot exceed 1.25 (i.e. generators cannot receive more than 1.25 certificates per MWh of electricity generated).[27]

2.5 Finally, the process of calculating the OT and banding factors for each technology under the 2013 scheme includes a stakeholder engagement

[23] 2009 Energy Decree, Article 7.1.6, §1.
[24] Ibid., Article 13.3.5, §1, 1°.
[25] Ibid., Article 7.1.1, §2.
[26] Ibid., Article 7.1.4/1., §1.
[27] Ibid., Article 7.1.4/1., §4.

exercise.[28] This involves VEKA consulting stakeholders on their draft determinations, allowing stakeholders to submit observations.

Box 2.1 Overview of the calculation of banding factors

Banding factors are calculated using the formula below:

$$B_f = \frac{OT}{BD}$$

Where:

- OT is the project-specific unprofitable top, expressed in €/MWh;
- BD is the denominator of the banding calculation that is specifically used for the purposes of calculating the banding factor, and is equal to €97.[1]

The total number of certificates awarded to a generator is equal to its production (in MWh) multiplied by the banding factor. The banding factor therefore represents the appropriate number of certificates (with a hypothetical value of €97) that VEKA should award the generator per MWh of production in order for the generator to expect to recoup its OT.

We note that the denominator of the banding calculation exceeds the minimum certificate price (€93), but is lower than the fine charged for not fulfilling the obligation to buy green certificates (€100). Due to the incentive structure of green certificates schemes, it is likely that the price at which generators are able to sell green certificates will lie between these two prices. Therefore, using a denominator of €97 may underestimate the actual number of certificates a generator should be awarded in order to recoup its OT compared with a minimum certificate value of €93.

Since the 2013 scheme entered into force, the maximum banding factor has always been set at or below 1, which is below the 1.25 cap from the 2009 Energy Decree.[2] This means that, for those technologies where the theoretical banding factor would exceed the maximum banding factor, the actual banding factor would be set at a level such that the generator would not be able to recoup its OT. Consequently, these generators could be structurally undercompensated.

As a result, we consider that the methodology that has been followed by VEKA to calculate the banding factor is conservative.

Note: [1] As determined in the 2009 Energy Decree, Article 1.1.3. §13. [2] The maximum banding factor has been revised several times and may differ between technologies.

Source: Oxera analysis based on VEKA's annual banding factor calculation reports.

2.6 The support period is equal to the depreciation period that is used to calculate the appropriate level of support for each type of RES-E generator.[29]

2.7 Importantly, in contrast to the pre-2013 scheme, the 2013 scheme includes two key mechanisms aimed at avoiding overcompensation:

- banding factors for new plants are updated at least annually, for all types of RES-E generator.[30] This ensures that VEKA can adapt the level of support awarded to new plants on a regular basis. This mechanism is specifically targeted at avoiding structural overcompensation (i.e. overcompensation that

[28] In line with the 2009 Energy Decree, Article 7.1.4, §3, and as indicated in (for example) VEKA (2013), 'Rapport 2013/2—Deel 1: definitief rapport OT/Bf voor projecten met een startdatum vanaf 1 januari 2014', 28 June, p. 15.
[29] Ibid., Article 7.1.1, §2.
[30] Ibid., Article 7.1.4/1., §1.

occurs due to a miscalibration of the parameters that are used to determine the initial level of support);

- banding factors for existing plants are also updated (*actualiseren*) for non-fuel-based technologies.[31] As a result, the banding factors for existing solar PV plants and windfarms are updated (*actualiseren*) annually. This mechanism is specifically targeted at avoiding ex post overcompensation (i.e. overcompensation that might occur during the operational life of the plant as actual price movements differ from the assumptions used to determine the initial level of support). However, under the 2013 scheme, the banding factors for RES-E fuel-based technologies (i.e. biogas and biomass technologies) are not updated (*actualiseren*) for existing plants over the normal support period.

2.8 We note that, in its 2018 Decision, the Commission concluded that the 2013 scheme was designed in such a way that it would not overcompensate the generators. This was due mainly to the banding mechanism being reviewed annually for new plants and updated (*actualiseren*) for existing plants that do not use fuel as an input (i.e. solar PV plants and windfarms).[32]

2.9 In order to assess whether the 2013 scheme overcompensates generators, we have therefore reviewed the evolution of the banding factors of all technologies since 2013, and examined whether overcompensation is likely to occur based on the way in which the banding factors have been calculated.

2.10 In our report on the pre-2013 scheme, we did not assess the risk of ex post overcompensation: this is because the pre-2013 scheme did not include a mechanism that specifically aims at addressing the risk of ex post overcompensation, in contrast to the 2013 scheme, which includes a banding mechanism for solar PV plants and windfarms. As a result, it is appropriate to analyse the risk of ex post overcompensation under the 2013 scheme by assessing the effectiveness of the mechanism that exists to address this risk, and the implications of its application (for solar PV plans and windfarms) or lack thereof (for biofuel plants).

2.11 The following sections focus on our overcompensation assessment of the 2013 scheme for each type of RES-E technology depending on whether it incurs fuel

[31] Ibid., Article 7.1.4/1., §1 and §4.
[32] European Commission (2018), 'State Aid SA.46013 (2017/N) – Belgium—Green electricity certificates and CHP certificates in Flanders', 16 February, para. 94. The banding factor that is applied to existing plants is updated (*actualiseren*) each year only for those technologies that do not use fuel as an input—that is, the banding factor is updated (*actualiseren*) annually for solar PV plants and windfarms. See 2009 Energy Decree, Article 7.1.4/1, §1.

costs. In particular, section 2B discusses solar PV plants and windfarms. Section 2C then discusses the level of support awarded to biofuel plants.

2B Overcompensation assessment for solar PV producers and windfarms

2.12 Under the 2013 scheme, VEKA calculates a banding factor applicable to newly built solar PV plants and windfarms at least annually. This initial banding factor is then frequently updated (*actualiseren*), in line with the requirements of the 2009 Energy Decree, in order to reflect the evolution of electricity prices.

2.13 Our assessment of whether the 2013 scheme overcompensates solar PV and wind generators therefore first focuses on the calculation of the initial level of support for newly built solar PV and wind plants, in order to check that there is no structural overcompensation for such plants (see section 2B.1). We then assess the likelihood of ex post overcompensation by evaluating the methodology used by VEKA to update (*actualiseren*) the banding factors for existing solar PV plants and windfarms (see section 2B.2).

2B.1 Assessing the likelihood of structural overcompensation for new solar PV plants and windfarms

2.14 In order to determine the initial level of support for new solar PV and wind installations, VEKA estimates the appropriate OT based on a set of assumptions, and calculates the applicable banding factor using the formula set out in Box 2.1. This exercise is carried out on a yearly basis, and sometimes more frequently for certain categories of RES-E generator.

2.15 Our assessment is based on VEKA’s reports where the agency outlines its reasoning and assumptions regarding the main parameters that have been used to derive the initial level of support for newly built generators. In particular, we understand that VEKA uses a combination of publicly available data and insights from surveys of generators (where data is collected on investment and operating costs as well as the price at which electricity is sold by producers) in order to determine the appropriate parameters. We consider that this approach is appropriate, given that it allows the agency to combine Flemish-specific parameters with market evidence to determine the initial level of support.

2.16 From a conceptual point of view, the fact that every year VEKA calculates a new banding factor applicable to newly built generators ensures that the evolution of the main economic and financial parameters is regularly reflected in the estimated level of support awarded to new plants. This approach should therefore ensure that no structural overcompensation occurs, provided that the parameters are estimated correctly.

2.17 In order to determine whether the 2013 scheme involves structural overcompensation of solar PV and wind generators, we have evaluated whether the economic and financial parameters used to derive the level of support are adequately calibrated. If this is the case, we can conclude that it is likely that there is no structural overcompensation under the 2013 scheme. Where possible, we have therefore cross-checked VEKA's assumptions, which are based primarily on surveys of generators, with publicly available evidence to ascertain the reasonableness of the assumptions.

2.18 In Table 2.1 below, we summarise how VEKA has derived the main economic and financial parameters that are used to determine the OT of solar PV and wind generators for new plants. We also comment on the methodology, indicating whether we consider the methodology to be appropriate.

Table 2.1 Methodology used by VEKA to determine the main economic and financial parameters of solar PV and wind generators under the 2013 scheme

Parameter	Methodology for determining the value of the parameter	Oxera comment on implementation
Investment costs	Based on actual investment costs for plants installed over previous year(s).	In principle, the methodology appropriately captures investment costs providing that VEKA focuses on the most recently built generators and accounts for price dynamics between the point in time when the installation was built and when the level of support is determined for the subsequent period. As set out below, we have cross-checked VEKA's assumptions against market data in order to ensure that the methodology appropriately reflects investment costs over time.
O&M costs	Based on actual O&M costs observed over the previous year(s) for existing plants. We also note that certain O&M costs of wind generators are capped.[1]	Similarly to the approach adopted for investment costs, in principle VEKA's methodology is appropriate. As set out below, we have also cross-checked VEKA's assumptions against market data to ensure the appropriateness of the methodology.
Market price of electricity	The price at which electricity is sold by the generator is calculated based on Belgian electricity market indices. A correction coefficient is used to adjust the market index, in order to account for the specific production patterns of solar PV and wind generators. The coefficient is determined	The methodology is appropriate to determine the market price of electricity sold by generators. The use of a correction coefficient is of particular importance in obtaining a representative market price, as solar PV and wind generators have specific production patterns that need to be taken into account in order to estimate an appropriate selling price.

	based on producer surveys undertaken by VEKA.	
Mitigated electricity expenses[2]	Based on non-household consumer prices for the consumption band (i.e. for the range of estimates of the undertaking's electricity consumption, in MWh) that matches the capacity of the reference plant, as reported by Eurostat for Belgium. While some reports mention that actual invoice data has been used for some years, we understand that VEKA based its assumptions for mitigated electricity expenses on Eurostat data, as it was considered representative of actual mitigated costs.	The methodology is appropriate, as it is based on publicly available data and accounts for the fact that a reference plant with a higher electricity consumption would pay less per unit of electricity consumed than a reference plant with a lower consumption. Therefore, the owner of a large installation has a lower saving per kWh through avoided purchases of electricity. We also note that VEKA has checked the appropriateness of using Eurostat data, based on actual invoice data from generators.

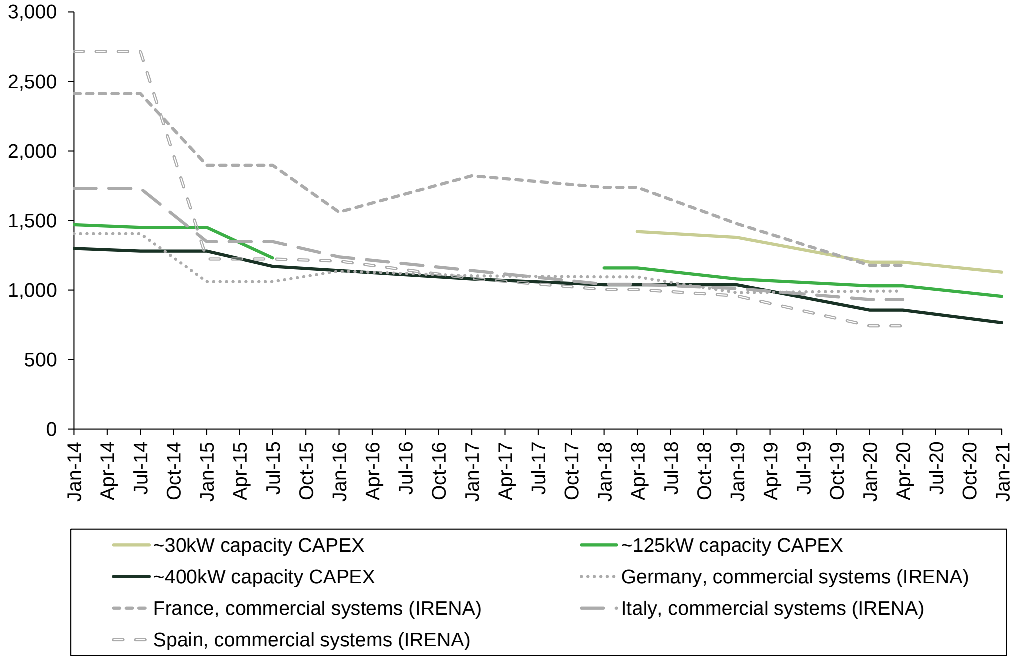
Note: [1] See Energiebesluit van 19 november 2010, Bijlage III/1, p. 24. [2] VEKA assumes that wind generators have 0% self-consumption; therefore this parameter is not relevant for such generators.

Source: Oxera analysis based on VEKA's annual banding factor calculation reports (*deel 1*).

2.19 As set out in Table 2.1, and described in further detail below, we have undertaken cross-checks on the investment cost and operating cost assumptions in order to ensure that VEKA's use of data from recently built generators is appropriate. Specifically, we have compared the evolution of investment costs and O&M costs (which are typically based on service contracts with installers) underpinning VEKA's calculations of the banding factors with the evolution of outturn data on investment costs and O&M costs as reported by the International Renewable Energy Agency ('IRENA'). IRENA compiles information on an annual basis and therefore the data provides a consistent cross-check over the full period since the introduction of the 2013 scheme.

2.20 Figure 2.1 shows that the assumptions used by VEKA for the investment costs of solar PV generators are in line with observed data in comparable EU countries.

Figure 2.1 Investment costs of solar PV generators, VEKA and IRENA comparison (in €/kW)

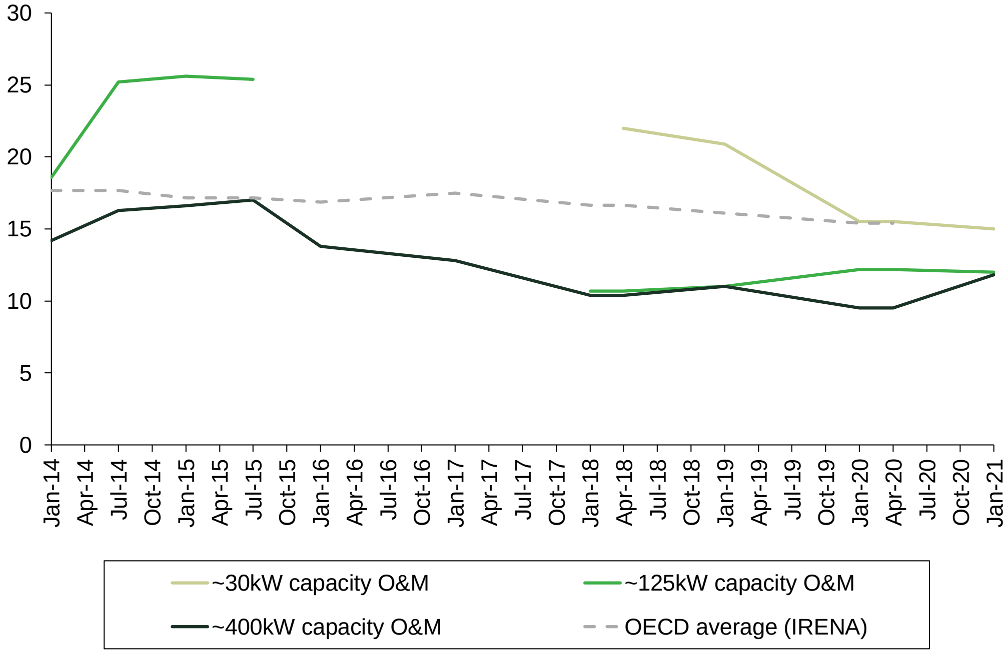


Note: Data from VEKA is compared with data on EU countries reported by IRENA. Data from IRENA reported in constant 2020 US dollars has been converted to euros based on the average 2020 exchange rate and then adjusted for inflation.

Source: Oxera analysis based on VEKA's annual banding factor calculation reports (*deel 1*), and IRENA (2021), 'Renewable Power Generation Costs in 2020', June, p. 77.

2.21 A similar observation holds for O&M costs. As shown in Figure 2.2, on average, the O&M assumptions used by VEKA for different capacities are in line with, or even below, the average O&M costs observed in the OECD.

Figure 2.2 O&M costs of solar PV generators, VEKA and IRENA comparison (in €/kW)

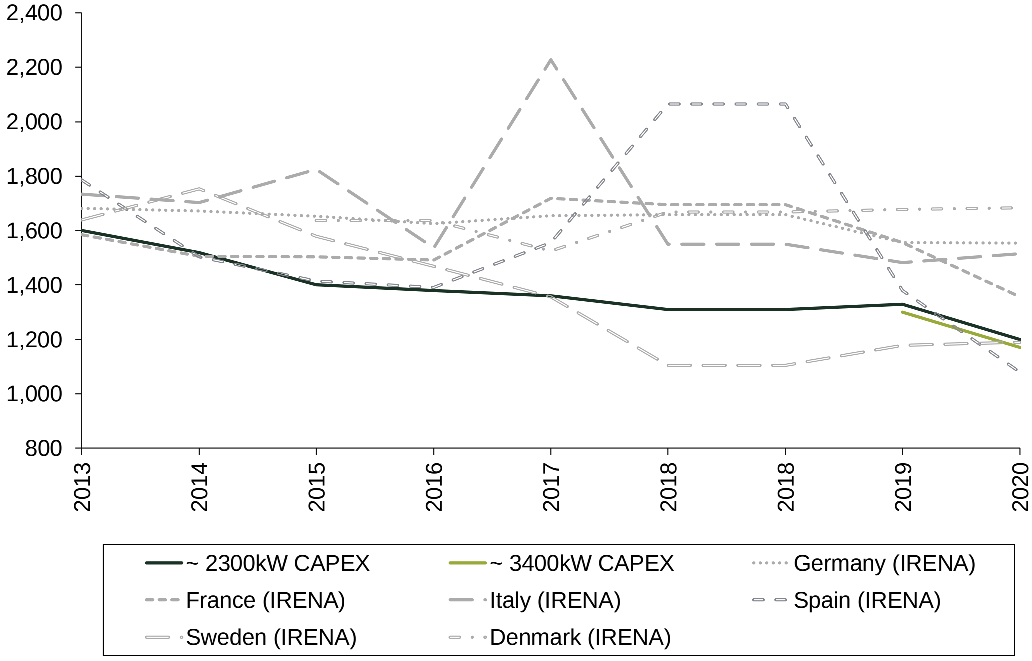


Note: The data reported by IRENA is available only for the OECD average. Data from IRENA reported in constant 2020 US dollars has been converted to euros based on the average 2020 exchange rate and then adjusted for inflation. The O&M costs reported by IRENA may cover cost elements that are not covered by the O&M assumptions used by VEKA.

Source: Oxera analysis based on VEKA's annual banding factor calculation reports (*deel 1*), and IRENA (2021), 'Renewable Power Generation Costs in 2020', June, p. 173.

2.22 Similar observations for both CAPEX and O&M costs can be made for wind generators. In particular, as shown in Figure 2.3 and Figure 2.4 below, VEKA's assumptions for investment and O&M costs of wind generators are broadly within the range of market evidence.

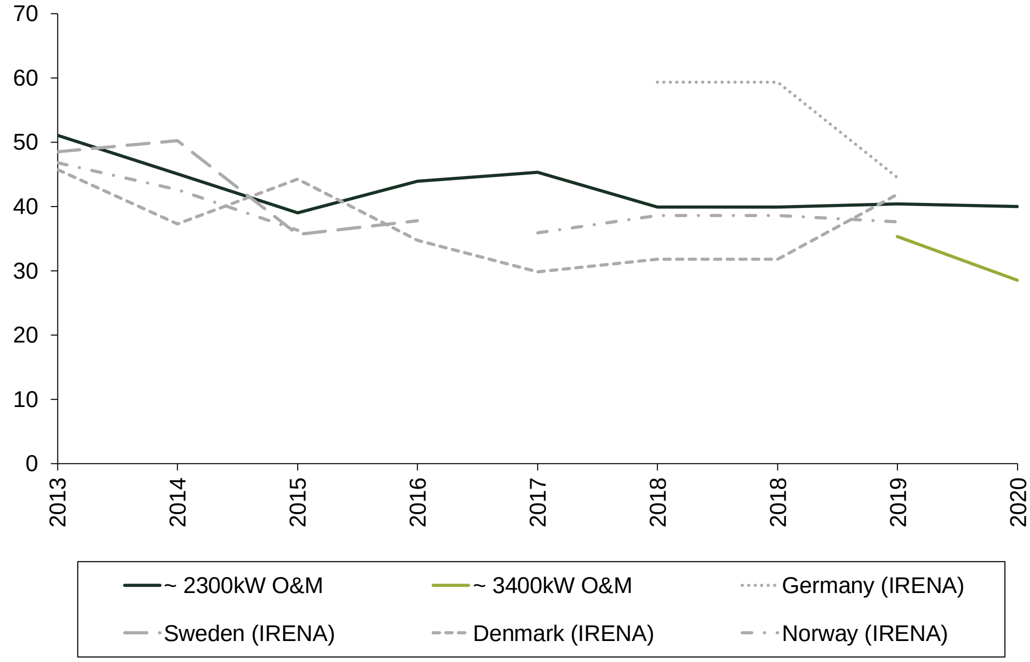
Figure 2.3 Investment costs of wind generators, VEKA and IRENA comparison (in €/kW)



Note: Data from VEKA is compared with data on EU countries reported by IRENA. Data from IRENA reported in constant 2020 US dollars has been converted to euros based on the average 2020 exchange rate and then adjusted for inflation.

Source: Oxera analysis based on VEKA's annual banding factor calculation reports (*deel 1*), and IRENA (2021), 'Renewable Power Generation Costs in 2020', June, p. 56.

Figure 2.4 O&M costs of wind generators, VEKA and IRENA comparison (in €/kW)



Note: Data from VEKA is compared with data on European countries reported by IRENA, with sufficient data points over the 2013–20 period. Data from IRENA reported in constant 2020 US dollars has been converted to euros based on the average 2020 exchange rate and then adjusted for inflation. The O&M costs reported by IRENA may cover cost elements that are not covered by the O&M assumptions used by VEKA.

Source: Oxera analysis based on VEKA's annual banding factor calculation reports (*deel 1*), and IRENA (2021), 'Renewable Power Generation Costs in 2020', June, p. 61.

2.23 Overall, our assessment of the 2013 scheme leads us to conclude that there is no structural overcompensation for solar PV and wind generators in relation to newly built plants.

2B.2 Assessing the likelihood of ex post overcompensation for existing solar PV plants and windfarms

2.24 In addition to calculating a new banding factor for newly built plants at least once a year, VEKA updates (*actualiseren*) the banding factor of existing solar PV plants and windfarms on an annual basis. We have assessed the appropriateness of this methodology.

2.25 The aim of the updating is to avoid the risk of ex post overcompensation, by correcting the electricity prices that are used to calculate the OT compared with the assumptions that underpinned the estimates of the initial level of support, which are based on forecasts of the cost of electricity over the full support period. This approach is followed in order to avoid increasing electricity prices leading to generators achieving returns above reasonable levels.

2.26 In particular, the market price of electricity (i.e. the price at which solar PV and wind generators sell electricity), as well as (in the case of solar PV) the mitigated electricity expenses, are updated (*actualiseren*). Based on VEKA's OT models, we understand that, in order to update (*actualiseren*) the banding factor, VEKA recalculates the OT incorporating outturn data on electricity prices as it becomes available. If actual prices exceed the assumptions in the original OT calculation, the level of support in the subsequent year will decrease (as generators' revenues exceed the initial expectations).

2.27 Importantly, we also understand, based on a review of VEKA's OT models and discussions with VEKA, that, in any given year, VEKA also includes the value of green certificates that have been awarded for the previous year's production. This ensures that the calculation of the appropriate OT going forward accounts for any deviations between forecast and actual electricity prices in previous years, as well as the evolution of the level of support received by generators between the point in time when the plant was commissioned and the date of the updating.

2.28 If electricity prices increased substantially, VEKA would have the option to adjust future support through this mechanism. Only in the final year of the support period would VEKA not be able to correct for changes in electricity prices, which could potentially lead to overcompensation. Overcompensation could also arise if extreme price increases occurred in a given year during the support period. Although VEKA could revise the banding factor to zero in the subsequent year, i.e. no longer grant certificates, the installations could still generate revenues from the sale of electricity in subsequent years, which could potentially result in overcompensation on an ex post basis.

2.29 However, overall, based on our review of VEKA’s modelling underlying the updates (*actualiseren*) of the banding factors applicable to existing plants, for the reasons outlined above, we consider that it is unlikely that the 2013 scheme materially overcompensates generators on an ex post basis.

2C Overcompensation assessment for biomass and biogas plants

2.30 Under the 2013 scheme, VEKA calculates, at least once a year, a banding factor that will be applied to biomass and biogas plants that will be built during the following year. Once it has been estimated, the initial banding factor applied to these generators does not change in subsequent years. Therefore, in contrast to solar PV plants and windfarms, VEKA does not update (*actualiseren*) the banding factor applicable to existing biomass and biogas plants over time.

2.31 If VEKA correctly determines the initial level of support, structural overcompensation should be avoided. Section 2C.1 therefore discusses whether the initial banding factors applicable to newly built biomass and biogas plants are set using appropriate methodologies and assumptions. We also analyse the banding factors that have been set by VEKA between 2013 and 2021 for newly built biomass and biogas plants, in order to inform our assessment of the risk of overcompensation.

2.32 Given the absence of any annual updates (*actualiseren*) of the banding factor for existing plants, we then assess the likelihood that existing biomass and biogas plants have been overcompensated on an ex post basis in section 2C.2.

2C.1 Assessing the likelihood of structural overcompensation for newly built plants

2.33 VEKA determines the initial level of support for newly built plants by calculating the appropriate OT and banding factor based on a set of assumptions (see Box

2.1 for more details). VEKA then applies this banding factor to new generators, at least once a year.

2.34 As a first step, similarly to the analysis undertaken in section 2B.1 for solar PV plants and windfarms, we evaluate VEKA's reasoning and assumptions regarding the main parameters for newly built biomass and biogas plants based on its reports.

2.35 VEKA's reports are based on different methodologies depending on the year and the specific biomass or biogas plant considered. Various sources, such as publicly available data (i.e. market evidence), previous VITO reports and insights from surveys of generators (i.e. Flemish-specific evidence), are used by VEKA to determine the parameter values.

2.36 Table 2.2 summarises how VEKA derives the main economic and financial parameter values that are used to determine the OT of newly built biomass and biogas plants. We have reviewed the approach followed by VEKA to determine the parameters, and we set out our view on the appropriateness of VEKA's methodology for each parameter in the table.

Table 2.2 Methodology used by VEKA to determine the main economic and financial parameters of biomass and biogas plants in the 2013 scheme

Parameter	Methodology for determining the value of the parameter	Oxera comment on VEKA's methodology
Investment costs	Depending on the technology and the year, investment costs are based on data from existing plants in Flanders; previous VITO reports; bioenergy platforms; previous VEKA reports; independent studies; and/or the results from surveys of generators in previous year(s).	In principle, the methodology appropriately captures investment costs providing that VEKA focuses on the most recently built generators and accounts for price dynamics between the point in time when the installation was built and when the level of support is determined for the subsequent period. Given the specificity of some technologies, it is appropriate for VEKA to rely on Flemish-specific data. Nevertheless, as discussed below, we have checked (at a high level) the assumptions used by the agency against market data to ensure that VEKA's assumptions reflect international trends.
O&M costs	Depending on the technology and the year, O&M costs are based on previous VITO reports; previous VEKA reports; independent studies; and/or the results from surveys of generators in previous year(s).	In principle, the methodology appropriately captures O&M costs providing that VEKA focuses on the most recently built generators and accounts for price dynamics between the point in time when the installation was built and when the

		level of support is determined for the subsequent period.
Market price of electricity	The parameter is based on Belgian electricity market indices.	This methodology is appropriate.
Mitigated electricity expenses	Depending on the year and reference plant, the parameter is based on (adjusted) Belgian electricity market indices or the most recent Eurostat data on electricity prices (for Belgium). An adjustment is made to account for different consumption bands (i.e. the range of the undertaking's electricity consumption, in MWh) depending on the capacity of the reference plant.	The methodology is appropriate, as it is based on publicly available data and accounts for the fact that a reference plant with higher electricity consumption would pay less per unit of electricity consumed than a reference plant with a lower consumption. We also note that VEKA has checked the appropriateness of using Eurostat data, based on actual invoice data from generators.
Mitigated primary fuel expenses	Depending on the year and reference plant, this parameter is based on Belgian natural gas market indices or the most recent Eurostat data on natural gas prices (for Belgium). An adjustment is made to account for different consumption bands (i.e. the range of the undertaking's fuel consumption) depending on the capacity of the reference plant.	The methodology is appropriate, as it is based on publicly available data and accounts for the fact that a reference plant with higher fuel consumption needs would pay less per unit of fuel consumption than a reference plant with lower consumption.
Input and output costs/revenues[1]	Depending on the technology and year, the parameter is based on previous VITO reports and/or the results from surveys of generators in the previous year(s).	The methodology is appropriate. We understand from discussions with VEKA that contracts related to inputs and outputs are concluded on a bilateral basis: therefore, they are best approximated by surveys of existing generators, in line with the approach followed by VEKA.
Price of fuel	Depending on the technology and year, the parameter is based on previous VITO reports; data from various sources (e.g. World Bank, OVAM, ECN, VREG, and Inagro); existing contracts of representative projects; and/or results from surveys of generators in the previous year(s).	This methodology is appropriate.

Note: [1] Input and output costs and revenues relate to the operations of biogas plants: for these technologies, inputs (such as organic waste) are used to generate the gas that powers the plant; outputs are the by-products of the chemical process.

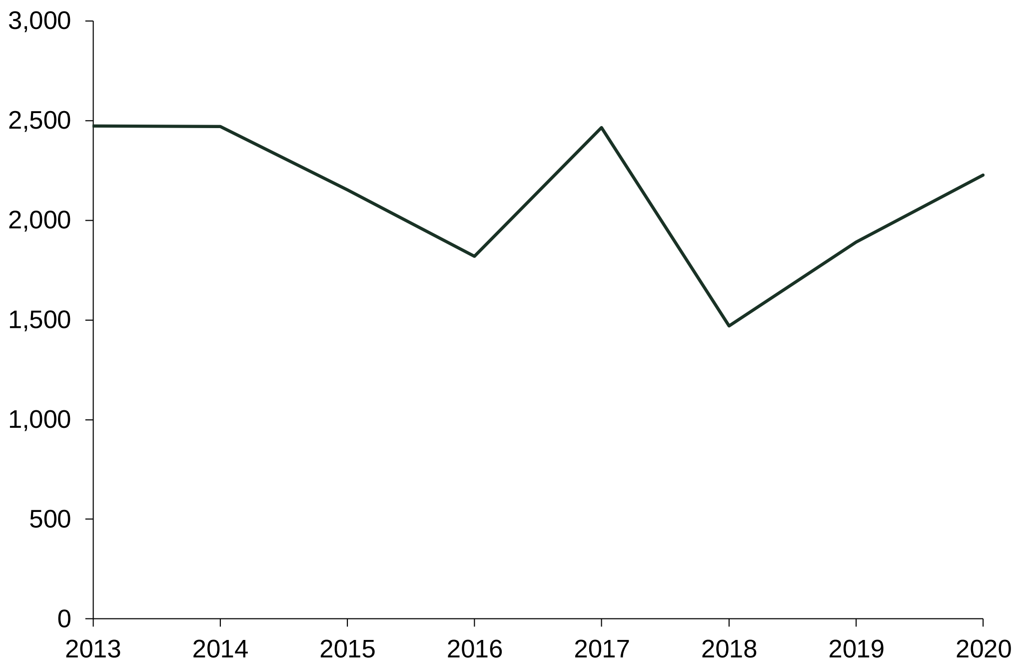
Source: Oxera analysis based on VEKA's annual banding factor calculation reports (*deel 1*).

2.37 As set out in the above table, we consider that it is appropriate for VEKA to rely on data from existing Flemish plants to determine the parameter values, in particular input and output costs and revenues, as well as fuel prices, in order to derive the initial level of support for biomass and biogas plants.

2.38 In contrast to our analysis for solar PV plants and windfarms, as there are very limited independent sources of data available for the various biomass and biogas plants, and due to the specificity of some biomass and biogas installations, we have not undertaken an exhaustive cross-check of the parameters for the various biomass and biogas plants.

2.39 While consistent and specific data on the costs of biomass or biogas plants cannot be easily obtained, we note that IRENA does show that the average investment costs of bioenergy plants have not fallen significantly over the past decade, in contrast to the sharp decrease in the costs of solar PV plants and windfarms. This is shown in Figure 2.5 below.

Figure 2.5 Global average investment costs of bioenergy plants (in €/kW)



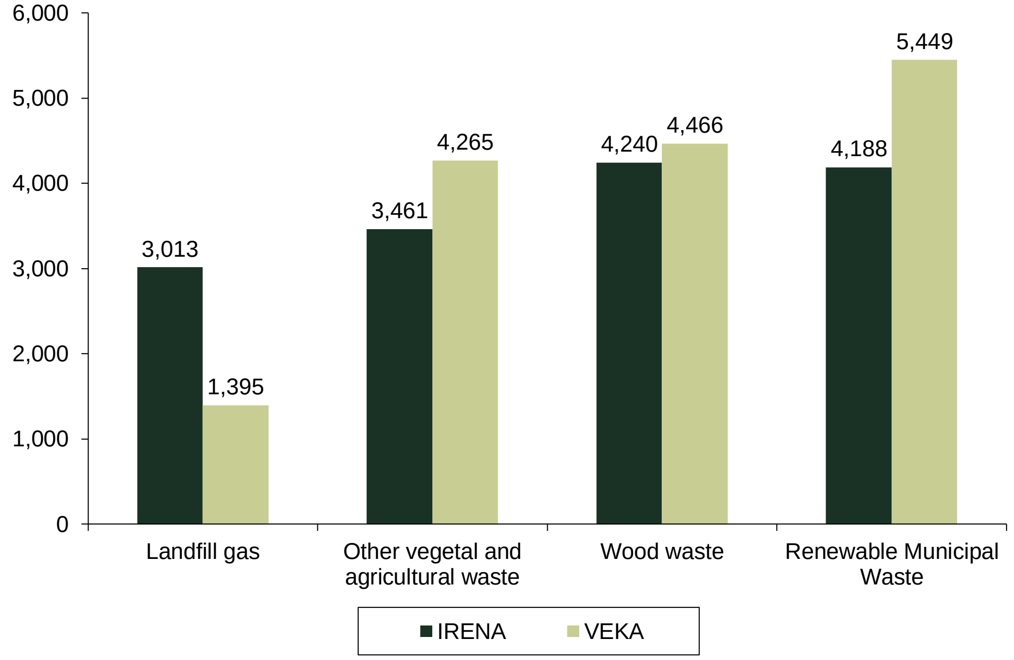
Note: Data from IRENA reported in US dollars has been converted to euros based on the average 2020 exchange rate. Global average investment costs for bioenergy projects in any given year depend on the geographic and technology mix of the installed projects.

Source: IRENA (2021), 'Renewable Power Generation Costs in 2020', June, p. 141.

2.40 In order to control for geographic and technological differences with regard to investment costs of bioenergy, we have also examined the investment costs of bioenergy plants in Europe, depending on the technology (see Figure 2.6).

2.41 Figure 2.6 compares the average investment costs for different technologies, as reported by IRENA, with the average investment costs for the corresponding categories used by VEKA. The results show that the different cost assumptions adopted by VEKA are within the range of the market evidence from IRENA. In particular, while IRENA reports higher costs than VEKA for landfill gas, both IRENA and VEKA indicate that the investment costs associated with this technology are lower than for other technologies.

Figure 2.6 Average investment costs of bioenergy plants in Europe, depending on the technology (in €/kW)



Note: Data from IRENA reported in US dollars has been converted to euros based on the average 2020 exchange rate. Data from VEKA from 2013 to 2020 has been adjusted for inflation and an average has been calculated.

Source: IRENA (2021), 'Renewable Power Generation Costs in 2020', June; VEKA's annual banding factor calculation reports (*deel 1*).

2.42 Overall, we consider that the methodologies adopted by VEKA are appropriate, particularly in light of the specificities of bioenergy technologies, and that they are corroborated (albeit at a high level) by international evidence available in the public domain.

2.43 We have also reviewed the banding factors calculated by VEKA for newly built plants under the 2013 scheme. The banding factors are set out in Table 2.3 below. Specifically, Table 2.3 shows that the theoretical banding factors for the majority of plants were either zero or above the maximum banding factor across the different years. As outlined in Box 2.1, the 2013 scheme uses the maximum banding factor (cap) if the theoretical value exceeds the maximum value. Consequently, plants with a capped banding factor structurally received fewer certificates than they would need to recoup their OT.

2.44 This implies that (assuming the OT and the banding factors were correctly calculated) the 2013 scheme is more likely to result in under- rather than overcompensation for the majority of biomass and biogas plants.

2.45 Therefore, for most technologies, as set out above, structural overcompensation is unlikely to arise for newly built biomass or biogas plants under the 2013 scheme, given that:

- the OT and banding factors applied to new plants are calculated at least once a year;
- the reasoning and parameter values used by VEKA to determine the OT and the banding factors are appropriate (at least to the extent that data is available in order to be able to evaluate this quantitively);
- since 2013, for the majority of plants, the theoretical banding factors are either zero (meaning that plants do not receive support at all) or above the cap (meaning that plants do not receive sufficient support to recoup their OT).

2.46 However, we do note that there could be a greater risk that the parameters underpinning the reference plants for biomass and biogas have been miscalibrated compared to the other technologies, such as solar PV and windfarms. In particular, as data availability is more limited for biogas and biomass technologies (as we also highlight in paragraph 2.38 and 2.39), this is likely to make it more difficult to determine appropriate parameter values.

2.47 Moreover, given the range of different types of biomass and biogas installations, it may also be more challenging to determine parameters that have the same level of technology-specificity as the parameters used in the assessment of widely-used technologies such as solar PV and windfarms. These factors contribute towards there being a comparatively greater risk that the parameters underpinning the biomass and biogas reference installations have been miscalibrated compared to solar PV and windfarms. A miscalibration of parameters could potentially lead to overcompensation or undercompensation.

2.48 In order to identify the possible technologies for which the parameters may have been miscalibrated, we have identified those technologies for which the banding factor has decreased significantly from one year to the next. There is a risk of miscalibration, in particular, if the banding factor decreases to a level that is below the maximum banding factor, or even to 0.

2.49 Such a situation might be indicative of overcompensation in that a sudden decrease of the banding factor would normally result from a (probably significant) change in a key parameter associated with the reference plant from one year to the next. This might indicate that the banding factor initially awarded to these technologies before the change may have been determined based on inappropriately calibrated underlying assumptions. Furthermore, if the banding factor in the subsequent year is calculated to be below the cap or indeed equal to 0, then it would mean that the banding factor calculated before the change was overcompensating generators (given that the same level of electricity production would result in a higher number of certificates being awarded prior to the change).[33]

2.50 Based on Table 2.3, we consider that the reference plants associated with biogas plants using sewage sludge as fuel and biomass waste plants might have been miscalibrated.[34] These are the technologies for which the banding factor has decreased to zero from one year to the next.

2.51 Based on information provided by VEKA, we consider that there is no risk of overcompensation for biogas plants using sewage sludge. This is because, at the time of writing this report, based on information from VEKA, there are no plants that use this technology that receive green certificates under the 2013 scheme.

2.52 However, we understand that there might be the potential for biomass waste plants to be overcompensated, in so far as the banding factor applicable to a number of plants using this technology with a significant production capacity decreased significantly between 2019 and 2020. Specifically, as shown in Table 2.3, the banding factor applicable to such plants was estimated in 2019 to be 0.80—i.e. at the level of the cap (while the theoretical banding factor was 0.96). In the following year in 2020, the banding factor applicable to such plants declined to 0. As noted in paragraphs 2.48–2.49, this might be indicative of overcompensation.

2.53 After discussions with VEKA and assessing the calculations carried out by the agency in 2019 and 2020, we understand that the sharp decrease in the banding factor was caused by a change of a parameter relating to the technical design of the reference plant. Specifically the thermal efficiency assumption for the reference plant for such technologies increased from 15.0% in 2019 to

[33] On the other hand, if the banding factor decreases significantly but remains above the cap, then the likelihood of overcompensation remains limited for the reasons outlined in paragraphs 2.43–2.44.
[34] In particular, Table 2.3 shows that the relevant banding factors for sewage sludge and biomass waste have decreased to zero in 2016 and 2020 respectively.

48.8% in 2020 (while the electrical efficiency[35] decreased slightly, from 28.4% to 18.4%).[36]

2.54 Based on discussions with VEKA, we understand that the change in these parameters was due to new biomass plants commissioned as of 1 July 2019 being required to be designed to achieve a high thermal efficiency, a requirement that did not exist previously. As a result, the banding factor applicable to some large, high thermal efficiency, biomass plants was set equal to 0.80 in 2019 (i.e. reflecting the lower thermal efficiency of the reference plant), rather than the banding factor that was subsequently introduced in 2020 (i.e. 0) that would have been more reflective of their technical design (i.e. high thermal efficiency).

2.55 Therefore, we consider that the change in the value of this parameter does not imply that the previous values were inappropriate. Instead, we understand that the change was intended to reflect a new technical requirement that was introduced for new plants. As a result, the technical design of the reference plant was required to change to ensure consistency with the new requirements, rather than as a result of the reference plant being miscalibrated in previous years.

[35] The electrical efficiency refers to the yield of electrical power relative to the usage of an input.
[36] VEKA (2018), 'Rapport 2018/2—Deel 1: Rapport OT/Bf voor projecten met een startdatum vanaf 1 januari 2019', 1 July, section 12.5 and VEKA (2019), 'Rapport 2019—Deel 1: Rapport OT/Bf voor projecten met een startdatum vanaf 1 januari 2020', 1 July, section 13.5.

Table 2.3 VEKA’s banding factors of biomass and biogas technologies between 2013 and 2021

Technology	2013		2014		2015		2016		2017		2018 Q1		2018 Q2-4		2019		2020 Q1		2020 Q2-4		2021	
	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap	BF	BF cap
Biogas: agricultural (U ≤ 5MWe)	1.59	1.00	1.76	1.00	1.97	1.00	1.53	1.00	1.24	1.00												
Biogas: agricultural (5MWe < U ≤ 20MWe)	1.24	1.00	1.31	1.00	1.48.	1.00	1.31	1.00	1.12	1.00												
Biogas: agricultural/industrial (10KWe < U ≤ 5MWe)											1.15	1.00	1.02	0.80	1.13	0.80	1.04	0.80	0.93	0.80	0.82	0.76
Biogas: agricultural/industrial (5MWe < U ≤ 20MWe)											1.19	1.00	1.04	0.80	1.15	0.80	1.03	0.80	0.93	0.80	0.75	0.75
Biogas: fermentation of green waste (U ≤ 5MWe)	2.12	1.00	2.39	1.00	2.47	1.00	2.84	1.00	3.04	1.00												
Biogas: fermentation of green waste (5MWe < U ≤ 20MWe)	1.48	1.00	1.55	1.00	1.63	1.00	1.91	1.00	2.10	1.00												
Biogas: fermentation of green waste (10KWe < U ≤ 5MWe)											3.01	1.00	2.45	0.80	2.49	0.80	2.36	0.80	1.98	0.80	2.01	0.76
Biogas: landfill (U ≤ 5MWe)	0.20	0.20	0.24	0.24	0.29	0.29	0.40	0.40	0.56	0.56												
Biogas: landfill (5MWe < U ≤ 20MWe)	0.00	0.00	0.04	0.04	0.10	0.10	0.24	0.24	0.40	0.40												
Biogas: sewage sludge (U ≤ 5MWe)	0.21	0.21	0.33	0.33	0.37	0.37	0.00	0.00	0.00	0.00												
Biogas: sewage sludge (5MWe < U ≤ 20MWe)	-0.00	0.00	0.08	0.08	0.12	0.12	0.00	0.00	0.00	0.00												
Biogas: other (U ≤ 5MWe)	1.66	1.00	1.84	1.00	1.91	1.00	2.99	1.00	2.85	1.00												
Biogas: other (5MWe < U ≤ 20MWe)	1.33	1.00	1.41	1.00	1.46	1.00	2.47	1.00	2.33	1.00	1.19	1.00	1.04	0.80	1.15	0.80	1.03	0.80	0.93	0.80	0.75	0.75
Solid biomass (10KWe < U ≤ 20MWe)	0.98	0.98	1.04	1.00	1.22	1.00	1.22	1.00	2.38	1.00	2.51	1.00	2.15	0.80	2.39	0.80	3.04	0.80	2.76	0.80		
Liquid biomass (10KWe < U ≤ 20MWe)	1.19	1.00	1.41	1.00	1.33	1.00	1.72	1.00	1.98	1.00	2.04	1.00	1.85	0.80	1.86	0.80	1.96	0.80	1.89	0.80		
Biomass waste (10KWe < U ≤ 20MWe)	0.83	0.83	0.88	0.88	0.94	0.94	0.58	0.58	1.24	1.00	1.28	1.00	1.01	0.80	0.96	0.80	0.00	0.00	0.00	0.00		
Household or industrial waste (10KWe < U ≤ 20MWe)	-0.08	0.00	0.05	0.05	0.00	0.00	0.00	0.00														

Note: The table shows banding factors as presented by VEKA. The ‘BF’ columns show the theoretical banding factors, calculated by VEKA based on the OT. The ‘BF cap’ columns show the banding factors that have been implemented in practice, which take into account the maximum banding factors. ‘U’ refers to the capacity of the plant.

Source: Oxera analysis based on VEKA’s annual banding factor calculation reports (*deel 1*).

2C.2 Assessing the likelihood of ex post overcompensation for existing plants

2.56 In contrast to VEKA's approach for solar PV plants and windfarms, the agency does not update (*actualiseren*) the banding factors for existing biomass and biogas plants. Since the aim of updating the banding factors is to avoid ex post overcompensation by correcting for the subsequent evolution of various prices (such as electricity prices), we have considered the implications of the lack of updates (*actualiseren*) for whether biomass and biogas plants might have been overcompensated.

2.57 Unlike solar PV plants and windfarms, the operating costs of biomass and biogas plants, and in particular fuel costs, are significant. When the 2013 scheme was introduced, the legislator motivated its decision not to introduce an annual update (*actualiseren*) of the banding factor for biomass and biogas plants on the assumption that higher electricity prices in the market would be compensated by higher fuel costs, such that the OT would remain broadly constant despite variations in both the revenue and cost parameters.[37] In general, we consider that this argument is valid only under specific circumstances.[38]

2.58 Another (similar) argument that could be put forward to justify this approach is that if generators were to achieve significant profits in any given year due to unforeseen price developments regarding electricity prices or fuel costs, it might be compensated by variations having a compensating effect later such that there is no overcompensation over the full period of support.

2.59 While we acknowledge that there is some merit to these arguments, we consider that the lack of an annual updating of the banding factors might lead to ex post overcompensation (or, symmetrically, undercompensation) if there is a sustained disconnect between the dynamics observed for the revenue parameters (i.e. electricity prices) on the one hand and the cost parameters (i.e. mainly fuel costs) on the other.

[37] Flemish Parliament (2012), 'Voorstel van decreet van de heren Bart Martens en Robert Bothuyne, de dames Liesbeth Homans, Michèle Hostekint en Sonja Claes, en de heren Marc Hendrickx en Dirk de Kort', Stuk 1639 (2011-2012) – Nr. 1, 29 May, p. 8.

[38] Specifically, this would be true when biomass or biogas plants set the price for the whole market under electricity market price formation rules. The assumption would hold when the (short-term) market price of electricity is set by the 'marginal plant', i.e. by the plant supplying the last unit of electricity demand. Under this model, plants are ranked according to their 'merit order', i.e. by the price at which they are willing to supply electricity. In an assessment of the merit order curve in Germany in 2017, Blume-Werry, Faber, Hirth, Huber and Everts show that biomass plants rarely represent the marginal plant, which may be due to significant coal- and gas-fired generation capacities, which often constitute the marginal plant. See Blume-Werry, E., Faber, T., Hirth, L., Huber, C. and Everts, M. (2018), 'Eyes on the Price: Which Power Generation Technologies Set the Market Price? Price Setting in European Electricity Markets: An Application to the Proposed Dutch Carbon Price Floor', FEEM Working Paper No. 34.2018, December.

2.60 In Table 2.3, we showed that many technologies have an initial theoretical banding factor that was calculated by VEKA to be above 1. This implies that these generators are likely to be structurally undercompensated, as the number of certificates they receive does not allow them to recoup their OT. For these plants, diverging price dynamics between the revenue and cost parameters would not necessarily lead to overcompensation. For example, it might decrease the theoretical banding factor (were it to be updated (*actualiseren*)), but it might not reduce it sufficiently for it to fall below 1. If such a situation were to arise (i.e. the theoretical banding factor were to fall below 1), an appropriate banding factor would imply that the generator would have to generate more than 1MWh of production in order to receive a certificate, when it actually receives one certificate per MWh of production under the initial banding factor.

2.61 To illustrate this, consider the example of a technology which has an initial theoretical banding factor of 1.5. This banding factor would be brought back to 1 as a result of the cap on the banding factor, as explained in section 2A. If the banding factor were updated (*actualiseren*) annually to mitigate the risk of potential ex post overcompensation, and if this update (*actualiseren*) were to result in a theoretical banding factor of 1.2, the cap would still be binding, resulting in a level of support below what is required by the generator to recoup its OT.

2.62 In the case of technologies that have a theoretical initial banding factor that is above 1, even if annual updates (*actualiseren*) would lead to the banding factor falling below 1, it is possible that overcompensation might not arise over the full duration of the period of support. For example, while the generator would still be awarded one certificate per MWh of production when it should receive less if the banding factor had been updated (*actualiseren*), the difference could compensate for previous undercompensation arising from the cap applying to the theoretical initial banding factor. However, it is also possible that the cumulative ex post overcompensation might exceed the initial undercompensation over the entire support period.

2.63 Therefore, ex post overcompensation is more likely to arise for those technologies for which the initial banding factor was calculated to be between 0 and 1. For these technologies, it is more likely that the absence of any annual updates (*actualiseren*) to the initial banding factor might lead to ex post overcompensation. Based on Table 2.3, we understand that this would affect only a limited number of technologies. Specifically, the banding factor for biogas plants using landfill gas or sewage sludge as fuel and biomass waste plants ranged between 0 and 1 in the early years of the 2013 scheme.

2.64 We have previously discussed the risk of structural overcompensation for sewage sludge and biomass waste plants. To analyse whether there is a risk that such technologies have been overcompensated on an ex-post basis, we have first assessed the number of green certificates that have been awarded to these technologies. Based on the information that we received from VEKA, these technologies either have a limited use in practice (i.e. only very few plants using landfill, sewage sludge or biomass waste were built after 2013) or receive a limited number of green certificates, meaning that they are likely to fall below the *de minimis* threshold.[39]

2.65 Second, as an illustrative example, we have performed a more in-depth (theoretical) analysis for one technology—namely, biogas plants using biomass waste as fuel—by analysing the effect of updating the banding factor. In particular, we have recalculated the banding factor for a plant using biomass waste with an initial start date in 2014 by correcting for electricity and fuel prices in the following years (using data from the VEKA reports).[40]

2.66 Table 2.4 shows that the banding factor fluctuates over time, i.e. the banding factor ranges from 0.588 to 0.933 using updated (*actualiseren*) electricity and fuel prices. While we do not see an exact reversion to the initial value, the theoretical banding factor, if it were to be updated (*actualiseren*) on an annual basis, would vary either above or below the initial banding factor, depending on the year.

[39] Specifically, with a €93 certificate price, a generator would need to receive approximately 715 certificates to receive compensation above the *de minimis* threshold (dividing the *de minimis* threshold of €200,000 by three consecutive years, and then by €93 per certificate). For a generator with a banding factor equal to 1 (i.e. one that is awarded one certificate per MWh of production), this amounts to 715MWh of electricity production per year. When the banding factor is below 1, the amount of production that is necessary to receive a sufficient number of certificates such that the amount of aid exceeds the *de minimis* threshold increases (as generators need to produce more than 1MWh to receive one certificate).
[40] Annual VEKA reports (*deel 1*), such as VEKA (2014), 'Rapport 2014/1—Deel 1: definitief rapport OT/Bf voor projecten met een startdatum vanaf 1 januari 2015'.

Table 2.4 Update (*actualiseren*) of the banding factor for a plant using biomass waste

	Banding factor
2014	0.884
Update in 2015	0.933
Update in 2016	0.588
Update in 2017	0.860
Update in 2018	0.892
Update in 2019	0.782
Update in 2020	0.599
Average	**0.791**

Note: The banding factor is updated (*actualiseren*) each year based on the evolution of electricity and fuel prices in the previous year, in line with VEKA's approach.

Source: Oxera analysis.

2.67 Overall, we consider that the scheme is compliant, given that the risk of overcompensation is limited to ex post overcompensation, and even then only a limited number of technologies are exposed to such risk. We also note that, in practice, the technologies that might be at risk of being overcompensated have seen limited take-up, such that the scope for meaningful overcompensation is likely to be limited.

2.68 Where the risk of ex post overcompensation arises, it might be desirable for VEKA and the Flemish authorities to implement a specific mechanism targeted at mitigating that risk. This might take the form of an one-off adjustment that could be triggered under specific circumstances, for example if the dynamics of electricity prices or fuel costs diverge significantly from the forecasts included in the calculation of the initial level of support. In such a situation, if the appropriate banding factor for existing plants were to be recalculated, this might significantly reduce the risk of ex post overcompensation.

3 Conclusions

3.1 We have investigated whether the 2013 scheme may overcompensate RES-E generators. We have undertaken this assessment by considering the evolution of the banding factors for all technologies since 2013,[41] as well as evaluating the methodology underpinning the calculation of the banding factors.

3.2 We have not identified any evidence of structural overcompensation for newly built plants using solar PV installations or windfarms. This follows from our review of both the conceptual structure of the 2013 support scheme for wind and solar PV, and an evaluation of the appropriateness of the calibration of the economic and financial parameters for newly built plants.

3.3 We have also assessed the methodology for updating the banding factors of existing solar PV plants and windfarms. Although ex post overcompensation is not fully precluded, it is unlikely that the 2013 scheme materially overcompensates generators.

3.4 We have also considered whether there is a risk that newly built biomass and biogas plants might be structurally overcompensated under the 2013 scheme. Given that the OTs and banding factors were calculated annually based on the available information, the parameters appear to have been calibrated appropriately, and the majority of technologies have either received no support or received support that is below the OT since 2013, and therefore structural overcompensation is unlikely to arise. We have, however, noted that the risk of miscalibration is comparatively higher for biomass and biogas plants relative to solar PV and wind installations. We have also carried out cross-checks for installations for which this may have occurred.

3.5 Finally, we have considered whether existing biomass and biogas plants might have been overcompensated on an ex post basis, given that the banding factors are not updated (*actualiseren*) annually for these plants. We note that, in practice, the OTs of existing biomass and biogas plants vary over time, in contrast to VEKA's current approach, which keeps the banding factor constant over the full support period. Failing to take into account these fluctuations may lead to ex post overcompensation. However, there is only a risk that the lack of annual updates (*actualiseren*) to the banding factor could lead to ex post

[41] Banding factors determine the number of certificates that an installation receives per MWh of electricity produced. Banding factors are calculated by dividing a technology-specific OT by a scaling factor. For further discussion on the banding factors, see section 2A.

overcompensation for a handful of technologies, and the take-up of these technologies has been very limited. Furthermore, many of the technologies with biomass and biogas have theoretical banding factors which are above the maximum banding factor. Therefore, the risk of ex post overcompensation for existing biomass and biogas plants under the 2013 scheme is limited.

3.6 Our findings corroborate the European Commission's 2018 decision that found that the 2013 scheme was compatible with State aid rules and, in particular, that it did not overcompensate generators due to the banding mechanism.

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