The Economics and Governance of the Circular Economy in Cities and Regions

The case of Groningen, The Netherlands

(Confidential, please do not share)

This draft is the result of the interviews held during the OECD mission to Groningen, Netherlands (12-15 February 2019) organised within the OECD Programme on the "Economics and Governance of the Circular Economy in Cities and Regions"; the OECD (2019) Survey on the Circular Economy in Cities and Regions and desk research. The OECD team is grateful for comments received from the Municipality of Groningen, as well as from: Eileen Blackmore (House of Design), Pieter Jan Bouwmeister (Province of Groningen), Cor Dijkstra (Kaaskop), Michael Freerks (HaskoningDHV Nederland B.V.), Marco Kwak (Attero,) Tjitse Mollema (Waterschap Noorderzijlvest), Mathijs Niehaus (DaaromWel, Elze Reitsema (van Wijnen),Maarten Wiersma (ABC2).

Abstract: The City of Groningen is the biggest urban centre of a prevalently rural region and hosts the youngest population in the Netherlands. The presence of renowned universities, the high number of students and a fast growing start-up scene alongside a vibrant business and innovation environment, make Groningen a knowledge hub for the region. Since the Dutch national cabinet decided to phase out natural gas production by 2022, Groningen has intensified its regional leading role in the energy transition aiming to become energy neutral by 2035, according to which the energy demand is met entirely by renewables. In 2018, the Municipal Council took the unanimous decision of making the circular economy a priority for the city, identifying three priority areas: public procurement, waste and knowledge. This case study presents the state of the art of the circular economy in Groningen; the main challenges for designing a circular economy strategy and the ways forward for the city's circular transition.

Table of contents

Tables

Figures

Boxes

The City of Groningen: a snapshot

1. **The City of Groningen is the 6th city of the Netherlands, the biggest city of the Northern Netherlands Region, and the urban centre of a prevalently rural area.** Groningen is part of the Groningen-Assen metropolitan area that hosts approximately 500 000 inhabitants distributed in 11 municipalities, of which Groningen is the biggest one. The city currently has a population of 230 000 inhabitants. It is the capital city of the homonymous province .,. Around 185 000 people commute every day into Groningen from the metropolitan and regional areas (City of Groningen, 2015[1]). In January 2019, the City of Groningen merged with the small municipalities of Haren and Ten Boer adding 27 000 inhabitants[1](Box 1).

2. **Groningen hosts the youngest population in the country**. Half of the population of Groningen is under 35 years old, making Groningen's population one of the youngest in Europe, on average. The renowned Universities (i.e. University of Groningen, the Hanze University of Applied Science and the University Medical Centre Groningen) attract each year 60 000 students (Statistics Service Municipality of Groningen, 2017[2]). As such, 1/3 of the population is represented by students. In 2015, the City of Groningen recorded the highest level of satisfaction regarding the provision of education and training in the EU (Eurostat, 2019[3]).

Box 1. The demographic, administrative and economic structure of the Northern Netherlands Region

The Netherlands is composed by 4 Regions and 12 provinces. Groningen is located in the Northern Netherlands Region, which includes the provinces of Groningen, Friesland and Drenthe. Groningen is the largest city and the biggest functional urban area[2] in the region, which hosts 775 000 inhabitants (Figure 1). The Northern Netherlands Region is defined as a "frontier region"[3] alongside the North Holland Region, which includes Amsterdam and the South Holland Region, which includes Rotterdam and The Hague. The Region's industrial cluster, formed by 31 companies and organisations in the provinces of Groningen and Drenthe, has set the goal to become Europe's most sustainable industrial area by 2030 (Groningen Seaports, 2018[4]).

The city's economy is driven by the education, care and services sectors, employing a total of 145 000 people (Statistics Service Municipality of Groningen, 2017[5]). (Statistics Service Municipality of Groningen, 2017). The Groningen province is a main contributor to the Netherland's labour productivity growth. In 2014, Groningen was the only province in the EU that more than doubled the labour productivity average ratio of the EU-28 (Eurostat, 2018[6]). In the Groningen province, the main activities are related to the industry, business sector, mineral extraction and ICT.

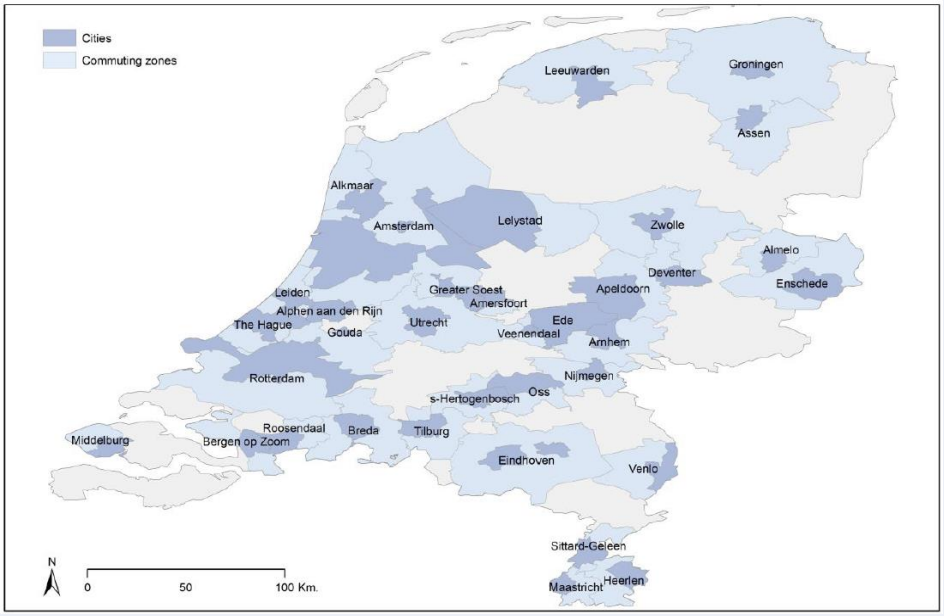
[1] There are 380 municipalities in the Netherlands. The number has been reducing over the past years due to a merging of small municipalities in order to improve policy making and service delivery.

[2] A functional urban area consists of a densely inhabited city and of a surrounding area (commuting zone) whose labour market is highly integrated with the city (OECD, 2012).

[3] A frontier region is defined as the top 10% of regions in GDP per employee. These are regions with the highest GDP per employee until the equivalent of 10% of national employment is reached (OECD, 2015[74]).

Groningen province represents almost 4% of the Dutch GDP (European Commision, 2019[7]). On the other hand, the contribution of the Provinces of Friesland and Drenthe, to the national GDP and labour productivity growth are among the lowest in the country (OECD, 2016[8]).

Figure 1. Functional areas in the Netherlands



Source: Functional urban areas Netherlands, (OECD, 2019[9]).

Source: OECD Regions and Cities at a Glance 2018 (OECD, 2018[10])*; The Northern Netherlands aims to be Europe's most sustainable industrial area by 2030 - Groningen Seaports* (Groningen Seaports, 2018[4]).

3. **Groningen is a digital city and knowledge hub for the region.** The city's research facilities are increasingly specialising on cyber safety, big data and blockchain. Since 2017, Groningen has been hosting the largest international hackathon on blockchain, gathering 6 000+ participants from all over the world. The University of Groningen hosts the Digital Business Centre to support new talents and entrepreneurs to start their digital company. It also allows connections with big firms already located in the city, such as IBM and Google (University of Groningen, 2019[11]). This contributed to define Groningen as the "new silicon valley" thanks to the growing digital sector specialisation (DVHN, 2018[12]). The city ranks second for number of online companies in the Netherlands and it is the 2nd internet city in the country, currently rolling out the 5G[4].

[4] Launched in 2017 by the Economic Board Groningen (EBG), "5Groningen" is an initiative by which entrepreneurs and non-profit organisations test 5G applications in 5 specific sectors: care, energy, traffic, agriculture and living environment sectors. These pilot experiences vary from 5G applications for use in

4. **There is a vibrant business and innovation scene.** A total of 20 000 companies (e.g. in agro-food, energy, health care, chemical industry and digital society' sectors) are based in Groningen and 400 of them are international firms. The city has been classified as the 2nd tech city in the Netherlands during the last five years, hosting 8 of the 50 fastest growing start-ups in 2018 (Deloitte Fast50, 2018[13]). The city's economy is driven by the education, care and services sectors, employing a total of 145 000 people (Statistics Service Municipality of Groningen, 2017[5]). The firm creation rate in the Groningen Province stands between 10% and 12% and the number of patents registered per million inhabitants is between 70 and 140. Both figures match Amsterdam's levels (OECD, 2018[10]). In the Groningen province, the main activities are related to the industry, business sector, mineral extraction and ICT. Groningen province represents almost 4% of the Dutch GDP (European Commision, 2019[7]). On the other hand, the contribution of the Provinces of Friesland and Drenthe, to the national GDP and labour productivity growth are among the lowest in the country (OECD, 2016[8]).

5. **Groningen is taking actions towards ambitious environmental goals, such as energy neutrality.** Following the municipality's goal of becoming energy neutral by 2035, new forms of energy have recently been tested. The production of green electricity, from solar and wind sources, the advances in renewable heating options (biomass, soil energy and biogas) and the attention to the development of hydrogen are examples of the new energy mix that the city is aiming to achieve. In 2017, the city accounted for a share of 5.9% renewable energy out of the total energy production, compared to the national average of 6.6% (City of Groningen, 2018[14]). The municipality plans to increase the renewable energy production share to 9.4% by 2023 (Groningen Municipality, 2015[15]). The city is paying specific attention to the energy transition after the Dutch national cabinet decided to phase out gas production by 2022, for which the region has been the major supplier in the country for the last sixty years (see the section on energy transition).

6. **The young population, the presence of Universities and research centres and a fast-growing start-up scene are important factors for the transition from the linear to the circular economy**. Universities, research centres and innovative companies are developing and testing solutions to increase resource efficiency in production systems, use alternative energy sources for transport or bio-based product from organic waste as raw material. Technical solutions, in conjunction with a vibrant private sector and environmentally engaged citizens are key factors towards the transition to the circular economy.

arable and livestock farming in North-Groningen to care solutions for the ageing population (5Groningen Website (2019[75]); Economic Board Groningen Website (2019[70]).

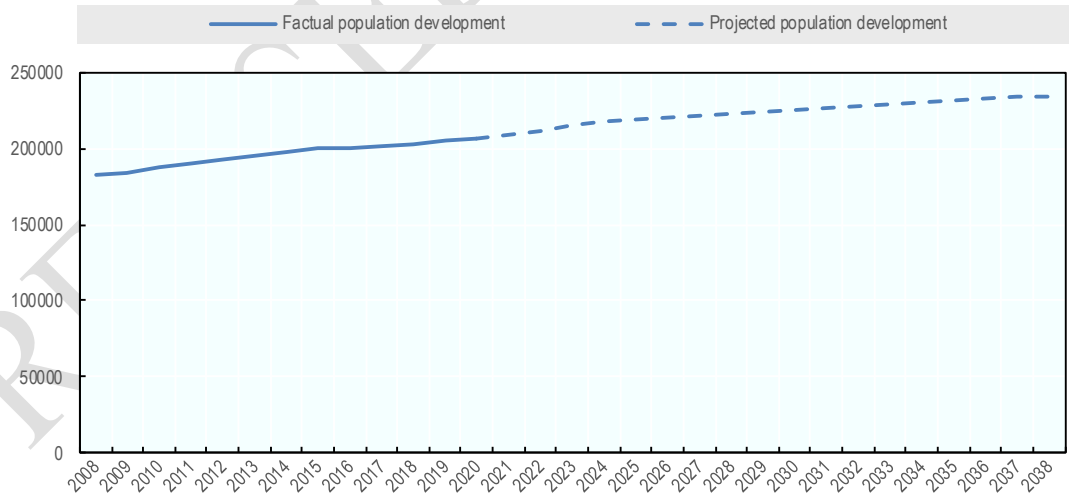
Future trends affecting the transition to the circular economy

7. **Socio-economic and environmental trends affect the transition from the linear to the circular economy in Groningen**. Population growth generates the need for new houses (20 000, by 2030) that can be potentially built according to circular principles. The municipality aims to create 5 000 new jobs in the next few years linking the Health, ITC, Energy and Creative industries to the circular economy. Also, more circularity can be introduced in daily production and consumption activities, from retail to mobility, while contributing to reaching also two additional long term objectives set by the municipality: to become CO_2 neutral by 2035 and to separate and reuse all waste by 2025. This section discusses that may have an impact on the transition from the linear to the circular economy while driving future decisions.

Demographic trends

8. **Groningen is the only city in the Northern Netherlands Region expecting population growth in the next two decades.** The population in the City of Groningen grew 12% from 2004 to 2018. It is foreseen to grow within the next 15 years from approximately 230 000 in 2018 to almost 250 000 (Figure 2). Surrounded by a mainly rural region in which the majority of the municipalities are experiencing population decline, the average annual population growth is expected to be 1.3% from 2018 to 2023 and 0.6% from 2024 to 2038 (Statistics Service Gemeente Groningen, 2018[16]).

Figure 2. Population development in the municipality of Groningen, 2008-2038

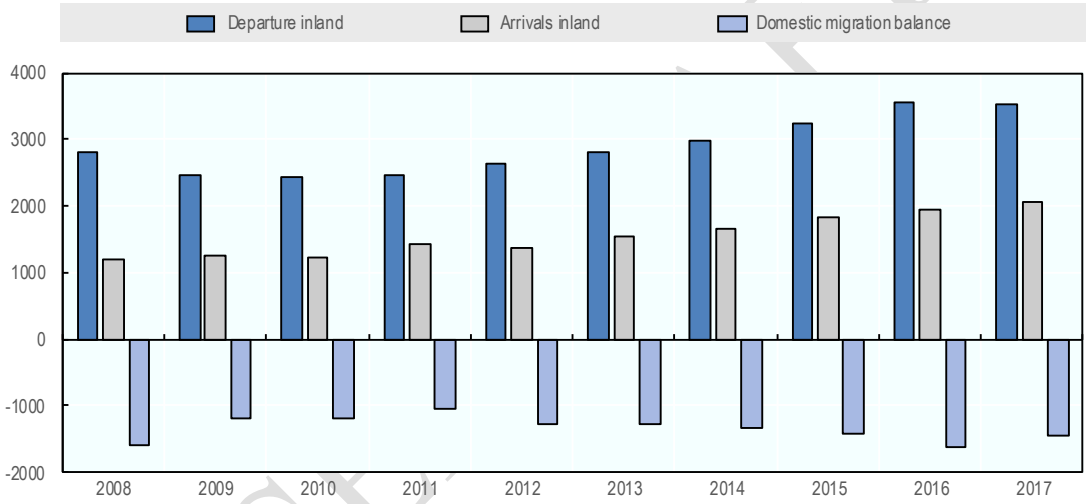


Source: Statistics Service Gemeente Groningen, (2018[16]).

9. **The population growth and the increasing number of students are the main drivers of Groningen's demographic changes**. The actual birth surplus will continue during the 2018-2038 period while, due to population ageing, mortality will increase at a faster pace during the same period. In the next two decades, the

city expects, on average, an inflow of nearly 20 800 immigrants per year (mostly students), and an annual net migrant population surplus of 1000 people. The main cause of this trend is the continuous inflow and outflow of foreign students. In 2018, the University of Groningen increased the number of students by 20%. It expects to receive almost 50% more foreign European students and about 31% non-EU students more in the upcoming years. Nonetheless, almost 3500 students, aged between 25 to 30 years old, are leaving the city after finishing their studies reducing the net population balance (Figure 3). In 2017 only 28% of international students stayed in the city after finishing their studies. However, to revert this trend, the city is putting in place several initiatives, such as communication campaigns to showcase the job opportunities available to stay in the City after graduation (Groningen Municipality, 2017[17]) (Statistics Service Gemeente Groningen, 2018[16]).

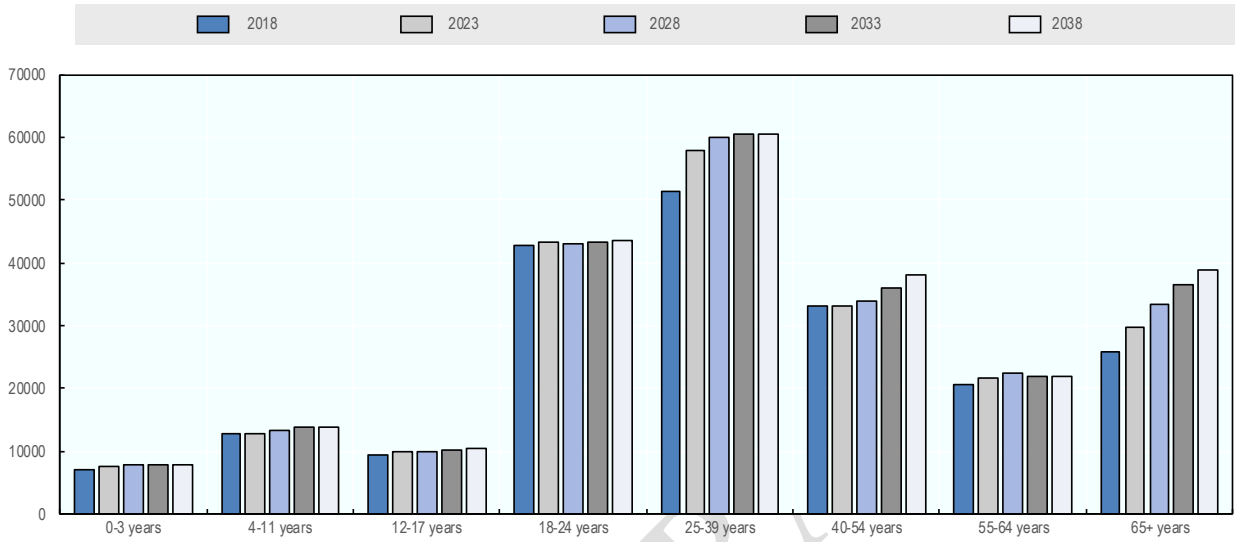
Figure 3. Domestic migration balance for 25 to 30-year-olds, 2008-2018



Source: Statistics Service Gemeente Groningen (2018[16]).

10. **The age group older than 65 is expected to double by 2038.** While it is foreseen a 20% population increase for the 25 to 39 age group of in the next two decades, the group that is projected to experience the highest growth is the population aged 65 or higher with a 50 % growth (Figure 4; (Statistics Service Gemeente Groningen, 2018[16]). These figures express two contrasting trends affecting the city: an important amount of young population that do not settle in Groningen after finishing the studies and, at the same time, a sustained increase of the aged population.

Figure 4. Change in population size per age group, Groningen municipality 2018-2038



Source: Statistics Service Gemeente Groningen (2018[16]).

11. **The expected population growth demands an expansion of the housing stock.** The city government plans to build 20 000 new houses by 2030. This plan is considered a necessary condition to meet the growing population of 230 000 inhabitants by that time (Statistics Service Gemeente Groningen, 2018[16]). This scenario is an opportunity for the city to create the necessary incentives to ensure that the new housing stock is built in a circular way, advancing in reducing the city's carbon footprint (see next session). In November 2018, the city was designated a European "lighthouse city"[5] aiming to become a smart zero CO_2 city in the next two decades.

Socio-economic trends

12. **The economic activity in the Northern Netherlands Region has been decreasing markedly in the last decade, but it is expected to recover gradually.** Between 2012 and 2015, the Northern Netherlands Region was between the six EU regions that suffered the biggest contraction in economic activities from a total of 38 regions analysed. The regional GDP decreased at an annual average rate of -3.1%, below the Dutch average which increased by 1.5% in the same period (European Commission, 2019[18]). In the Groningen province, the GDP per inhabitant decreased by 31% between 2007 and 2016 (Eurostat, 2018[19]). This trend is mostly explained by the restrictions to natural gas production applied by the national government from 2013, which led to a 50% reduction in gas extraction by

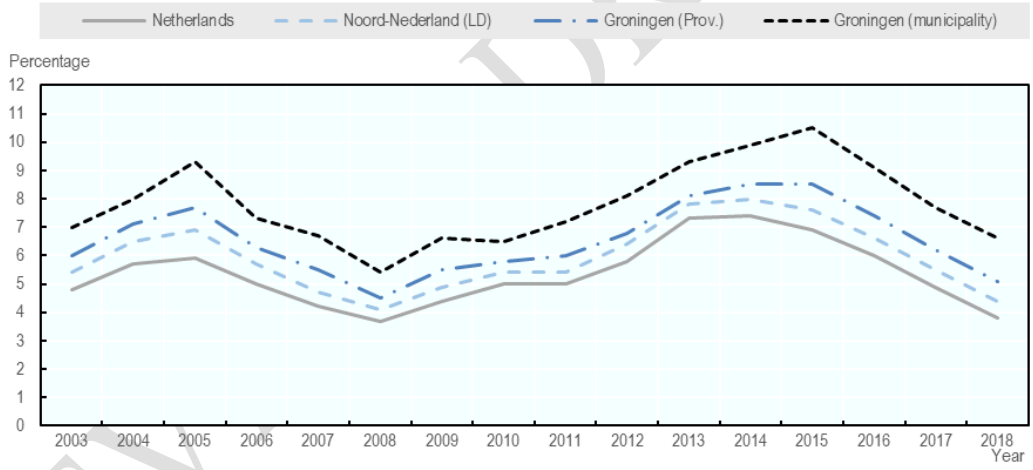
[5] The "lighthouse" cities are part of the EU Horizon 2020 project "SmartEnCity" which aims to develop a highly adaptable and replicable systemic approach for transforming European cities into sustainable, smart and resource-efficient urban environments. Other cities involved in the project are: Vitoria-Gasteiz in Spain, Tartu in Estonia and Sonderborg in Denmark (SmartEnCity, 2019[71]).

2017. In 2017, Groningen was the only Dutch province reporting economic shrinkage (CBS, 2018[20]).

13. **Since the early 2000s, the Groningen province and municipality have shown one of the highest unemployment levels in the Netherlands.** The provincial unemployment rate raised from 4.5% in 2008 to a pick of 8.5% in 2015 to go down to 5.1% in 2018. In 2016, Groningen was the province with the highest unemployment rate in the country with a rate of 7.2%. The municipality of Groningen has experienced a similar trend but at even higher rates. The unemployment rate almost doubled between 2008 (5.4%) and 2015 (10.5%)[6]. After reaching this peak in 2015, the percentage of unemployed workers fell markedly to 6.6% in 2018 (Figure 5). Unemployment in Groningen continues to be above the country levels. In 2018, the national unemployment rate (3.8%) returned to pre-crisis levels after experiencing a pick in 2014 (7%) and is expected to reach the 3.5% in 2019 (EURES, 2018[21]).

Figure 5. Unemployment trend (2003 - 2018)

National, regional, provincial and municipal level



Source: Own elaboration; Arbeidsdeelname; regionale indeling 2018, Statistics Netherlands, CBS (2018[22]).

14. **The Northern Netherlands region expect a further drop in unemployment in the upcoming years.** This is mainly due to the creation of an increasing number of vacancies in the technology, engineering and ICT sectors as well as in education, health, transport and logistics. The digital economy is the fastest-growing sector in the region. A total of 7 300 jobs are related to the digital economy and projected to grow in the future, as there is a demand for 400+ ITC jobs to be filled. Employment is increasing mainly in the private sector, health care and

[6] Partially, the increase in unemployment between 2013 and 2015 can be attributed to administrative matters. Until 2013, people receiving unemployment benefits were themselves responsible for extending their registration before the Employee Insurance Schemes Implementing Body (Uitvoeringsinstituut Werknemersverzekeringen, UWV) and sometimes failed to do it. After 2013, the municipal government started to monitor this issue resulting in a partly artificial increase in the number of unemployment benefits beneficiaries (Groningen Municipality, 2017[72]).

temporary employment arrangements. In Groningen, citizens show a low level of satisfaction in relation to employment (27%) and housing (47%) and compared with health services (95%), public spaces (94%) and education services, which instead score very high (Eurostat, 2019[3]). It is not clear yet how the transition towards the circular economy will affect exactly the employment rate by sector in the city. However, the municipality aims to create 5 000 new jobs in the next few years linking the Health, ITC, Energy and Creative industries to the circular economy. Questions remain on the type of skills to be built for future jobs in the circular economy. Both low and high skilled jobs will be needed, stimulating the demand for new training and educational programmes.

The energy transition

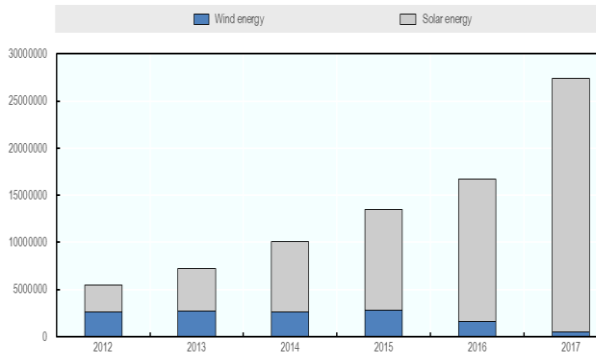
15. **The phasing out of natural gas extraction is opening new opportunities for renewable energy in the region.** For the past sixty years, the North Netherlands region has been a major supplier of natural gas. In 2015, 56% of the total gas production in the Netherlands generated in the Groningen field (W. J. Evert van de Graaff, Lucia van Geuns and Tim Boersma, 2018[23]). However, since 2013, natural gas extraction has been reduced by 50%. In 2018, the Dutch national cabinet decided to scale back gas production and for the first time the Netherlands became a net importer of natural gas (CBS, 2018[20]). This decision came after pressing requests from the population living near the gas fields and suffering earthquakes induced by the extraction of natural gas (Bourne et al., 2014[24]; Grasso and Wittlinger, 1990[25]; Nederlandse Aardolie Maatschappij BV, 2013[26]; Wetmiller, 1986[27]). The 3.6-magnitude earthquake in 2012 near Huizinge led to a 50% reduction in natural gas extraction. However, only after the 3.4-magnitude episode in 2018, the government decided on the phasing out by 2022. There is a momentum for the City of Groningen and for the entire region to rethink their role as key players in the energy sector. As such new forms of energy (e.g. hydrogen, biomass) have been tested in recent years (Groningen Municipality, 2015[15]).

16. **Groningen is transitioning from being a major player in the natural gas sector to becoming a green energy fore-runner.** The municipality launched the "Groningen Energizes" programme 2015-2018 in order to accelerate the city's energy transition from a historic natural gas producer position to a "green energy city" focusing on energy transition and bio-based economy opportunities (Groningen Municipality, 2015[15]). The City also recently published the roadmap "Groningen CO_2 Neutral 2035. Strategy 2023 and final image 2035" towards becoming CO_2 neutral by 2035. To address the necessity of securing heat demand during the energy transition, the municipality developed a map that establishes which city districts will become totally electric, which areas will receive energy through a heat network and which neighbourhoods will experience hybrid solutions (a combination of electricity and green gas). According to the roadmap's goals, by 2035: the City will replace gas, gasoline and diesel as energy sources by using sustainably generated electricity (specially produced from wind and solar sources). The industry sector will use sustainable electricity in at least half of the heating processes involved in their production chains (the pending required energy will be provided by biogas and green gas); and all passenger cars will be fossil-free and emission-free (1/3 electric, 1/3 hydrogen, 1/3 biofuel) (Groningen Municipality, 2018[28]). The following alternative energy sources are used or will be in the future:

- Hydrogen: Groningen is the only city in the region that foresees hydrogen in its future energy plans (Delta Plan). The New Energy Coalition favours the experimentation with hydrogen, because of its capacity of storing energy and the potential of using the existing natural gas infrastructure. The City is developing a New Economic Plan for "green hydrogen" starting in November 2019. The "green hydrogen" is foreseen to be produced using electricity from renewable sources (electrolysis of water). Some issues that should be addressed are the requirement of high levels of electricity to generate hydrogen and safety and infrastructural aspects.
- Solar: Groningen aims to have 700 000 solar panels installed by 2023. Solar energy has been increasing at the household level. In 2017, in the city, almost 30 000 solar panels were installed in private houses (46% more than in 2016). That same year, three parks accounted for more than 50 000 panels: Vierverlaten near Hoogkerk (7 777), Woldjerspoor (43 000) and Zernike (1 700) (Groninger Internet Courant, 2018[29]).
- Wind: A total of 274 wind turbines produce energy in the Groningen province (34 at Delfzijl; 90 at Eemshaven and 150 at the Gemini offshore wind farm). The Gemini offshore wind project, one of the largest offshore wind farms in the world, is located 85 km away from the coast in the North Sea with a total capacity of 600 Megawatts,meeting the annual energy needs of one and a half million people and reducing the annual CO_2 emissions of the Netherlands by 1.25 million tons (Northland Power, 2019[30]). The region aims to produce 855.5 MW by 2020. At the same time, wind energy has generated some resistance for the installation of windmill parks from communities in different regions of the Netherlands.

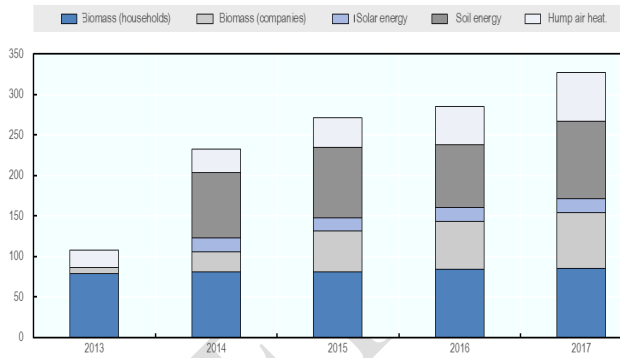
17. **Green electricity production has grown in the last five years, although it is still relatively low.** The production of green electricity (from solar and wind sources) within the municipality grew by 500% in five years (from 5 million kWh, in 2012, to 27.4 million kWh, in 2017) (Figure 6). The production in 2017 alone, represented the electricity demanded by 12 000 households, avoiding 12 ktonnes of CO_2 emissions (Groningen, 2018[31]). While solar energy production has grown steadily between 2012 and 2017, wind energy has declined during the same period. Partly, this can be explained for the existence of subsidies on solar energy and of conflicts driven by land property and by the so-called "Not In My Backyard" (NIMBY) attitude regarding the installation of wind energy turbines.

Figure 6. Green electricity produced in Groningen Municipality (2012- 2017)



Source: Own elaboration. CO_2 Monitor Groningen (2018[31]).

Figure 7. Renewable heating consumption in Groningen municipality (2013-2017)



Source: Own elaboration; CO_2 Monitor Groningen (2018[31]).

18. **Renewable heating consumption has tripled in five years and this trend is expecting to increase.** The total production of renewable heat in 2017 was 327 TJ, almost 3 times the production registered in 2012 (approximately 110 TJ; Figure 7). This volume of production provided heating to 8 700 households and prevented 18.3 ktonnes of CO_2 emission [7]. Biomass, coming from wood residues, manure and waste from the food processing industry, along with soil energy are the most common types of heating sources in Groningen. The Netherlands is the third worst-ranked from a group of 34 EU member countries in terms of the share of renewable energy gross final energy production (European Environment Agency, 2018[32]).

National and regional circular economy initiatives

19. **The national government set a circular economy strategy, which provides goals, inspiration and ambitions to local governments**. The aim of the national strategy is to achieve a waste-free economy in the by 2050. It outlines a vision of a future-proof, sustainable economy for current and future generations. According to the Netherlands Organisation for Applied Scientific Research (TNO), the circular economy can generate EUR 7.3 billion within the sectors involved and up to 54 000 jobs, while the use of raw material can be reduced of 100 megatons (one-quarter of the Dutch annual import of raw material). The strategy is based on five priorities: biomass and food; plastics; manufacturing industry; construction sector and consumer goods. Adequate regulation, finance and knowledge will help achieve the objective of no waste by 2050. This implies making the best use of raw material; replace fossil-based materials with sustainable and renewable ones and

[7] A kiloton is a mass unit (1 000 tons or 1 million kilograms).

designing products by taking into account the period following their use (Ministry of Infrastructure and the Environment and Ministry of Economic Affairs, 2016[33]).

20. **The national government has also put funding available to implement circular economy projects**. The funding is linked to the envelope of EUR 300 million that the government makes available annually for the climate. Subnational governments should have access to this envelope. At the same time, the national Ministry of infrastructure's has allocated 40 million EUR to fund circular economy-related projects in 2019 and 2020, while the national regional strategies and the SDGs implementation programmes also provide financial opportunities to promote the circular economy transition (NL Times, 2019[34]). Businesses and local governments can present projects eligible for national subsidies at the National Enterprise Agency (*Rijksdienst voor Ondernemend Nederland*), although conditions for applying are still to be clarified.

21. **The Northern Netherlands Region carried out a material flow analysis to identify priority areas for the circular economy.** In 2018, the Northern Netherlands commissioned a material flow analysis to better understand the input and output of materials within the region. Four sectors were identified as key for the circular economy: construction, waste, chemistry and agro-food (Metabolic, 2018[35]). The study concluded that although the perspectives for a circular economy in the three Northern provinces, including Groningen, are favourable, there are financial and regulatory bottlenecks to take into account, which are outside the direct sphere of influence of the provinces and the municipalities. Therefore, co-ordination with the national government is needed.

22. **The bio-based economy strategy of the North Netherlands Region represents an important starting point for future developments of the circular economy in Groningen.** The Northern Netherlands Region is one of the six top European regions in the bio-based economy according to the European Union. About 70% of the land in the region is devoted to agricultural production. As such, there is a high likelihood to transform agricultural waste into biomass. The presence of strong chemical, energy and agro-food sectors provide Groningen with relevant opportunities to transition to a bio-based circular economy (Groningen Municipality, 2019[36]). In 2013, the municipality developed a bio-based strategy focusing on three strategic lines: waste collection and management; economic policy areas; and the "Groningen Knowledge City" policy. One of the ambitions of the bio-based strategy is to reach 20% of the energy produced in the city through biomass by 2035. This will contribute to the urban energy supply planning (Groningen Municipality, 2013[37]).

23. **Partnerships and cooperation platforms across the provinces foresee joint activities on the circular economy.** The Groningen-Assen Regional Alliance is a voluntary platform of co-operation at the scale of the functional urban area. The platform includes the provinces of Groningen and Drenthe and seven municipalities[8]. The Alliance identifies construction and waste as strategic sectors to develop joint circular economy projects. The Northern Netherlands Alliance (SNN) is a partnership amongst the three Northern provinces - Groningen, Friesland and Drenthe- and the four largest cities in the region, Assen, Emmen, Groningen and

[8] These are: Groningen, Midden Groningen, Assen, Het Hogeland, Noordenveld, Tynaarlo en Westerkwartier

Leeuwarden. The circular economy is one of the topics incorporated into the Alliance's future actions, aiming at reusing at their highest quality level energy and waste materials, while strengthening the links between natural and social capital.

The circular economy in Groningen

24. **The Municipal Council of Groningen considers the transition to a circular economy a policy priority**. In March 2019, the Municipal Council took the unanimous decision of making the circular economy a priority for the city. This entails providing space for experimentation, sharing knowledge, leading the co-ordination among stakeholders and defining a circular economy framework (Groningen Municipality, 2018[38]). Importantly, a vice mayor with responsibilities on the circular economy took office after the elections in November 2018 (Box 2). According to the OECD Survey, the words that the city associated the most with the circular economy are "raw material", "zero waste" and "innovation", reflecting the intention of the city to combine innovation (e.g. in design and planning) to a more sustainable waste management able to reduce waste production and transforming waste into resources (Figure 8; (OECD, 2019[39]).

Figure 8. Tag cloud on the circular economy in Groningen

Source: Own elaboration; OECD Survey on Circular Economy in Cities and Regions, OECD, (2019[39]).

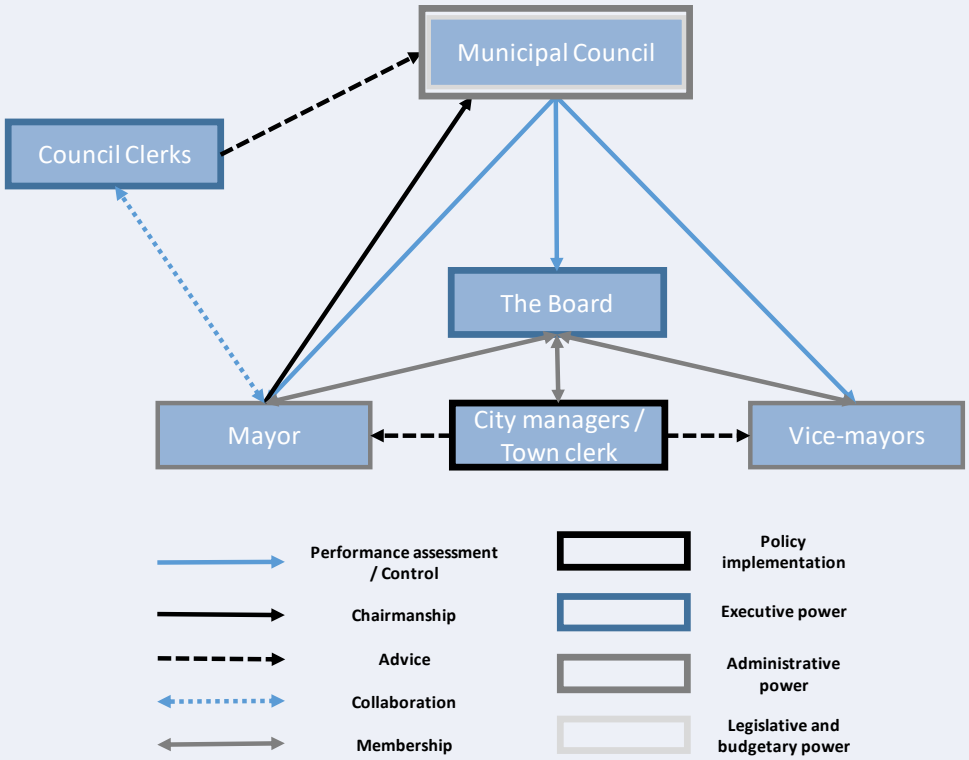
Box 2. The institutional organisation of local government in the Netherlands

The Municipal Council

The municipal council is an elected body with administrative, legislative and budgetary powers. The size of the municipal council depends on the size of the municipality: from 9 (municipalities with less than 3,000 inhabitants) to 45 seats (municipalities with over 200,000 inhabitants). Municipal council's representatives are elected every four years. The municipal council oversees the municipal executive, by critically assessing its performance. It is responsible for controlling the mayor and the vice-mayors. The mayor is the chair of the council, but with no right to vote; the vice-mayors are not allowed to be members of the municipal council. Full council meetings and committee meetings are open to the public. In order to encourage participation in local politics, municipalities offer

citizens the opportunity to intervene in committee meetings and sometimes, also during plenary sessions.

Figure 9. Institutional map of Groningen Municipality



Source: Own elaboration

Council clerks

Council clerks are the most important advisors to municipal councils and play a vital and supporting role for council members, political parties and council committees. They are appointed and dismissed, if necessary, by a vote of the municipal council. They work alongside members of the executive, in particular, the mayor.

The Executive (or Board): colleges of mayors and vice-mayors

Executive power is wielded by colleges of mayor and vice-mayors. The colleges are responsible for governing municipalities and leading the public administration. They are accountable to the council. The internal distribution of tasks differs according to the local circumstances in each municipality.

Mayors

Mayors chair municipal councils and executive colleges. They act as intermediaries between the parties and ensure continuity. Therefore, they do not usually propose regulations or policies. The mayoral term lasts six years. This term may be renewed on the

recommendation of the municipal council. Mayors can be reappointed, although it is rare for mayors to serve for more than two terms and exceptional to serve for more than three.

Vice mayors

Along with mayors, vice-mayors are the other administrators of local government. The number of vice-mayors depends on the size of the municipality (from 2 to 9). In Groningen there are 7 vice-mayors. Like ministries at the national level, they are each responsible for a specific policy area.

City managers/ Town clerks

City managers or town clerks are employed by the college of mayor and vice-mayors. Therefore, they are not elected. City managers have a dual responsibility: they are the senior advisors to the colleges of mayor and vice-mayors and are also responsible for the implementation of policies and decisions. They act as directors of the municipal civil service.

Source: Local team Groningen

25. **The Council proposal for a *Circular Groningen* identified three priority areas**. In 2018, the Council instructed the Board to develop a sustainable and circular vision for the city, by co-ordinating the already existing initiatives linked to the circular economy. Three priority areas were identified by the Council (Groningen Municipality, 2018[38]):

- Public procurement: As a means to influence the business community towards circular practices, for example in service provision and in the building sector;
- Waste: As an opportunity to re-think the processing of the waste streams towards increased separation and recycling, jointly with the termination of the contract with the waste company in 2022 and with the objective of the city to become waste neutral[9] by 2025;
- Knowledge: To establish connections with knowledge networks and create platforms amongst the private, the public and the non-for profit sectors.

26. **The Municipality is getting ready to promote, facilitate and enable the circular economy.** Referring to the three priority areas identified by the Municipal Council, a series of existing and planned activities are focusing on public procurement, waste and knowledge (Table 1). Current activities are focusing on upstream and downstream sustainable waste management. The city aims to put in place circular public procurement. City employees are being trained to make this happen through dedicated circular procurement workshops. Circular public procurement is being applied to the purchase of a 10-year service of refurbished furniture for the municipality, currently in the tender phase. Since 2018, all public plastic bins must be made of recycled plastics, as established by public procurement requisites. The municipality recognises that the current activities in place represent

[9] Waste neutrality at the city level aims to achieve, within the different waste streams, a volume of recyclables leaving the city that is equal or smaller than the volume of products made from recyclables that enter the city (EU Eden Project, 2002[80]).

a starting point, but that a more holistic vision is needed to avoid fragmentation and efficiently allocate funds.

27. **The city aims to achieve the goal of becoming waste neutral by 2025, following circular economy principles**. The Municipality of Groningen is responsible for the municipal and household waste collection. Industrial waste is collected by commercial companies. Groningen's household and municipal waste processing takes place at the treatment plant managed by Attero in the City of Wijster (separation and incineration) and Groningen (separation)[10]. Today, in Groningen, 40% of waste is incinerated. The city wants to take that to zero by 2025. The goals by 2020 are the following: max 150 kg waste for incineration per inhabitant and 65% of waste separated for reuse (100% by 2025). The city has put in place an awareness campaign to communicate regularly about the available options for the separation of waste and to prevent waste production.

28. **Separated waste is treated for secondary material production and biomass is processed to biogas.** There are different producers of biogas in the city (Suiker Unie, Attero, RWZI Garmerwolde and Stainkoeln) (Groningen, 2018[31]). Today, the biogas production capacity has the potential to provide 17 000 homes with gas. During the summer, when temperatures are higher than 30 degrees, it could meet the green gas demand of the entire city. Suiker Unie provides 7 000 households with green gas generated from fermented sugar beet residues. Green gas producers ask for energy taxes to foster green fuels.

29. **To foster circularity in the waste sector, the Municipality carrying out several activities.** For example, a "circular hub" is planned. The hub is expected to pay specific attention to the high-end reuse of raw materials such as metal, plastics, beverage cartons and organic waste. One of the initiatives will consist of hosting a bulky waste depot for receiving large household reusable goods (furniture, electrical goods, and garden cuttings, among others). The city also foresees an incubator facility for circular small businesses and start-ups that could benefit from the secondary materials. An information centre focusing on circular economy activities and opportunities, a repair café and second-hand shops are also planned. The hub will focus on different value chains (e.g. waste energy, biomass), identify key stakeholders, possible launching customers and involve designers for product solutions and new business models (Groningen Municipality, 2019[40]).

30. **The City of Groningen supports SMEs in the transition towards the circular economy**. The municipality recently initiated "Front-runner project" (*Koploperproject*) to help SMEs in the implementation of more sustainable and circular business models in a 1-year period. During this time, expert advisors produce a baseline measurement analysis of the company; determine the environmental performance and the CO_2 footprint of the organisation, while defining a Sustainability Profile. Each company establishes an action plan and a communication strategy based on the recommendations received and exchanges experiences with the other companies and members of the project. The project foresees networking events to promote the exchange of experiences and creates a permanent network among members. Between 8 and 15 companies and SMEs, are taking part of the project alongside with 6 municipalities (Hogeland, Groningen,

[10] The pant has a separation capacity: 810.000 tons / 3 lines and an incineration capacity: 625.000 tons / 3 furnaces.

Oldambt, Stadskanaal, Westerkwartier, Westerwolde), the province of Groningen, cooperatives, banks and educational institutions. Since 2015, six *Koploper* projects have been carried out in the province of Groningen with around 65 participants, with two special projects on village houses and the food chain (Koploperproject, 2019[41]).

Table 1. The circular economy activities in Groningen

	Activity	Description	Status
Procurement	Circular tender office furniture	Replace office furniture for ten years for the whole municipality.	Planned
	Circular Procurement	Large scale purchase of circular products used by the municipality in public spaces (e.g. re-used materials for constructing bridges decks, waterway timbering and highway fences built using recycled material, waste bins and containers made of circular plastic).	Ongoing
		Purchase in a circular way office furniture, coffee machines, to infrastructure projects (e.g. reusing, leasing).	Planned
	Circular Procurement training	Eight interactive workshops for purchasing in a circular way: from request and procedure, measuring and weighing of the criteria, business models, contract secure.	Delivered in 2018
	Circular iq	An online software application for collaboration, data monitoring and analysis which uses simple data to support circular decision making. It is planned to be used for the circular public procurement.	Not yet in use
Waste	Circular Economy Hub	A space as incubator for circular small businesses and start-ups for start-ups, information centre, repair hub and second-hand shops next to the waste delivery station.	Planned
	Re-use	Repair cafes; collection of reusable items and paint for second-hand shops.	Ongoing
	Waste management concession	Inclusion of circular criteria for waste processing for the new waste management concession after the year 2022.	Ongoing
	Groningen Ontwerpt (Groningen designs)	This initiative applies sustainable design to re-use of waste streams. It created) new products from waste and residual material coming from 7 shops in Groningen.	Delivered in 2018
	Waste sorting facility	The Council of Groningen operates a waste sorting facility with the highest possible resource recovery rate and the production of sustainable energy such as green gas.	Ongoing since 1988
Knowledge and awareness-raising	100x100x100	Awareness campaign challenging 100 households to live 100% waste-free for 100 days. Around 200 households joined. The local television channel followed the participants in a series of programmes.	Delivered in 2017
	The Food Battle	Challenge inviting inhabitants to stop wasting food. Around 250 households joined.	Delivered in 2017
	Dismissed industrial area as experimentation space	Former sugar factory hosting temporarily 50 initiatives and business as a playground for circular economy.	On-going

Source: OECD Survey on Circular Economy in Cities and Regions, OECD, (2019[39]) and interviews performed in the City of Groningen in February 2019.

Towards a circular economy strategy

31. The following section aims to identify the categories of stakeholders that can contribute to the transition to the circular economy, the most promising sectors and the possible interaction across areas (e.g. cities and surroundings). This follows the 3 Ps Framework (OECD, 2015) according to which for the circular economy to happen in practice, co-ordination is needed across *people, policies and places*:

- People: The circular economy is a shared responsibility across levels of government and stakeholders. The business sector can determine the shift towards new business models (e.g. using secondary material, recycling, sharing, etc.). Citizens, on the other hand, make constant consumption choices and can influence production.
- Policies: The circular economy requires a holistic and systemic approach. A variety of goals makes the circular economy systemic in nature. It implies a wide policy focus and re-think in government processes and skills, through integration across often siloed policies, including water, waste, energy, transport, housing and land use.
- Places: Cities are not isolated ecosystems, but spaces for inflows and outflows of materials, resources and products, in connection with surrounding areas and beyond. Therefore, adopting a functional approach going beyond the administrative boundaries of cities is important for resource management and economic development.

This section draws from the inputs provided during the OECD mission to Groningen in February 2019, when 40+ stakeholders form the private, public and non-for profit sectors were interviewed.

People

32. **Government, business sector and universities could create a circular economy "ecosystem" to allow co-operation and knowledge building**. In Groningen, representatives of the universities and the public and private sectors gather together in an organisation called "De Koepel", which meets every three months to identify opportunities for business and collaboration. The meeting held in February 2019 discussed opportunities for the circular economy in Groningen. It concluded with the proposal of creating a circular economy "ecosystem"[11] to allow co-operation and knowledge building, in the same way as for the existing ecosystems for digital economy, energy transition and healthy ageing. Indeed, there is a fertile environment for collaboration in Groningen. For example, the Municipality of Groningen, the Business Association WEST and the Province of Groningen cooperate within the Campus Groningen, one of the biggest campuses in the Netherlands. Local authorities define the campus as a "model of cooperation" to

[11] Ecosystems are formed by diverse stakeholders (e.g. companies, research institutes and public authorities) from different industry sectors that conform dynamic and co-evolving communities. Innovative ecosystems drive regional economic growth by promoting close collaboration between their diverse members (Nord Regio, 2018[79]).

promote innovation in energy transition, artificial intelligence, health and in the future in the circular economy.

33. **The transition towards the circular economy is supported by various public, private and not-for-profit organisations.** For example, the Business Association West representing more than 300 SMEs and entrepreneurs gathers SMEs working together with the local government on waste, energy and bio-economy. These sectors are all relevant within the circular economy approach, therefore specific initiatives to maximise resource efficiency, reuse resources and prevent waste production are increasingly foreseen in the future. Private, public and non-for profit sectors can receive support for building capacities and identifying opportunities for collaboration through the Northern Innovation Circular Economy lab (NICE), which aims at speeding up the transition from the linear to the circular economy. This initiative gathers 18 organisations, including local governments, SMEs, and knowledge institutes. Similarly, associations and NGOs are raising awareness on the circular economy practices and implementing circular economy principles in the food and construction sectors (see section on policies).

34. **Entrepreneurs in Groningen have also set up a platform expected to stimulate actions following the circular economy principles.** Retailers gather in the Circular Economy Club, a platform, created in 2018, to discuss common problems and solutions related to their business activities and following circular economy principles. The club can play a role to connect the municipality with entrepreneurs and companies to develop a long-term circular economy city vision. Stakeholders are organised in different thematic commissions. A commission created in 2018 focuses on issues related to waste and product distribution. Currently, the Club is dealing with the problem of traffic due to the various companies collecting waste in the city centre. The Club is trying to find solutions towards an emission-free city interacting with the Waste and Mobility Departments of the Municipality.

Policies

35. **Various sectors can be taken into account when it comes to foster the transition from a linear to a circular economy.** According to the OECD Survey 2019, the municipality identified the following sectors as of interest for a circular economy strategy in Groningen: waste, mobility, water, energy, food and beverage, sanitation, biomass, construction and demolition and creative industry (Figure 10). Below, specific attention will be dedicated to those sectors that more prominently came out from the discussion with various stakeholders. This is key to signal an existing interest from “do-ers” to transition from a linear to a circular economy in a shared responsibility with the local governments and to foresee coherent policies in the future.

Figure 10. Sectors of interest for a circular economy strategy in Groningen

Source: Own elaboration; OECD Survey on Circular Economy in Cities and Regions, OECD (2019[39]).

Waste

36. **The circular economy cannot leave aside activities in relation to waste prevention, reuse and recycling amongst others**. As highlighted above, the City of Groningen is planning to reduce incineration, becoming waste neutral by 2025, while promoting reuse of raw materials, use of secondary material across businesses and start-up. In this sense, the city is also promoting waste prevention campaigns and challenges amongst citizens to reduce waste production (e.g. 100x100x100, Table 1). Further thoughts should be dedicated to the policy options for reducing and securing the safety of industrial waste. There is little or no incentive for separate collection of industrial waste, and for organic collection from restaurants and bars in the city. However, a separate facility is in place for the collection of organic waste.

Biomass

37. **The biomass can contribute to the achievement energy neutrality and can be used by green raw material.** The bio-based economy vision of the municipality aims to strengthen the position of Groningen as an agro-food city (Groningen Municipality, 2013[37]). Groningen presents other optimal characteristics to thrive in the bio-economy sector advancing towards circularity. First, it is located in a region with a strong agro and energy connotation. Large production of potatoes and sugar beets are also sources of secondary materials and energy, once transformed into waste; second, it ranks high (third in the Netherlands) in the biotech sector., thanks to the presence of life sciences companies (European Commission,

2019[18]); third the city can further benefits from the presence of several companies which are very active in bio-economy (e.g. Suiker Unie, Attero, Smurfit Kappa and Avebe) producing energy from biomass and advancing with innovative research in the sector together with the universities.

Food

38. **Reducing food waste and increasing local food production is part of current and future circular activities.** The municipality launched the "Food Battle Groningen" to raise awareness on reducing food waste (Table 1). Local not for profit organisations are taking the lead in this sector by pushing the demand towards local food consumption, reducing food waste and promoting urban agriculture. As such, the circular approach whereby the overall food chain can reduce the production of waste from beginning to end has the potential to benefit vulnerable social groups, by creating job opportunities and engaging communities (Box 3). For example, the Toentje Foundation produces honey, local food and social beer in disadvantaged neighbours. Another example is the "Reframe Project" [12]in the food chain, gathering together hospitals, farmers, producers and government since 2015. The idea of the project is to reduce food waste by allocating food leftovers to potential customers as the hospital. The Regional Cooperative of Western Catering[13], created in 2013, aims to develop new business models rethinking food chains for the next generation of cooperative business and start-ups. Nevertheless, some regulatory and financial barriers inhibit these activities: from the legal prohibition to use of green areas to produce local food, to the difficulty in accessing funds, making possible to implement only small initiatives thanks to the private support.

Box 3. Food and the circular economy in cities

. By 2050 cities will consume 80% of the food. A total of 2.9 bn of tonnes are annually destined to cities (resulting 0.5 bn of tonnes wasted). According to the Ellen MacArthur Foundation (2019), cities can significantly influence the way food is grown, distributed and consumed, by ensuring environmentally sustainable cultivation and by fostering the interaction with producers in their peri-urban and rural surroundings. Moreover, achieving a regenerative food system in cities will entail an annual reduction of greenhouse gas emissions by 4.3 bn tonnes of CO2 equivalent and the generation of annual benefits worth $ 2.7 trillion by 2050.

Circular food system in cities and regions are based on strengthening synergies across the with food value chain from production to distribution and waste handling. Circular food entails the below key phases:

- **Production**: the food production phase in a circular economy would be local and regenerative. Local food means reduced transportation, packaging and emissions. Food production in rural areas should be compatible with decarbonisation and

[12] A project co-funded by the North Sea Region Programme 2014 - 2020 and involves five different countries in the North Sea Region (Denmark, Sweden, Germany, Belgium and the Netherlands).

[13] It gathers 450 rural entrepreneurs, industry and logistical companies and governments.

renewable energy objectives. There are examples of urban agriculture that while producing very small quantities of food, they work as green natural solutions, for example against floods. In Brussels, Belgium, in order to increase the urban production, the 2015 Food Strategy Plan provides access to crops in areas above the ground such as rooftops and cellars.

- **Distribution**: Partnerships across actors in rural and urban areas could support last-mile food distribution. For example, in Valladolid (Spain), the eco markets located in the city and in the surrounding Centre of Environmental Resources (Centro de Recursos Ambientales, PRAE) are a first step to bring local production to city customers. Moreover, planned actions in Valladolid (Spain) are related to the organic waste from urban (e.g. hotel and restaurant sector) and rural actors aiming to improve the measurement, tradability and quality of organic waste.
- **Waste handling**: in a circular economy, food waste should be reduced as much as possible or transformed in usable products for agriculture. To tackle food waste, initiatives are in place to divert edible food waste from landfill by redistributing it and ensuring that defective fruits and vegetables are eaten by marketing products that producers find hard to sell (e.g. in Porto, Portugal). France has advanced in enacted legislation on food waste and the circular economy.

There are several examples of initiatives to make the food sector more circular in urban and rural areas. These initiatives focus on different aspects of the food sector dynamics that go from reducing food waste (Groningen, Umeå, Ljubljana, Porto), promoting urban agriculture (Paris, Brussels, Guelph), supporting local food production (Umeå), improving the co-ordination between urban and rural areas (Valladolid), incorporating restaurants and the hospitality activities to these efforts (Amsterdam, Valladolid, Umeå) or the production of organic fertilisers (Porto).

Source: Cities and Circular Economy for Food, Ellen Macarthur Foundation (2019[42])*; Good Food Strategy – Towards a sustainable food system in the Brussels-Capital Region, Brussels-Capital Region Government* (2015[43])*; and The circular economy in cities and regions. Key lessons learnt, OECD* (2019[44]).

Energy

39. **There is an on ongoing debate on the energy transition, which can benefit also the future circular economy strategy**. The energy sector plays an important role in production and consumption activities; in the way future infrastructure will be built, the land use and the connection with other sectors (e.g. waste) strengthened or created. There is a strong debate on the energy transition and the most suitable alternative sources of energy to respond to the demand. Hydrogen, solar energy, wind power, geothermal energy, aquathermy[14] and biogas are alternative sources of energy shaping, amongst others, new forms of mobility and transport, agriculture and building. There is no one solution to replace the amount of energy that has been provided by natural gas during the last 60 years and that will

[14] Thermal energy form wastewater and surface water.

stop after the phasing out of natural gas production established by the national authorities by 2022 (Reuters, 2019[45]).

40. **A combination of energy alternatives is foreseen by several stakeholders and local plans**. The municipality is developing "energy district plans" to provide three energy alternatives to natural gas heating in all city neighbourhoods by 2035: based on a collective heating network, electric heating and hybrid schemes combining electricity and green gas (Groningen Municipality, 2019[46]).

41. **Innovation, knowledge and capacity building play an important role in applying circular principles to the energy sector.** The New Energy Coalition, created in 2018, is expected to build knowledge on the circular economy and its relation to the energy transition, as one of the pillars of the city. It fosters innovation by connecting knowledge institutions, entrepreneurs, social organisations and governments. The Energy Transition Centre is a public-private partnership led by the Hanze University of Applied Sciences Groningen, University of Groningen and the Energy Academy Europe that functions as a testbed for new sustainable energy technologies. Start-ups, students, scientists, businesses and public authorities share ideas and business models in an open innovation workspace collaborating to speed up the energy transition and strengthening the knowledge economy in the north of the Netherlands (Entrance, 2019[47]).

Building sector

42. **The building sector can have a strong potential to become circular**. Groningen will be the only city of the Region in which the population is projected to grow. As a consequence, during the next 20 years, a total of 20 000 new homes will be built, while houses damaged by the earthquakes will have to be renewed. This is an opportunity to move from business as usual to a more circular approach where material from demolitions and secondary material from construction can be used, while combining with energy and water efficiency in buildings. Newly build houses can be energy neutral and also energy producers. Some examples of Cradle to Cradle (Box 4), as well as modular constructions (called the New Approach (*De Nieuwe Aanpak* -D.N.A.) (ABC2C, 2019[48]) are taking place in Groningen.

Box 4. Cradle to Cradle construction

Cradle to cradle is a design concept developed in the 1990s by architect William McDonough and chemist Michael Braungart, which promotes the use of construction materials and products that are recyclable in order to respond to the challenges of waste reduction and health protection. To achieve this goal, it proposes to design products or constructions that will mitigate the negative impacts of human activities, having as a result, the regeneration of the environment and the preservation of diseases.

This approach also enables to design products that can be reintroduced into new manufacturing processes after their use, adopting a different way of thinking about the design, materials and flows employed for product durability.

Since 2010, the Cradle to Cradle Products Innovation Institute administers the Cradle to Cradle Certified™ Product Standard, providing designers and manufacturers with information on products materials and manufacturing process. It measures five key aspects: material health, material reuse, renewable energy and carbon management, water stewardship, and social fairness and the product receives a grade in each category (basic, bronze, silver, gold, or platinum), being the lowest grade level the one representing the product's overall qualification.

Some cities have already made some progress in this area:

- The **City & County of San Francisco** adopted in 2018 a new regulation requiring all carpet installed in city-funded construction projects to be Cradle to Cradle Certified. This initiative intends to address San Francisco's priorities for sustainability and material health, including the avoidance of chemicals of concern, appropriate durability, carbon impact and the use of fibre and supporting materials that contain recycled content and are recyclable.
- In 2007, in the **City of Venlo** (Netherlands) made a commitment whereby all new city buildings were to be designed by cradle to cradle principles, and as a result, the new city hall, built in 2016, was designed employing this method. In order to observe the benefits of the new building, measurements such as air quality and temperature were taken from previous building and will be compared with the new one in a comparative study in 2019. However, it has already been observed that the new building's facade absorbs 30% of sulphur and nitrogen oxides in the building surroundings and regarding the economic benefits, the project is estimated to deliver a 12,5% return on investment by 2040.

Source: Cradle to Cradle Certified™, Cradle to Cradle Products Innovation Institute (2019[49])*; EPEA GmbH Website* (2019[50]).

43. **The value chain around the building sector implies a strong emphasis on design**. Designers can help the early stage of a strategy on the circular economy, identifying appropriate materials and making a link between the demand and how people use resources. Circular building is different from sustainability building: the circular way of building consists of rethinking upstream and downstream processes to minimise waste production and maximise waste reuse. It also implies new forms of collaborations amongst designers, constructors, contractors and owners, looking at the life cycle from construction to demolition. There is a motivated community of designers in Groningen that can foster circular design. For contractors, there is a market place for reusing materials, but data is lacking. The dataset *Madaster* aims to fill this gap keeping track through material passports to the different material used in new and existing buildings (Box 5). In this way scarce raw materials could be used as secondary materials for other construction projects.

Box 5. Material passports

Material passports are digital sets of data describing defined characteristics of materials and components in products and systems that give them value for present use, recovery,

and reuse. These passports are based on Cradle to Cradle design and can be introduced by clients and be used by architects and contractors for renovation and construction projects.

They represent a tool for the improvement of transparency on the materials used during construction and renovation stages. Among several benefits, they are expected to avoid costs related to the investigation of dangerous materials before demolition and to enhance better asset management of constructions since public authorities will have clearer information about materials and potential reuse.

Some stakeholders are already developing and providing these passports:

- The Dutch company *Madaster* is one of the companies providing digital material passports to real estate owners and property administrators.
- The company *SundaHus,* founded in 1990 in Sweden, provides structured material data and consulting services for sustainable development in the construction and property sectors.
- BAMB (Building As Material Banks), an EU Horizon 2020 project counting with partners from 7 European countries, has developed more than 300 digital materials passport for products, materials and components.

With the objective of stimulating the reuse, the City of Amsterdam has introduced material passport as one of the main action points of its circular economy action agenda in 2016. In this sense, one of the proposed actions consists of encouraging construction companies to use materials passports by offering discounts on plots to them. At a national level, the Dutch Government has set up two investment measures to offer deductions (up to 75% of investment costs) to 310 eligible green investments, including material passports.

Sources: Circular Amsterdam - A vision and action agenda for the city and metropolitan area, Circle Economy et al. (Circle Economy et al., 2016[51])*; Materials Passports: Optimising value recovery from materials, Lars Marten Luscuere* (2016[52])*; Madaster Website* (Madaster, 2019[53]) *; Tax relief schemes for environmentally friendly investment (Vamil and MIA), Netherlands Enterprise Agency* (2014[54]).

44. **Knowing how materials can be used and reused and harvesting from urban mining can be a way to reduce raw materials extraction**. Construction companies in Groningen highlight that the current regulation does not fully allow the reuse of wood. Historically, wood waste went to the landfill. Nowadays, to incinerators. Instead, like other construction materials, under certain quality conditions, it could still be reused. The Circular Friesland, for example, is working with companies towards the constructions of the future, which builds and re-builds energy-neutral homes, and also increasingly uses more circular construction materials (Circulair Friesland Association, 2015[55]).

45. **The idle capacity of buildings should also be considered for better use of resources**. In the city, as well as in the province, a number of dismissed buildings can be used as testbed for the circular economy experimentation or can have a second life, avoiding new constructions. Consumer behaviours are also changing the way spaces and buildings are used. Typically, with the increasing use of online shopping, high streets are going through a rethinking of their purpose. Empty buildings in the city centre can have alternative use for social activities. A dataset on empty buildings can help to map these available spaces. In Groningen, a project

of using the dismissed Sugar Factory aims to create a "zero waste" neighbourhood (Box 6).

Box 6. An urban regeneration project in Groningen

The old sugar factory closed down in 2010. Since then, the 120 hectares centrally located have served as an experimentation space. Until 2030 the municipality declared the area for temporary development. Nowadays over 50 initiatives (e.g. projects related to creative industries, sustainable housing programs, music festivals, and shared workspace for entrepreneurs) are being carried out in the area. By 2030, the Sugar Factory will become a zero-waste neighbourhood with a closed material flow. The old sugar factory will need to generate an energetic surplus to compensate for the old buildings in the city centre, which cannot turn into turn energy-neutral ones. The energy will be distributed through a smart grid that will ensure coordination between supply and demand. Rainproof will produce clean water and extracts nutrients and energy from wastewater. The grey wastewater will be purified as much as possible within the area, while black water is used for biomass and energy generation.

The *De Loskade*, in particular, is a building project exploring the creation of a circular district within the Sugar Factory. It consists of experimenting with bio-based materials and mobility. The project foresees the building up of 14 houses and 32 circular apartments by 2030. The *De Loskade* is projected to be a "removable" and "short stay" neighbourhood. As a "pop-up" neighbourhood, temporary properties after the rental period that will end in 2030 will be dismantled and re-built in other areas (Van Wijnen, 2019). Extensive pilots and testing are taking place at *De Loskade*, for example with gas-free installations and off-the-grid and energy-efficient homes.

Source: Proposal City of Groningen for Circular and regenerative cities: focus on industrial areas as regenerative drivers for the cities of the future, City of Groningen (2019[56])*; and Circulariteit, Van Wijnen* (2019[57]).

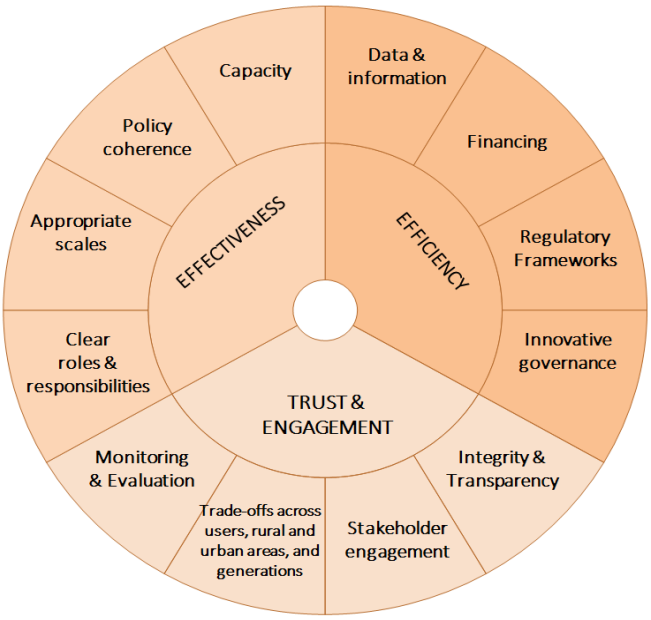
Places

46. **The metabolic connection between the city and the surroundings creates opportunities for collaboration within the circular economy approach**. The traditionally close relationship between the City of Groningen and its rural surroundings has become weaker in the last decades. While the city has been conceived more and more as a place for living and larger industrial production, its surroundings have been associated strictly with agricultural production and the economic connection between both has become less intense. There is a need to connect the industry sector with agriculture stakeholders and customers in urban and rural areas. Small farmers are starting to produce energy besides producing food. Consumers are also gradually becoming potential energy producers, redefining their way of participating in the actual production processes. The local administration has a key role to facilitate a social and urban-rural dialogue in order to get them involved in the circular transition and foster new cross-cutting coalitions.

Governance challenges

47. **A number of governance dimensions should be taken into account for achieving effective, efficient and inclusive circular economy systems in Groningen.** Three mutually reinforcing and complementary governance dimensions contribute to the design and implementation of tangible and outcome-oriented public policies: (i) *Effectiveness* refers to the contribution of governance to define clear sustainable policy goals and targets at all levels of government, to implement those policy goals, and to meet the expected targets. (ii) *Efficiency* relates to the contribution of governance to maximise the benefits of sustainable management and welfare at the least cost to society. (iii) *Trust and engagement* refer to the contribution of governance to ensuring the inclusion of stakeholders and building public trust through democratic legitimacy and fairness for the entire society (OECD, 2015[58]). Using the assessment framework provided by the OECD Principles on Water Governance (OECD, 2015[58]), this section analyses 12 key governance dimensions and related challenges vis a vis the circular economy transition in the City of Groningen (Figure 11).

Figure 11. Governance dimensions for the circular economy



Source: OECD Principles on Water Governance, (OECD, 2015[58]).

Effectiveness

48. Effectiveness can be boosted by allocating clear roles and responsibilities, while improving coordination across levels of government; implementing circular activities at the appropriate scale; enhancing policy coherence to favour a system approach; and adapting the technical and human capacities to the needs when transitioning from a linear to a circular economy. Observations in regard to the City of Groningen are discussed below.

49. **Horizontal coordination (across municipal departments) and vertical coordination (across levels of government) can be improved to avoid silos and duplications while transitioning towards the circular economy.** Several initiatives linked to the circular economy take place in different departments, such as the waste department, procurement department, city planning department and economy department. The City of Groningen has put in place environmental sustainable initiatives that can help to build a narrative on the circular economy, from waste to mobility to energy. For example, initiatives concern the use of hydrogen cars as sweepers and cleaners, awareness-raising and communication campaigns to reduce waste. However, these initiatives are still fragmented and would benefit from greater inter-relation with the aim of achieving common socio-economic and environmental objectives. As such, there is room to improve effective and timing communication, in order to maximise synergies and opportunities related to the use of natural, human and financial resources. In Groningen, there are not joint programmes amongst municipal departments. The Department of Economics of the Groningen municipality has taken the lead in drafting the forthcoming circular economy strategy. This will require further co-ordination amongst municipal departments and the identification of synergies.

50. **While a number of co-ordination mechanisms exist within the regions and the provinces, there is room for improvement**. Each province made steps towards the circular economy transition: the Province of Friesland launched the "Circular Friesland" an association of public and private partners to put in place a number of projects within five main sectors: circular agriculture, circular plastic, organic waste streams, construction and saline agriculture. The Provinces of Drenthe and Groningen started in the late '80 to invest in waste sorting plants to reduce incineration. The province of Friesland followed this example. In collaboration with the national government and the Waste Fund, the Province of Friesland launched in 2018 a national test centre for plastics, in order to improve techniques of sorting, recycling and re-using plastic packaging. The Centre organises awareness-raising activities on the circular economy. The Province of Groningen focuses on green chemistry and energy in combination of agro-industry for a future circular economy strategy. Each province could maximise efforts and impacts by being aware of initiatives in other provinces, co-ordinating efforts and learning from one another. Inhibiting factors for collaboration can be related to different political priorities.

51. **The issue of scale is of relevance, especially for certain circular economy activities that involve local and regional value chains.** Whether the local or regional scale is appropriate depends on the type of activities, availability of resources and the existence of a market for secondary material. A local and regional economic perspective is important to strengthen the co-operation links between the city and its rural surroundings. For example, in the province of Groningen the "Local Making Space" project (2019-2020) aims to set up a local value chain and establish

a link between creative industries in the city and its rural area. The initiative aims to create new products from renewable resources available within the territory of the Province (House of Design, 2019[59]).

52. **Policy coherence could be fostered to create a vision across circular economy initiatives.** The circular economy approach provides an opportunity to foster complementarities across policies. Typically, synergies can be created with the City Global Climate Adaptation Centre working on agriculture and food in dry areas, sea-level rise and urban resilience. It would help the municipality to move from a reactive (e.g. focus on energy transition in reaction to the phasing out of the natural gas extractions and earthquake) to a pro-active attitude, anticipating risks and creating opportunities.

53. **Human and technical capacity should meet the needs for defining and implementing a circular economy strategy**. City administrators are increasingly aware of the role of the municipality in promoting the circular economy and give positive examples to citizens and business. As such, initiatives are in place to build capacities amongst public officers to learn about Green Public Procurement and the circular economy. Regional and local governments are in fact struggling with innovative ways of doing contracting. As such, the use of circular public procurement is still limited. This is not only due to a capacity gap but to the difficulty in introducing clear circular related criteria for tendering. The city administration is willing to learn and build capacities for rethinking of policies following the circular economy principles. The tender set up for the office furniture of the municipality was mentioned as an example of a procurement procedure that incorporates circular aspects and benefits smaller firms. The tender was conferred to a regional firm that hired local companies to implement the project. Nonetheless, the municipality acknowledges that price continues to be the most decisive factor in public procurement tender selection.

Efficiency

54. Achieving efficiency requires that information, financing and regulatory framework are adequate to favour the transition toward the circular economy. In addition, innovative governance can help scale up pilots and experimentations. Each of these governance dimensions for the City of Groningen are discussed below.

55. **In Groningen, there is room for a more systematic data collection that could allow take circular decisions**, **measure progress and improve implementation.** The city collects regularly data on waste collection, energy production and consumption and CO_2 emissions. As per international practices, while these data are used to measure circular economy-related outputs, it is difficult to find a causal relation between policies and impacts. Moreover, beyond the outputs, inputs should also be measured. For instance, in the case of the building sector, data on material for construction would help understand what kind of material is used for building and how can be used in the future (see above section on “Policies”). Mapping empty buildings would help avoid new constructions and plan alternative use of existing ones; mapping input and output of material flows would help establish priority actions. Overall, improving data and information would help reach a better understanding of what the circular economy is and improve policy-making and implementation.

56. **Funding for the transition from a linear to a circular economy are yet to be defined.** As of now, provincial and regional funds directly related to the circular economy have not been allocated. On the other hand, the municipality's waste sector budget suffered cuts of more than EUR 100 million during the last 10 years due to national government decisions. Possibly, the city could benefit in the future of funds from the National Government, which allocated in 2019 a total of EUR 22.5 million extra for sustainable and circular initiatives consequent to the definition of the Circular Economy Strategy. However, it is unclear what the procedures are to access this fund and when the City of Groningen could benefit from it. The funding is linked to the envelope of EUR 300 million that the government makes available annually for the climate. The government, in fact, strongly believes that the circular economy is needed to achieve climate goals and that waste is a resource. In the words of the State Secretary of Infrastructure and Water Management Stientje van Veldhoven "*Our raw materials will no longer come from an oil barrel, but from the garbage bag*"[15]. The EUR 22.5 million are structured as follows: EUR 10 million for stimulating reuse of plastics and consumer goods; EUR 5 million for recycling of asphalt, concrete and steel; EUR 7.5 million have been allocated to promote climate-neutral and sustainable procurement (e.g. sustainable purchasing in the healthcare sector).

57. **Several initiatives related to the circular economy and specific sectors, but in practice lack financial support**. Often, innovative ideas risk to function on paper, but not in practice, especially due to a lack of financial resources. As a consequence, only small scale low-risk projects can actually materialise with limited impacts in terms of job creation and positive environmental effects. On the other hand, specific activities at large scale are strongly dependent on subsidies, as in the case of green gas, whose production would not be possible otherwise, as it is expensive compared to other sources, including fossil ones. Relying on subsidies could end up restricting the entrepreneurial initiative.

Regulatory frameworks could be adapted and updated to facilitate the transition. A range of stakeholders from waste operators to constructors in Groningen finds regulations related to waste recycling and reuse too rigid to allow the transition from the linear to the circular economy. There is uncertainty around the concept of waste and how materials can be reinserted in production processes when they are still reusable, but by Law they are qualified as "waste". This is the case of using wood in the construction sector: companies are re-using small quantities of wood as residual of works. However, for much bigger quantity the regulation on the re-use of material generates uncertainties across operators of the sector. Innovative thinkers ask for loosing up rules (e.g. permits for waste reuse). While in some cases the local government does not have direct responsibilities to adequate the regulations to emerging needs related to the circular economy, in others some adaptation can be made (e.g. land use, permits). The legal and regulatory framework at the national level is expected to adapt in order to make the Netherlands an economy without waste in 2050, as defined by the National Circular Economy Strategy. For example, the national government aims to adopt a more flexible approach to amendments of the National Waste Management Plan (to anticipate the changes required by the transition (Ministry of Infrastructure and the Environment

15 https://www.rijksoverheid.nl/actueel/nieuws/2018/10/10/klimaatenvelop-225-miljoen-voor-circulaire-economie.

and Ministry of Economic Affairs, 2016[33]). Another example is the national Smart Regulation programme (*Ruimte in Regels*) that runs up to 2020, for which the government cooperates with entrepreneurs to look for greater room to promote sustainable innovations within current legislation (Ministry of Infrastructure and the Environment and Ministry of Economic Affairs, 2016[33]). In particular, in 2017, the companies in the wind energy sector contacted the Smart regulation programme's helpdesk specialised in the chemistry sector to raise the issue of the restrictive regulations regarding the inability to re-use plastic turbine blades for windmills after their replacement. Now, this plastic is used as an input in the car and ship industry. (Ministry of Economic Affairs, 2017[60]).

58. **While technical solutions are available, there is room for developing non-technical innovation on the circular economy.** Pilot initiatives aim to make the chemical and plastics industry more sustainable, replacing fossil fuels with bio-products (Bio BTX); to develop innovative research for the reuse of organic waste from potato and the production of plant-based protein (Avebe); to generate bioplastics from biomass (Suiker Unie); and provide district heating using green gas (Bareau). Regardless of how successful or not the pilot initiatives are, they intend to stimulate new techniques that can be used to concretise circular processes. However, beyond technical innovations, non-technical ones can help strengthen collaborations, overcome policy silos and stimulate innovative public procurement. For example, the *De Loskade* circular district experimentation (see Box 6) could inform through the results of the innovations (in this case a potential city district) future city urban plans (e.g. including housing, land use and mobility) and selection criteria for innovative public tenders concerning buildings and infrastructure. A clear. There are three types of challenges: i) increase acceptance of circular models by users of services and products; ii) clearly understand costs and benefits to help entrepreneurs shift from linear to circular production models. As of now, embracing circular principles is very much related to the willingness of innovative thinkers and forward-looking entrepreneurs, less risk-averse; iii) a challenge would consist in scaling up the projects, once they pass the pilot phase.

Trust and engagement

59. **Inclusive governance can help ensure buy-in and build consensus over the changes that the circular economy is supposed to bring in the everyday life of citizens, as well as in business practices**. Even though there is a high level of participation in the policymaking and implementation in the City of Groningen from various stakeholders, in some cases stakeholder engagement is challenging. The involvement of all stakeholders requires active, specific and tailored communication strategies. The main issue is to involve many people and not only the "happy few". Circular entrepreneurs in Groningen find difficult to get people involved even in small activities (e.g. urban gardening), aiming to raise awareness and stimulate more sustainable behaviour concerning the use (and reuse) of the resources. Cultural barriers in recycling, re-using material can be an obstacle towards greater engagement. Changing the business as usual and contributing to a behavioural shift is not an easy task, especially when risks, costs and benefits are not clear.

Ways forward

The City of Groningen can play a role as promoter, facilitator and enabler of the circular economy strategy. Cities act as *promoter*s when they identify priorities, promote concrete projects and engage stakeholders; they are *facilitators*, when fostering co-operation between stakeholders, citizens and levels of government. The city's *enabler* role entails creating the necessary conditions for the circular economy to happen (setting up incentives, identifying policy gaps, updating regulatory frameworks, catalysing funds, etc.). According to the assessed challenges and following the discussion between the OECD delegation and 40+ stakeholders in Groningen in February 2019, some ways forward are proposed (Table 2). The proposed ways forward were discussed during the OECD Policy Seminar held in Groningen on 17 September 2019 with a range of stakeholders from local and regional authorities, the private sector and academia. The main goal of the Policy Seminar was to co-create an Action Plan in relation to the policy recommendations.

Table 2. Suggested ways forward for the circular economy in Groningen

Promoter	Facilitator	Enabler
Make the city a role model	Facilitate coordination across municipal departments and across regional and provincial strategies	Identify gaps and ways forward on how to adapt laws and regulations
Map existing circular initiatives in various sectors	Facilitate offline and online platforms for practice exchange	Identify financial conditions and opportunities
Promote stakeholder engagement to identify their roles in the implementation of the circular economy strategy	Facilitate the connection with business and universities	Put in place Green Public Procurement
Develop a strategy on the circular economy	Establish a Single-Window for businesses	Create spaces for experimentation
Promote a circular economy culture	Strengthen the existing networks to grab the "low-hanging fruits" from co-operation of local businesses	Generate an information, evaluation and monitoring system
Promote training programmes and develop technical capacities	Facilitate the connection between urban and rural areas	Enable the circular economy transition beyond electoral cycles
Promote competition of ideas, awards and certifications		
Create demand by being a launching customer		

Source: Own elaboration.

Promoter

60. **The municipality can play an important role in promoting the circular economy in the city of Groningen and its surrounding area.** It is widely recognised that being Groningen the biggest and growing city in the Northern Netherlands Region, it can play a lead role in the transition from the linear to the circular economy. It is also important for the city to give a positive example to business and citizens for the circular economy to happen and to promote behavioural change. As such, the municipality could:

- **Make the city a role model** for the circular economy, triggering behavioural and business change inside and outside the city. The recipe of success consists in taking the risks and accepting failures. The municipality should be an example of change and make this an explicit target, while it would show the feasibility of the change. The local government should take the initiative of using sustainable products and building in a circular manner from roads to buildings. This would send a good signal to the market and would help brand the city with a new image within the whole country: moving out from the natural gas extraction to the circular economy.
- **Map existing circular initiatives in various sectors.** This would help identify circular sectors and those in which the transition is not happening in order to frame priorities and actions in the short, medium and long term, as well as identify synergies across sectors. It would also help to improve the existing policies and exploring the main gaps.
- **Promote stakeholder engagement to identify their roles in the implementation of the circular economy strategy.** The circular economy is a shared responsibility; therefore, various stakeholders need to be involved since the zero phase of the strategy to build consensus and vision. The implementation of the circular economy strategy is not just the responsibility of the municipality.
- **Develop a strategy on the circular economy.** This would help overcome the fragmentation of initiatives and build a common vision. The vision should be long term and go beyond the current political cycle. It will help define priorities and allocate funds. The strategy needs: 1) a strong vision and a relevant narrative – e.g. transitioning from natural gas-based economy (i.e. linear) towards innovative, cooperative circular economy, as a motive that could ensure long term political buy-in; 2) to be mainstreamed in different sectoral strategies, especially linking with their climate change strategies. The waste, construction and demolition, biomass and food sectors are interesting areas to start creating links and synergies; 3) to include the design of a participative methodology to engage key stakeholders taking into account their inputs and concerns; 4) to be accompanied with a dedicated budget; 5) to be implemented in a proper administration structure with appropriate authorities with clear roles and responsibilities; 6) to be regularly monitored and evaluated for improvements.
- **Promote a circular economy culture.** This can be done through furthering communication instruments (a dedicated website, communication campaigns, sharing success stories in the media to promote projects and initiatives), creating spaces for meetings and dialogues. For example, the City of Valladolid (Spain) organises “Circular Weekends”, during which entrepreneurs connect with one

another and join forces for circular projects. This participation space that involves citizens in public discussions can help promote a circular culture while raising awareness and engagement. Another way to strengthen the circular community would be through "circular economy ambassadors". The City of London has started recruiting "circular economy ambassadors" in different companies and local authorities to share the benefits of the circular economy with specific information for each economic sector and to raise awareness at the workplace (London Waste and Recycling Board, 2017[61]). In the waste sector, in particular, the municipality can play a role in raising awareness and promoting the circular economy culture amongst citizens. Being responsible for the waste collection and intending to create a circular economy hub, the municipality can promote waste prevention and reuse values among citizens and can foster companies to recycle and take the responsibility for their waste production and treatment.

- **Promote training programmes and develop technical capacities** on the circular economy, inside and outside the municipality, with a sectoral focus on upstream and downstream waste management, agro-food, product re-design, and construction and demolition.

- **Promote competition of ideas, awards and certifications** of circular economy initiatives, in order to stimulate new ideas and projects and provide support to put them in practice, including funding opportunities or space for experimentation.

- **Create demand by being a launching customer.** The city can be the first customer to stimulate the demand and help business for small companies and start-ups. More specifically, circular design products and technological solutions (e.g. in the recycling processes) need demand for them to be in the market. The local government can stimulate this demand by being the first customer of innovative products and goods.

Facilitator

61. **The municipality can facilitate collaborations and co-operation among a wide range of actors to make the circular economy happen on the ground**. These collaborations could consist of:

- **Facilitate coordination across municipal departments and across regional and provincial strategies,** by creating space for dialogue and experience exchange, enhancing common actions and learning processes. In some cases, circular economy-related activities go beyond the city and its surrounding areas. Input and output of energy, resources and material concern the entire regions. Moreover, since the three provinces and the local water boards have started a path towards the circular economy, their experiences represent learning factors for the others. The city is not isolated; it is within an administrative and geographical context.

- **Facilitate offline and online platforms for practice exchange** amongst public, not-for profit actors and business. For example, a dedicated webpage containing

information on circular economy-related activities, stakeholders involved and call for projects, can raise awareness, while representing the basis for possible new collaborations. It is important to share all the knowledge of the different stakeholders. Companies have expressed their interest in the development of a platform for knowledge sharing, which could be promoted by the government for continuity and long term purposes.

- **Facilitate the connection with business and universities** to stimulate innovation in the city. Further engagement with the academic sector can be considered to build knowledge on circular dimensions for example in bio-economy and circular design. This would help the city identify key sectors and opportunities. The connection with business and entrepreneurs is key to promote pioneering activities and innovative business models related to the circular economy. Some innovative thinkers and motivated entrepreneurs can be consulted to start pioneering activities for example in the building and construction and in the agro-food sectors. These activities could be scaled up after an initial pilot phase. Another way to connect the municipality and the entrepreneurs could be to link the city's future circular economy strategy with the programme that promotes start-ups in the municipality, support existing companies and promote capacity building through university modules on how to start company. Stimulating the connection between companies and universities on the circular economy would also help build an "ecosystem" (collaboration between government, universities and business) along the line of the existing ones on digital society and healthy ageing.
- **Establish a Single-Window for circular businesses.** This window should offer all services, information and administrative support regarding circular economy projects for businesses, in order to reduce transaction costs for entrepreneurs and SMEs willing to be part of the transition.
- **Strengthen the existing networks to grab the "low-hanging fruits" from co-operation of local businesses**. The networks **(**e.g. the Food Network, BUILT-IN Groningen) could include additional actors, generating activities related to streamlined waste treatment, re-use of materials and food, engagement of local communities, etc. with the support of the municipality, when possible (e.g. space, funds, awareness-raising).
- **Facilitate the connection between urban and rural areas.** The local administration has a key role to facilitate a social and urban-rural dialogue in order to get farmers, SMEs, consumers, business and knowledge institutions involved in the circular transition and foster new cross-cutting solutions (e.g. some key sectors are the bio-economy, food, biomass, construction, delivery, farming, agriculture, chemistry).

Enabler

62. **Making the circular economy happen is about enabling the necessary governance and economic conditions** (eco-design / new business models). To do this, the city government could:

- **Identify gaps and ways forward on how to adapt laws and regulations** for circular business to happen. This could imply a dialogue with the national

government when the responsibility go beyond that of the municipality. Also, identify cases in which it is possible to adapt the regulation (e.g. land use, permits) without waiting for the national initiative.

- **Identify financial opportunities** for the circular economy initiatives to be implemented and scaled up. An option for the SMEs, would be for example, to create a scheme to offer subsidised loans or credit guarantees to circular economy companies, in co-operation with private and semi-public financial institutions (e.g. banks, business funds). The idea would be for the municipality/public fund to compensate the financial institution for part of the interest rates or provide guarantees on collateral, to attach a value to the "public good" created by circular economy companies.
- **Put in place Green Public Procurement**. Green public procurement is a strategic governance tool to foster the circular transition. Some countries apply pre-tenders, which can help with the pre-analysis of the market and stimulate innovation avoiding tenders that do not receive any offer from the market. For example, in Italy, when launching the framework contract on "Integrated Energy Management Services" for heating services including improved energy efficiency, consumption reduction and CO_2 emissions avoidance, pre-procurement market consultation was carried out using online questionnaires addressed to businesses and the main trade associations. Calls should be compatible with the guidelines and principles of the circular economy. Circular economy principles could be included in tenders to stimulate circular building, such as including insulation and energy-saving, reusing material, using locally produced material, dismantling options. Other possible formats to enhance SME participation in public bids could be to introduce E-Procurement procedures (e.g., the Korean ON-line E-Procurement System – KONEPS- or the "Electronic Marketplace for the Public Administration" - MePA- in Italy) (Box 7).

Box 7. SMEs in Green Public Procurement

Large companies generally have more experience in responding to Green Public Procurement initiatives, due to their greater capacity for environmental management and bidding. However, there is a wide variety of initiatives that seek to increase the weight of SMEs in this process.

For example, in Brazil, one of the main barriers for SMEs regarding sustainable public procurement is the need of obtaining certifications or ecolabels, which are costly for SMEs. Through specific programmes that enable SMEs to meet these requirements, by 2014 SMEs reached 67% of the reported public sustainable purchases and 89% of registered suppliers for sustainable purchases.

Launching e-Procurement platforms may also enhance SME participation in public bids:

- In 2003, the Italian Ministry of Economy and Finance (MEF) introduced a procurement platform, the Italian Public Administration e-Marketplace (MePA). The MePA is a virtual market in which PA buy goods and services

offered by suppliers and it connects from suppliers and public authorities all over Italy.

- KONEPS (Korea ON-line E-Procurement SYSTEM) is an online procurement system in Korea, which handles the entire procurement process. The introduction of this system increased the participation of SMEs. In 2017 had the participation of 52 395 public organizations and 373 833 private companies.

The OECD Recommendation of the Council on Public Procurement suggests giving access to procurement opportunities for companies of all sizes for the well-functioning of the public procurement system.

Sources: *European Public Sector Award* (2011[62]); *SMEs in Public Procurement, OECD,* (2018[63]); *OECD Recommendation of the Council on Public Procurement* (2015[64]); *Promoting the participation of Small and Medium Size Enterprises (SMEs) in Green Public Procurement* (2016[65]); *e-Procurement in Korea Impact of e-Procurement Future Goals* (2012[66]).

- **Create spaces for experimentation**. Create a system for renting spaces, use and reuse products and share benefits as well as costs and risks with stakeholders. The government could seek partnership with private providers of co-working spaces (e.g. WeWork) to manage such spaces. These spaces could also be labelled (e.g. free space for Circular Innovation) to attract stakeholders, such as entrepreneurs and scientists.
- **Generate an information, evaluation and monitoring system** for the circular economy. For example, collect data on empty buildings, material used for construction, waste streams, as well as on economic and governance variables (e.g. inventory of laws and regulations that can foster the transition from the linear to the circular economy). Open data can enable further research, while boosting innovation and the development of new business models. For the future, monitoring and evaluating the targets and goals of the circular strategy in the short, medium and long term, would represent an important feature that would help identify how "circular" a city is and what works, what does not work and what can be improved (Box 8).

Box 8. Open data initiatives

Open data initiatives lead by local and national authorities are an important measure to reduce information asymmetries, and enable companies to produce, innovate and compete on a level playing field. Open data can lower barriers to entry and allow SMEs to compete and detect opportunities in the market.

For example, the municipal transport authority of London has moved towards the publication of consistent and up-to-date information about how people and public vehicles move around the city. It is estimated that it will provide savings of up to GBP 130 million

per year for customers, road users, the city of London and the municipal transport authority itself.

Studies also suggest that open data government initiatives foster the development of new start-ups. For instance, in London, the use of municipal data on transport enabled the development of innovative new start-ups and applications, including those that mixed publicly collected data with other sources. Firm-level studies estimate that open data added GBP 12 million to GBP 15 million per year for firms.

Source: OECD Going Digital: Shaping Policies, Improving Lives (2019[67])

- **Enable the circular economy transition beyond electoral cycles.** In the Netherlands, elections take place every four years. While at the moment in Groningen there is certainly a strong political will towards the circular economy, also by appointing the vice-mayor in charge of the circular economy, political continuity can represent a risk for the future of the circular economy agenda (in Groningen as elsewhere). As such, stakeholders should be involved and build consensus over needs and actions to be implemented for the circular economy to happen beyond the electoral mandate and as part of a new socio-economic paradigm.

References

5Groningen (2019), *5Groningen*, http://www.5groningen.nl/en (accessed on 30 April 2019). [75]

ABC2C (2019), *ABC2C Webpage*, 2019, https://abc2c.nl/over-abc2c/ (accessed on 26 July 2019). [48]

Aguilar, S. (2016), *Promoting the participation of Small and Medium Size Enterprises (SMEs) in Green Public Procurement*, https://www.oneplanetnetwork.org/sites/default/files/final_report_wg_3c_.pdf (accessed on 6 June 2019). [65]

BCI (2018), *Campus Groningen fastest growing Campus in the Netherlands › Campus Groningen*, https://campus.groningen.nl/en/news/campus-groningen-snelst-groeiende-campus-van-nederland (accessed on 30 April 2019). [73]

Bourne, S. et al. (2014), "A seismological model for earthquakes induced by fluid extraction from a subsurface reservoir", *Journal of Geophysical Research: Solid Earth*, Vol. 119/12, pp. 8991-9015, http://dx.doi.org/10.1002/2014JB011663. [24]

Brussels-Capital Region Government (2015), *Good Food Strategy - Towards a sustainable food system in the Brussles-Capital Region*, http://document.environnement.brussels/opac_css/elecfile/BRO_GoodFood_Strategy_ENGL.pdf (accessed on 30 April 2019). [43]

CBS (2018), *Arbeidsdeelname; regionale indeling 2018. Statistics Netherlands, The Hague, Netherlands*, https://opendata.cbs.nl/statline#/CBS/nl/ (accessed on 2 May 2019). [22]

CBS (2018), *Trends in the Netherlands 2018*, http://www.cbs.nl/-/media/_pdf/2018/26/trends%20in%20the%20netherlands_2018_web.pdf. [20]

Circle Economy et al. (2016), *Circular Amsterdam - A vision and action agenda for the city and metropolitan area*, https://www.circle-economy.com/wp-content/uploads/2016/04/Circular-Amsterdam-EN-small-210316.pdf (accessed on 30 April 2019). [51]

Circulair Friesland Association (2015), *Circulair Fryslân*, https://www.urgenda.nl/documents/CirculairFryslan2.pdf (accessed on 2 May 2019). [55]

City of Groningen (2018), *CO_2-monitor Groningen*, https://www.groningenco2neutraal.nl/co2-monitor (accessed on 8 November 2019). [14]

City of Groningen (2015), *Groningen Cycling Strategy 2015-2025*, https://groningenfietsstad.nl/friksbeheer/wp-content/uploads/2016/05/Groningen_CycleCity_Strategy_2015-2025.pdf (accessed on 2 May 2019). [1]

Cradle to Cradle Products Innovation Institute (2019), *Cradle to Cradle Certified™*, http://www.c2ccertified.org/ (accessed on 30 April 2019). [49]

Deloitte Fast50 (2018), *8 companies from Groningen in the Deloitte Fast50 › Founded in Groningen*, https://www.foundedingroningen.com/news/8-companies-from-groningen-in-the-deloitte-fast50 (accessed on 30 April 2019). [13]

DVHN (2018), *Noord-Nederland ontpopt zich tot het nieuwe Silicon Valley - Extra - DVHN.nl*, https://www.dvhn.nl/extra/Noord-Nederland-ontpopt-zich-tot-het-nieuwe-Silicon-Valley-23901389.html (accessed on 30 April 2019). [12]

Economic Board Groningen (2019), *Economic Board Groningen*, https://www.economicboardgroningen.nl/nl (accessed on 30 April 2019). [70]

Ellen MacArthur Foundation (2019), *Cities and Circular Economy for Food*, https://www.ellenmacarthurfoundation.org/assets/downloads/Cities-and-Circular-Economy-for-Food_280119.pdf (accessed on 30 April 2019). [42]

Entrance (2019), *About EnTranCe*, https://www.en-tran-ce.org/en/over-entrance/ (accessed on 29 April 2019). [47]

EPEA GmbH (2019), *EPEA GmbH*, https://epea-hamburg.com/ (accessed on 30 April 2019). [50]

EU Eden Project (2002), *Waste Neutral. A sustainable approach to waste and resource management*, Eden Project, http://ec.europa.eu/environment/archives/waste/pdf_comments/eden_annex.pdf (accessed on 6 June 2019). [80]

EURES (2018), *Labour market information - Noord-Nederland - European Commission*, https://ec.europa.eu/eures/ (accessed on 30 April 2019). [21]

European Commision (2019), *Province of Groningen - Internal Market, Industry, Entrepreneurship And SMEs*, https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/province-groningen (accessed on 22 July 2019). [7]

European Commission (2019), *Province of Groningen - Internal Market, Industry, Entrepreneurship And Smes - European Commission*, https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/province-groningen (accessed on 29 April 2019). [18]

European Environment Agency (2018), *Renewable energy sources Setting the scene Annual Indicator Report Series (AIRS)*. [32]

European Public Sector Award (2011), *The Italian public administration e-marketplace (MEPA)*, http://www.epsa-projects.eu/index.php/The_Italian_public_administration_e-marketplace_(MEPA) (accessed on 6 June 2019). [62]

Eurostat (2019), *Urban Europe — statistics on cities, towns and suburbs — satisfaction and quality of life in cities - Statistics Explained*, https://ec.europa.eu/eurostat/ (accessed on 29 April 2019). [3]

Eurostat (2018), *Change of gross domestic product (GDP) per inhabitant in purchasing power standards (PPS) in relation to the EU-28 average, by NUTS 2 regions, 2007–2015 (percentage* [19]

points difference between 2007 and 2015) RYB17.png - Statistics Explained, https://ec.europa.eu/eurostat/ (accessed on 30 April 2019).

Eurostat (2018), *GDP at regional level - Statistics Explained*, https://ec.europa.eu/eurostat/statistics-explained/index.php/GDP_at_regional_level#Economic_growth_and_productivity (accessed on 6 June 2019). [6]

Eurostat (2017), *Share of renewable energy in gross final energy consumption (%)*, https://ec.europa.eu/eurostat/ (accessed on 3 May 2019). [76]

Grasso, J. and G. Wittlinger (1990), "Ten years of seismic monitoring over a gas field", *Bulletin of the Seismological Society of America*, https://pubs.geoscienceworld.org/ssa/bssa/article-abstract/80/2/450/102493/ten-years-of-seismic-monitoring-over-a-gas-field?redirectedFrom=fulltext (accessed on 30 April 2019). [25]

Groningen Municipality (2019), *Chemistry | Groningen.nl*, https://groningen.nl/en/do-business/sector-information/chemistry (accessed on 29 April 2019). [36]

Groningen Municipality (2019), *Groningen Join Our Energy*. [40]

Groningen Municipality (2019), *Neighborhood energy plans*, https://gemeente.groningen.nl/wijkenergieplannen (accessed on 22 November 2019). [46]

Groningen Municipality (2018), *Council Proposal: Groningen Circular*. [38]

Groningen Municipality (2018), *Routekaart Groningen CO2-Neutraal 2035. Strategie 2023 en eindbeeld 2035*, https://gemeente.groningen.nl/sites/default/files/Routekaart-Groningen-Energie-%28CO2---neutraal%29.pdf (accessed on 6 June 2019). [28]

Groningen Municipality (2017), *How can we make Groningen more welcoming? Improve the housing situation of internationals*, https://gemeente.groningen.nl/sites/default/files/Welkomstbeleid%20International%20Groningen.pdf (accessed on 30 April 2019). [17]

Groningen Municipality (2017), *Statistical overview of the municipality of Groningen*, https://os-groningen.nl/wp-content/uploads/2017/04/thema06-werkloosheid.pdf (accessed on 30 April 2019). [72]

Groningen Municipality (2015), *Groningen Energizes Programme 2015-2018*, https://gemeente.groningen.nl/sites/default/files/Groningen%20energizes.pdf (accessed on 30 April 2019). [15]

Groningen Municipality (2013), *Op weg naar een groene kringloop-economie*, https://gemeente.groningen.nl/sites/default/files/groningen-visie-biobasedeconomy.pdf (accessed on 29 April 2019). [37]

Groningen Seaports (2018), *The Northern Netherlands aims to be Europe's most sustainable industrial area by 2030 - Groningen Seaports*, https://www.groningen- [4]

seaports.com/en/nieuws/the-northern-netherlands-aims-to-be-europes-most-sustainable-industrial-area-by-2030/ (accessed on 30 April 2019).

Groningen, C. (2018), *CO_2-Monitor Groningen*, http://www.groningenenergieneutraal.nl/co2-monitor (accessed on 29 April 2019). [31]

Groningen, M. (2019), *Proposal City of Groningen for Circular and regenerative cities: focus on industrial areas as regenerative drivers for the cities of the future*. [56]

Groninger Internet Courant (2018), *Aantal Groningse zonnepanelen in jaar tijd verdubbeld - Groninger Internet Courant*, https://www.gic.nl/innovatie/aantal-zonnepanelen-in-jaar-tijd-verdubbeld (accessed on 29 April 2019). [29]

Ho In Kang (2012), *e-Procurement in Korea Impact of e-Procurement Future Goals*, http://www.europarl.europa.eu/document/activities/cont/201207/20120710ATT48620/20120710ATT48620EN.pdf (accessed on 6 June 2019). [66]

House of Design (2019), *House of Design*, http://www.houseofdesign.nl/en/ (accessed on 26 July 2019). [59]

Koploperproject (2019), *Front-runner project (Koploperproject)*, https://www.koploperproject-groningen.nl/zo-werkt-het (accessed on 26 November 2019). [41]

London Waste and Recycling Board (2017), *London's Circular Economy Route Map*, http://www.lwarb.gov.uk/wp-content/uploads/2015/04/LWARB-London%E2%80%99s-CE-route-map_16.6.17a_singlepages_sml.pdf (accessed on 5 August 2019). [61]

Luscuere, L. (2016), "Materials Passports: Optimising value recovery from materials", http://dx.doi.org/10.1680/jwarm.16.00016. [52]

Madaster (2019), *Madaster*, https://www.madaster.com/en/about-us (accessed on 30 April 2019). [53]

Metabolic (2018), *Metabolic pioneers urban and regional approaches for Circular Economy - Metabolic*, https://www.metabolic.nl/news/metabolic-pioneers-urban-and-regional-approaches-for-circular-economy/ (accessed on 30 April 2019). [35]

Ministry of Economic Affairs (2017), *Better Regulation: Towards a Responsible Reduction in the Regulatory Burden 2012-2017*, https://www.government.nl/documents/reports/2017/08/22/better-regulation-towards-a-responsible-reduction-in-the-regulatory-burden-2012-2017 (accessed on 27 November 2019). [60]

Ministry of Infrastructure and the Environment and Ministry of Economic Affairs (2016), *A Circular Economy in the Netherlands by 2050*, https://www.government.nl/topics/circular-economy/accelerating-the-transition-to-a-circular-economy (accessed on 27 November 2019). [33]

Nederlandse Aardolie Maatschappij BV (2013), *A technical addendum to the winningsplan Groningen 2013 subsidence, induced earthquakes and seismic hazard analysis in the Groningen field.*, https://www.tweedekamer.nl/downloads/document?id=4ce3b996-fcb3-4d7b-9fd6-89be7fa10570&title=Technical%20Addendum%20to%20the%20Winningsplan%20Groningen [26]

%202013.%20Subsidence%2C%20Induced%20Earthquakes%20and%20Seismic%20Hazard%20Analysis%20in%20the%20Groning (accessed on 30 April 2019).

Netherlands Entreprise Agency (2014), *Tax relief schemes for environmentally friendly investment (Vamil and MIA)*, http://www.rvo.nl (accessed on 29 April 2019). [54]

NL Times (2019), *Dutch gov't pushes €80 million into promoting a circular economy*, https://nltimes.nl/2019/07/10/dutch-govt-pushes-eu80-million-promoting-circular-economy (accessed on 27 November 2019). [34]

Nord Regio (2018), *Developing and Managing Innovation Ecosystems in the Circular Economy*, http://norden.diva-portal.org/smash/get/diva2:1240777/FULLTEXT01.pdf (accessed on 6 June 2019). [79]

Northland Power (2019), *Gemini (Offshore wind)*, https://www.northlandpower.com/What-We-Do/Operating-Assets/Wind/Gemini.aspx (accessed on 27 November 2019). [30]

OECD (2019), *Functional urban areas Netherlands*, http://www.oecd.org/cfe/regional-policy/Netherlands.pdf (accessed on 30 April 2019). [9]

OECD (2019), *Going Digital: Shaping Policies, Improving Lives*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264312012-en. [67]

OECD (2019), *OECD Survey on Circular Economy in Cities and Regions*. [39]

OECD (2019), *The circular economy in cities and regions. Key lessons leart*. [44]

OECD (2018), *OECD Regions and Cities at a Glance 2018*, OECD Publishing, Paris, https://dx.doi.org/10.1787/reg_cit_glance-2018-en. [10]

OECD (2018), *SMEs in Public Procurement: Practices and Strategies for Shared Benefits*, OECD Public Governance Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264307476-en. [63]

OECD (2016), *OECD Regional Outlook 2016: Productive Regions for Inclusive Societies*, http://dx.doi.org/10.1787/9789264260245-en (accessed on 22 July 2019). [8]

OECD (2016), *OECD Territorial Reviews: The Metropolitan Region of Rotterdam-The Hague, Netherlands*, OECD Territorial Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264249387-en. [69]

OECD (2015), *Going Green: Best Practices for Sustainable Procurement*, https://www.oecd.org/gov/public-procurement/Going_Green_Best_Practices_for_Sustainable_Procurement.pdf (accessed on 3 May 2019). [77]

OECD (2015), *OECD Principles on Water Governance*, http://www.oecd.org/cfe/regional-policy/OECD-Principles-on-Water-Governance.pdf (accessed on 3 May 2019). [58]

OECD (2015), *OECD RECOMMENDATION OF THE COUNCIL ON PUBLIC PROCUREMENT Directorate for Public Governance and Territorial Development*, http://www.oecd.org/gov/ethics/OECD-Recommendation-on-Public-Procurement.pdf (accessed on 6 June 2019). [64]

OECD (2015), *OECD Regional Statistics*, https://doi.org/10.1787/region-data-en. [74]

OECD (2014), *Smart Procurement Going green: best practices for green procurement- Italy Integrated Energy Management Services*, http://www.oecd.org/gov/ethics/gpp-procurement-Italy-IEMS.pdf (accessed on 6 June 2019). [68]

Palen, R. and F. Diaz Alonso (2020), *Highest share of renewables in Sweden, lowest in Luxembourg, the Netherlands and Malta*, https://ec.europa.eu/eurostat/documents/2995521/9571695/8-12022019-AP-EN.pdf/b7d237c1-ccea-4adc-a0ba-45e13602b428 (accessed on 6 June 2019). [78]

Reuters (2019), *Netherlands to halt Groningen gas production by 2022 - Reuters*, https://www.reuters.com/article/us-netherlands-gas/netherlands-to-halt-groningen-gas-production-by-2022-idUSKCN1VV1KE (accessed on 26 November 2019). [45]

SmartEnCity (2019), *SmartEnCity.eu*, https://smartencity.eu/about/ (accessed on 30 April 2019). [71]

Statistics Service Gemeente Groningen (2018), *Demografische ontwikkelingen gemeente Groningen*, http://www.oisgroningen.nl (accessed on 30 April 2019). [16]

Statistics Service Municipality of Groningen (2017), *Employment and economy*, https://os-groningen.nl/wp-content/uploads/2018/02/thema05-werk-economie.pdf (accessed on 2 May 2019). [5]

Statistics Service Municipality of Groningen (2017), *Groningen City Monitor*, http://www.groningencitymonitor.nl/en/the-people/students (accessed on 2 May 2019). [2]

University of Groningen (2019), *Groningen Digital Business Centre*, https://www.rug.nl/gdbc/over-ons/ (accessed on 27 November 2019). [11]

Van Wijnen (2019), *Circulariteit - Van Wijnen - Meer dan bouwen*, https://www.vanwijnen.nl/thema/circulariteit-2/ (accessed on 5 June 2019). [57]

W. J. Evert van de Graaff, Lucia van Geuns and Tim Boersma (2018), *The termination of Groningen gas production production - background and next steps*, Columbia SIPA Center on Global Energy Policy, https://energypolicy.columbia.edu/sites/default/files/pictures/CGEP_Groningen-Commentary_072518_0.pdf (accessed on 29 April 2019). [23]

Wetmiller, R. (1986), "Earthquakes near Rocky Mountain House, Alberta, and their relationship to gas production facilities", *Canadian Journal of Earth Sciences*, Vol. 23/2, pp. 172-181, http://dx.doi.org/10.1139/e86-020. [27]