REGATRACE
Renewable Gas Trade Centre in Europe

D3.2 Report on the set-up of biomethane registries

Deliverable:	D3.2 Report on the set-up of biomethane registries
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Version:	Final
Quality review:	Stefano PROIETTI, ISINNOVA
Date:	17.10.2022
Dissemination level:	Public
Grant Agreement N°:	857796
Starting Date:	01.06.2019
Duration:	42 months
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This project receives funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation under Grant Agreement no. 857796

Executive Summary

The REGATRACE project aims to create an efficient trade system based on issuing and trading of biomethane/renewable gases certificates (including guarantees of origin) for preventing double counting of gas volumes. One of the core elements for achieving this objective is the existence of electronic registries and issuing bodies capable of tracking the green property and volumes of the gases being traded in Europe. Tracking the green property, when traded separated from the related physical volume, is the task of a book & claim system that reunites both elements when the consumer claims its usage as a green gas. In other words, a book & claim system is closely related to Article 19 RED II and its mandate for consumer disclosure. On the other hand, tracking the gas volumes requires a mass balance system capable of ensuring that a particular gas volume used by an end consumer is the one that was effectively shipped (or injected into the gas grid) by the initial gas producer or supplier. This second function of a registry is closely related to the mandate of Article 30 RED II.

The requirements of Articles 19 and 30 RED II shaped the nature (purpose) of the electronic registries developed by the target countries of Task 3.2 "Set-up of national/regional biomethane registries in the target countries" and Task 3.3 "Provisional IT system for start-up of registries". The interlinkage between both tasks is evident from their title. Setting up a biomethane registry capable of effectively tracking gas certificates (book & claim and/or with mass balance) and avoiding multiple counting requires an adequate IT system that is able to keep secure records of the certificates transactions at the national and international level. Each target country decided the purpose of its registry, but the majority will be for complying with Article 19 RED II. Additionally, the diverse situation of the biomethane sector at the project's start and the development of the related legal and regulatory framework had a strong influence on the final outcome when setting up the registry. By the time this report was written, the registries from Lithuania and Slovakia were almost finished and would most likely become fully operational before the end of 2022. The Czech Republic was also progressing relatively fast due to the strong political support from the government. The development of the Irish biomethane sector was also remarkably fast since REGATRACE began and GNI is now only waiting for the budget approval to start working on the upgrade of the already existing IT solution for the registry operated by GNI. The situation in Belgium is a complex one due to the regional and federal energy policies. Flanders started operating a biomethane registry (compliant with Article 19 RED II) on January 1, 2020, but the other regions (Wallonia and Brussels) have not yet fully transposed RED II into their regional legislation. The Belgian federal government is, on the other hand, responsible for compliance with Article 30 RED II (mass balance for biofuels, i.e., bio-LNG, bio-LNG and RFNBOs). Italy, Poland, and Spain were still in the development phase, which was highly influenced by the delay of the legal framework needed for setting up the registry. Sweden, as a third-linked party from EBA and ERGaR, had a brief participation in the project due mainly to two factors: (1) already good existing infrastructure for biomethane and (2) the Swedish authorities are waiting for the final publication of the CEN Standard EN16325. Romania also had a brief participation in REGATRACE due to reasons external to the project, and its role as a target country was taken by the Czech Republic in September 2021.

The work done under the umbrella of Tasks 3.2 and 3.3 is summarized in the following chapters, providing a good overview of the situation of the biomethane sector in each target country, the production potential for the future and the level of implementation of the Country Action Plan for setting up the registry. The relevance of Task 3.3 relies on the fact that the target countries could use the provisional IT system for capacity building and demonstration purposes to the relevant authorities in order to raise more political awareness and accelerate the decisions of policy makers for legitimizing the creation of a registry for biomethane certificates.

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Abbreviations

AD	anaerobic digestion
AGCS	AGCS Gas Clearing and Settlement AG
ANRE	National Energy Regulatory Authority, Romania
ARBIO	Romanian Association of Biomass and Biogas
ATM	autothermal reforming
bio-CNG	compressed biomethane
bio-LNG	liquefied biomethane
BLE	German Federal Office for Agriculture and Food
CAP	Country Action Plan
CEF	Connecting Europe Facility
CHP	combined heat and power
CIB	Consorzio Italiano Biogas (Italian Biogas and Gasification Consortium)
CIC	Certificates of Release, Italy
CoO	certificate of origin
CREG	Belgian Federal Commission for Electricity and Gas Regulation
CRU	Commission for Regulation of Utilities (Ireland)
CWAPE	Walloon Commission for Energy
CzBA	Czech Biogas Association
DAU	German Accreditation and Licensing Body for Environmental Auditors
DCCAE	Department of Communications, Climate Action and Environment (Ireland)
dena	German Energy Agency
DSO	Distribution system operator
EBA	European Biogas Association
EECS	European Energy Certificate System
EEG	Renewable Energy Act, Germany
ERGaR	European Renewable Gas Association
ERGaR CoO Scheme	ERGaR Certificate of Origin Scheme
ERO	Czech Energy Regulatory Office
EU	European Union
FIP	feed-in premium
FiP	feed-in premium
FIT	feed-in tariff
FQD	EU Fuel Quality Directive
GGC	Green Gas Certificates, Belgium
GNI	Gas Networks Ireland
GO	guarantee of origin
GSE	Manager of Energy Service, Italy
KIB	National Biofuel Chamber, Poland
KOWR	National Agricultural Support Center
Litgrid	Lithuanian electricity TSO
NIT	National indicative target of renewable fuels in the transport sector, Poland
OKTE	Short-term electricity Market Operator, Slovakia

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OTE	Czech electricity and gas market operator
PoS	proof of sustainability
POX	partial oxidation
PPA	Power purchase agreement
PtG	power to gas
RCFs	recycled carbon fuels
REAL	Renewable Energy Assurance Limited (UK)
RED III	Renewable Energy Directive III
RES	Renewable energy sources
RES Act	Renewable Energy Sources Act, Poland
RFNBOs	renewable fuels of non-biological origin
RFSUS	Renewable Fuel Statistical Units System, Lithuania
RGFI	Renewable Gas Forum Ireland
SEA	Swedish Energy Agency
SEAI	Sustainable Energy Authority of Ireland
SMR	steam methane reforming
TGE	Electricity Market Operator, Poland
TLD	third-linked party
TSO	transmission system operator
UDB	Union Database
UPEBI	Union of Producers and Employers of Biogas Industry, Poland
URE	Energy Regulatory Office Poland
VREG	Flemish Regulator for Electricity and Gas
WWTP	waste water treatment plant

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REGATRACE in a Nutshell

REGATRACE (REnewable GAs TRAde Centre in Europe) aims to create an efficient trade system based on issuing and trading biomethane/renewable gases certificates/Guarantees of Origin (GO) with exclusion of double sale.

This objective will be achieved through the following founding pillars:

- European biomethane/renewable gases GO system
- Set-up of national GO issuing bodies
- Integration of GO from different renewable gas technologies with electric and hydrogen GO systems
- Integrated assessment and sustainable feedstock mobilization strategies and technology synergies
- Support for biomethane market uptake
- Transferability of results beyond the project's countries

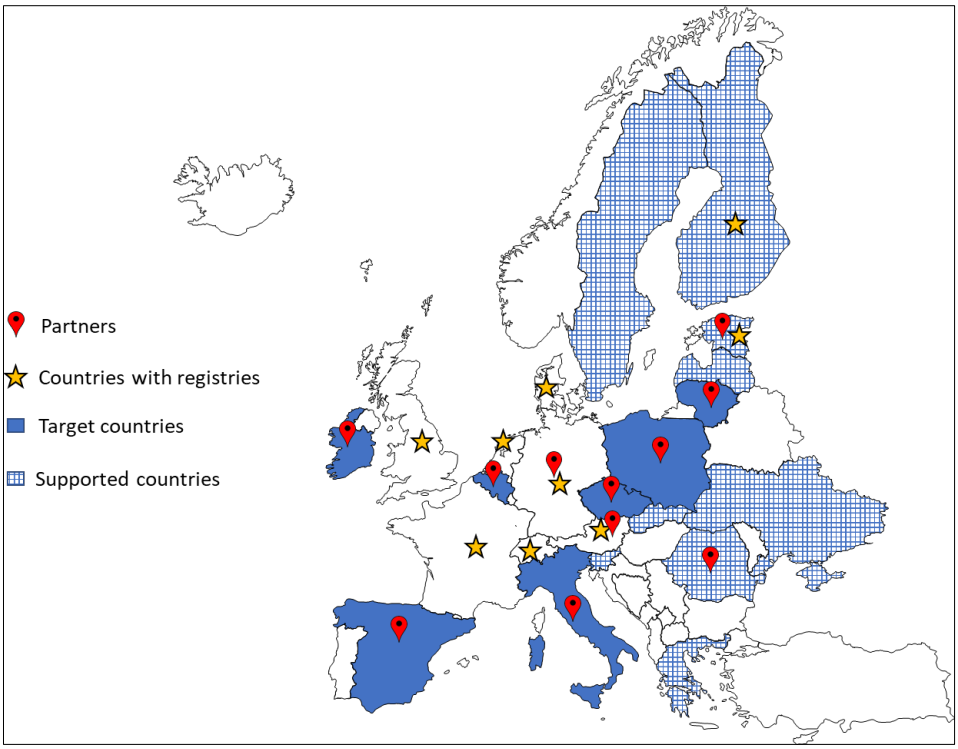

Fig. 1 REGATRACE countries and partners

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1. Introduction

The objective of Work Package 3 is to prepare the target countries to join the European biomethane/renewable gas trading system by establishing national or voluntary registries, together with the function of national issuing bodies for renewable gas certificates (including guarantees of origin – GO). To this end, a national biomethane registry is an essential component for the efficient and transparent ownership transfer of gas certificates. The registry must also serve as a secure platform for the avoidance of multiple counting of a particular certificate. Only then can a national issuing body be able to join the European trading system for renewable gas certificates without risking its credibility and future operation. Moreover, the biomethane registries are expected to function as lighthouses in their home countries. They are also thought to serve as a knowledge base, while providing guidance and assistance to potential biomethane investors. Finally, the biomethane registry is an essential element for giving assurance and confidence to end consumers and, especially, for large gas consumers seeking sustainability and competitiveness advantages of biomethane/renewable gases.

Work Package 3 comprises three Tasks: T3.1 "Guidelines for establishing national biomethane registries", Task 3.2 "Set-up of national/regional biomethane registries in the target countries" and T3.3 "Provisional IT system for start-up of registries". The work done in these tasks has helped target countries with the conceptualization and development of their respective biomethane (or renewable gas) registry. The report from Task 3.1 was concluded on October 1st, 2019 (link) and provides comprehensive guidelines for the establishment of national biomethane/renewable gas registries. It describes the structure and operation of a biomethane/renewable gas registry based on the experience of established national and voluntary registries in European countries.

The present report is based on the activities done under Tasks 3.2 and 3.3, which provided advisory services and hands-on information to target countries. With respect to Task 3.2, an initial survey was sent to each target country in order to acquire a better understanding of the biomethane/biogas sector in each one of them. Based on the information they provided, a second document was prepared that would help them create their country action plans (CAPs). Task 3.3 provided a personalized provisional IT system for starting up the registry in each target country. This provisional IT solution served as an excellent basis for the target countries and the respective relevant stakeholders to gain insight into the basic requirements and familiarize themselves with the functions and operation of a registry for biomethane certificates. The extent of the work accomplished by each target country varies greatly depending on the situation of the biomethane sector at the beginning of the REGATRACE project, as well as on the development of the energy policy and legal framework since the start of the project up until today.

This report presents the development of the biomethane registry in each target country. It is worth mentioning that the situation of the biomethane sector in each one of them varies greatly. Some already had a partial or full legal framework in place that allowed a faster set-up of the registry. On the other hand, some target countries have faced delays in the development of the legal framework, which has hindered the registry's set-up.

The report is structured into four chapters (introduction, two content chapters, and conclusions) and two annexes. Chapter 2 presents the methodology of Tasks 3.2 and 3.3. Chapter 3 shows an overview of the target countries for setting up their registry for gas certificates, including the partial work done with Romania as a target country, as well as with Sweden as a third-linked party of ERGaR and EBA. This chapter includes a description of the initial situation of the biomethane sector in each target country at the project's beginning; the creation of the Country Action Plans (CAPs) and their

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implementation, together with an overview of the sector's development in each target country over the course of the project. It also includes the milestones reached in the sector over the course of the REGATRACE project and the ones reached under the umbrella of Task 3.3 for starting up the registries in the target countries. Chapter 4 presents the conclusions based on the experiences from all target countries, as well as a summary of the registry's purpose in each one of them. Finally, the annexes include (1) the questionnaire for the initial survey for knowing the situation of the biogas/biomethane sector in each target country at the project's beginning, and (2) the guideline document for the creation of the CAP.

2. Methodology

2.1 Task 3.2 "Set-up of national/regional biomethane registries in the target countries"

The goal of Task 3.2 is to support the target countries in setting up their biomethane registries. The nature of the registry (voluntary or national/mandatory) and its purpose (compliant with Article 19 and/or with Article 30 RED II) depend largely on the energy policy and legal framework in place with respect to renewable gas certificates (including GOs and PoS) and the transposition of RED II into national legislation. Furthermore, the status of the biogas and biomethane sector when the REGATRACE project started also played a big influence on the registry's development.

For the aforementioned reasons, the German Energy Agency (dena), as task leader, created a first questionnaire (see Annex 5.1) in order to get to know the situation in each target country at the project's beginning. This questionnaire helped dena understand the needs in each target country because the situation in each one of them varies greatly. Once dena received the answers to this initial questionnaire, a follow-up call was organized with each one of the countries to clear any possible doubts arising from the answers they provided. This information helped to create a second document entitled "Guideline and Draft Structure for National Action Plans" (see Annex 5.2) that would assist target countries create their CAPs. This guideline document included the elements necessary to create the CAP and then proceed to translate it into a time schedule with specific milestones, activities, and responsible stakeholders for setting up the registry. Below is a summary of the elements to be considered for the creation of the CAP. The full document can be consulted in Annex 5.2.

1. Market assessment: including the current production volume and the potential for future growth.
2. Assessment of the regulatory and/or financial instruments for promoting the production and/or utilization of biomethane and other renewable gases.
3. Stakeholder identification for the development of a biomethane registry, including industry, ministries as well as governmental and non-governmental institutions.
4. Definition of the registry's purpose: compliance with Article 19 RED II (book & claim, consumer disclosure) and/or with Article 30 RED II (mass balance system).
5. Creation of commitment from the government and/or the industry for developing a biomethane registry: this includes the organization of workshops and/or bilateral discussions with governmental institutions and/or industry representatives.
6. Cost calculation and financing of the registry, including an evaluation of the financing schemes available for the registry's development (private and development banking institutions, governmental funds).
7. Development of a concept and basic principles for setting up the registry based on the present situation and future production technologies for renewable gases. This included the following:
   a) Identification of the production technologies that should be covered by the registry, considering the present ones. In addition, an assessment of the potential production technologies that would be technically and economically feasible based on the country's feedstock, natural resources, and infrastructure.

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b) Identification of the information and the entities to provide the information for the verification of biomethane and other renewable gases.
c) Development of a concept for collecting information according to b) in a reliable and efficient manner.
d) Development of a verification architecture for the biomethane registry.

8. Gap analysis of the legal and regulatory framework: this included the identification of improvement areas and processes in the present legislation for the successful development and implementation of the biomethane registry.
9. Identification and selection of the best IT solution from a technical and financial perspective, ensuring interoperability with other European registries.
10. Implementation of the selected IT solution, including a call for proposals for the selection of the registry developer and selection of the best proposal based on cost, quality, and service.
11. Capacity building and public awareness: this refers to the organization of workshops to raise awareness and acceptance among stakeholders, as well as offering trainings to potential users on the use, benefits, and advantages of the registry.

Once the tasks to which the aforementioned elements refer to have been completed, the target countries were in the position to create their CAP with a time schedule and defined responsibilities and tasks for each stakeholder. However, as previously explained, the situation of the biomethane sector in the target countries varies greatly. While some were almost finished with the creation of their registry when the REGATRACE started (e.g., Ireland), some others did not have yet any biomethane production plants or the legal and regulatory framework still under development due to delays from energy policy makers. In this regard, some target countries were actually able to produce a CAP with specific milestones, activities and dates (e.g., Slovakia, Czech Republic, Lithuania), while some others only produced a more generic one with the milestones and possible dates (e.g., Poland). For some others it was not possible to produce a CAP due to reasons external to the REGATRACE project and the partner institution in those countries (e.g., Romania, Italy, and Spain). Nevertheless, irrespective of whether the local conditions favored the creation of a CAP or not, dena continuously offered its support to the target countries based on its expertise operating the dena Biogasregister (link).

2.2 Task 3.3 Provisional IT system for start-up of registries

2.2.1 Target of Task 3.3

The functions of an IT-system have to follow the defined legal and market rules and not the other way around. However, the definition of necessary business and settlement processes, required user roles and their respective rights, the functions of the registry and the list and specifications of attributes and certificate design can be highly complex. The target of Task 3.3 was to provide a personalized IT-registry-system, which allowed overcoming this administrative burden.

In Task 3.3, the task leader AGCS Gas Clearing and Settlement AG, equipped the REGATRACE target countries with a provisional IT-registry system based on the application of the Biomethane Registry Austria to gain better understanding and deep insights on processes, role-system, attribute lists and standardization possibilities. Each organization (representing a REGATRACE target country) engaged in establishing their national registry and/or issuing body system received a dedicated pilot IT-system with personalized logins in English language.

AGCS Gas Clearing and Settlement AG (AGCS), Task 3.3 leader, is the balancing group coordinator of the Austrian Gas Market Area East. It documents all gas movements, including biomethane tracking and has thus been nominated via the Renewable Electricity Act 2012 as amended (Ökostromgesetz 2012 idgF, ÖSG 2012) to issue written confirmation (certificates) for energy amounts (kWh), also referred to as “biomethane certificates”, which is injected into the Austrian gas grid. These certificates provide the proof for receiving the feed-in tariff for renewable power from decentralized biomethane-

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based electrification. To fulfil this mandate, AGCS has established and has been operating the Biomethane Registry Austria since June 2012. The underlying IT-application was developed and is maintained by the Austrian IT-provider smart technologies Management- Beratungs- u BeteiligungsgesmbH (smart tech). For this reason, AGCS and smart tech collaborated on the development, deployment, and maintenance of the REGATRACE pilot IT-systems.

2.2.2 Delivery of pilot IT-systems

Each REGATRACE target country received an individual IT-registry system in the English language. The IT systems are personalized, incorporating the logos of the organizations representing the respective REGATRACE target country and their corporate color code. Only representatives of the organizations representing the respective REGATRACE target country and specifically nominated persons are enabled to access the IT system thanks to the deployment of personalized accounts. Screenshots of the login areas of each personalized IT-registry system and their URL are provided in Table 1.

The REGATRACE IT-registry-system fulfils the commonly requested requirements for renewable gas registries and gas issuing bodies:

- Stand-alone IT-system,
- Account-based IT-system with defined user roles,
- Web-based application (accessible via a web browser),
- Database handling users' master data and certificate data,
- Personalized access (with mail address or username; password-protected or multi-factor authentication necessary).

Table 1: View on the personalized REGATRACE IT-systems of each target country including individual URL

BE	 https://test-registry-regatrace-belgium.biomethanregister.at/emwebbioreg/login.html

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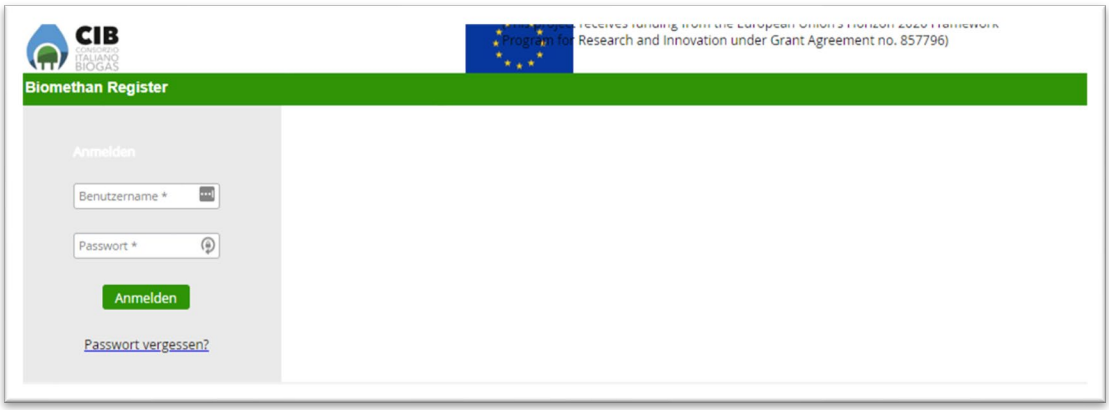
ES

https://test-registry-regatrace-spain.biomethanregister.at/emwebbioreg/login.html

IE

https://test-registry-regatrace-ireland.biomethanregister.at/emwebbioreg/login.html

IT

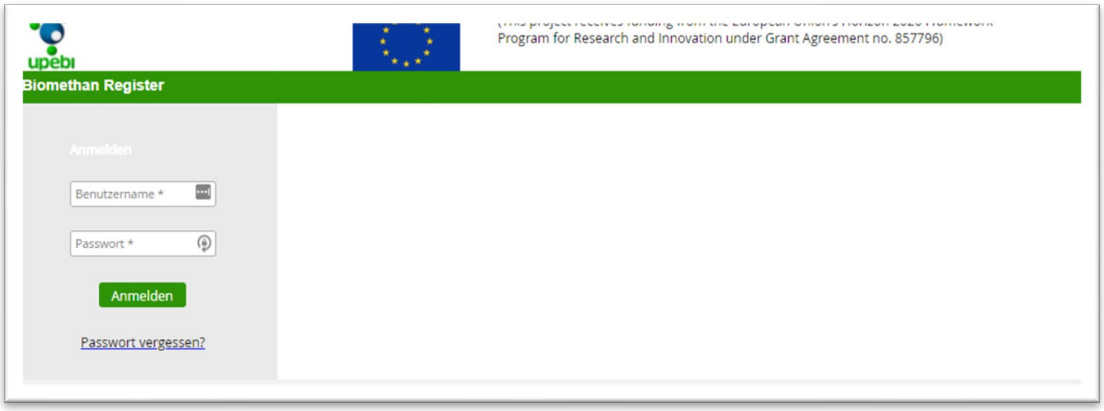


https://test-registry-regatrace-italy.biomethanregister.at/emwebbioreg/login.html

LT

https://test-registry-regatrace-lithuania.biomethanregister.at/emwebbioreg/login.html

PL



https://test-registry-regatrace-poland.biomethanregister.at/emwebbioreg/login.html

RO

https://test-registry-regatrace-romania.biomethanregister.at/emwebbioreg/login.html

SK

https://test-registry-regatrace-slovakia.biomethanregister.at/emwebbioreg/login.html

2.2.3 Set-up of the REGATRACE pilot IT-systems

The REGATRACE IT-registry-system fulfils all commonly requested functions and business processes. More details on the functions are provided in REGATRACE Deliverable 3.1 *Guidelines for establishing national biomethane registries.* A short list of functions of the IT-system is provided as follows:

- Issuing of certificates by back office
  - ♦ Interface for data transfer of meter values
    - ∗ Interface designed to accepted as MSCons data file format
    - ∗ Easy to handle by any type of operator
  - ♦ Add information of used additives by producers, meaning subtracting the energy amounts (kWh) from additives such as propane which some producers have to add in order to reach the requested calorific value for local grid injection
- Management of certificates and attributes
  - ♦ Transfer of certificates by user roles producer and registry user
  - ♦ Accepting or rejecting of offered certificates by user roles producer and registry user
  - ♦ Splitting of certificates by user roles producer and registry user
  - ♦ Cancellation of certificates by user roles producer and registry user
  - ♦ Issuing of Cancellation Statement as PDF by user roles producer and registry user
  - ♦ Issuing of Cancellation Statement in paper form (for signature and for purpose of prevention of replication and fraud) by the back office/registry operator
- Creation and management of master data particularly companies, persons and biomethane production plants
- Implementation of interface to a common, European scheme (→ ERGaR Certificate of Origin Scheme)
- Dashboard functionality

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2.2.4 Levels of support

Personalized, first level and second level support

AGCS worked in close contact with each target country to understand individual needs and to provide personalized support.

For continuous first-level support on IT-related questions, the e-mail address **support-regatrace@agcs.at** was created and used to communicate with target countries. In case of more specific and/or technical questions, the IT-provider Smart Technologies Management GmbH provided second-level support throughout the project lifetime.

Questionnaires and surveys

Using questionnaires and surveys as a tool for communication and collecting information, the following questions were asked by AGCS and addressed by the target countries:

- Requirements and framework of target countries
  - Purpose of registry system: voluntary, mandatory, IB for GOs, biofuel registry, national requirements, others;
- Is there a system in operation? And if yes,
  - How was it established (see purpose above)?
  - How is it financed? Financed by industry or governmental mandate, free regulation, etc.
- Provision of master data
  - Registration of market participants
  - Required user roles
  - Requirements for registrations
- Quantitative data: Issuing process and provision of energy amount data (kWh or MWh)
  - Energy amounts in kWh or MWh;
  - Who is data provider? TSO, DSO, external auditor;
  - How will data be introduced into the registry system – (manual or automatic) interface;
  - How often are data delivered and certificates issued? What is the documented production period?
- Qualitative data: biomass / substrate types, GHG emission value, sustainability criteria, etc.
  - Who is data provider? External auditor?
  - Which requirements for persons to become eligible auditors?
  - How will data be introduced into the registry system – interface;
  - Process for auditing of certificates within the registry system;
- Market rules
  - Rule book, terms and conditions, etc.
- Market support
  - Is there a market need for providing a dashboard function (matchmaking function to match bid/ask offers);

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Templates for stakeholder analysis

To support the target countries in defining the list of relevant stakeholders, a template for stakeholder analysis was provided by the task leader (see figure 2). There are four main stakeholder groups mentioned:

- Participants / Market Participants of the renewable gas registry
- Stakeholders of the national biomethane / renewable gas sector
- Stakeholders of the international biomethane / renewable gas sector
- Stakeholders of the gas sector

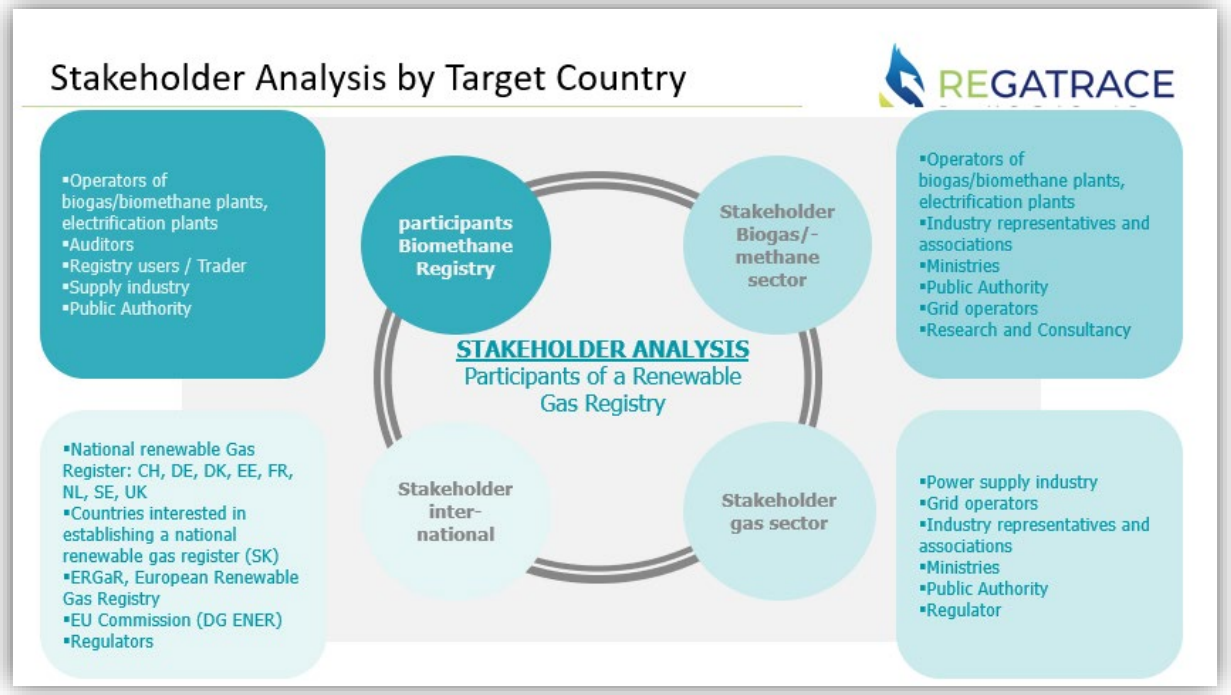

Fig. 2 Template for national stakeholder analysis by target countries

The stakeholder list of potential/future market participants of the national registry is important because it provides the basis of the master data of the users of the registry. Table 2 provides a template of the required master data of the necessary user roles of the registry.

Template for master data collection

If target countries already had a good view and contact with future market participants, they collected actual master data based via the template. For some target countries, market stakeholders were not known yet (e.g., no biomethane production installations in the country yet). For this reason, the task leader provided "provisional REGATRACE master data" which allowed testing the IT-system taking up different user roles.

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Table 2: Template table to collect master data of national market participants by target countries

	Biomethane plant operator 1 (legal entity - company)	Biomethane plant operator 1 (legal entity - natural person)	Auditor 1 (legal entity - company)	Auditor 2 (legal entity - natural person)	Trader 1 (legal entity - company)	Trader 2 (legal entity - company)	Trader 3 (legal entity - natural person)	CHP - electrification plant 1	Registry administrator
Company									
Company data									
Company name	x		x		x			x	x
Tax number (VAT)	x		x		x			x	x
Number Company Registry (register of commerce)	x		x		x			x	x
Certificate of Competence (respective for national situation of target country)			x						x
Registry ID	parameter of registry system	x						x	x
Company contact person									
Name		x	x	x		x	x		x
Surname		x	x	x		x	x		x
Date of birth		x	x	x		x	x		x
Place of birth		x	x	x		x	x		x
Tax number (if applicable)		x	x	x		x	x		x
Type of employment			x	x		x			x
Company address									
Street and number	x	x	x	x	x	x	x	x	x

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	Biomethane plant operator 1 (legal entity - company)	Biomethane plant operator 1 (legal entity - natural person)	Auditor 1 (legal entity - company)	Auditor 2 (legal entity - natural person)	Trader 1 (legal entity - company)	Trader 2 (legal entity - company)	Trader 3 (legal entity - natural person)	CHP - electrification plant 1	Registry administrator
Postal code	x	x	x	x	x	x	x	x	x
City	x	x	x	x	x	x	x	x	x
Country of origin	x	x	x	x	x	x	x	x	x
Phone	x	x	x	x	x	x	x	x	x
Fax	x	x	x	x	x	x	x	x	x
Email	x	x	x	x	x	x	x	x	x
Contact person 1									
Department	x			x	x	x		x	x
Gender	x	x	x	x	x	x	x	x	x
Name	x	x	x	x	x	x	x	x	x
Surname	x	x	x	x	x	x	x	x	x
Title	x	x	x	x	x	x	x	x	x
Phone	x	x	x	x	x	x	x	x	x
Fax	x	x	x	x	x	x	x	x	x
Email	x	x	x	x	x	x	x	x	x
Address (if different of company address)	x			x	x	x		x	x
Plant data									
plant specific data									
Plant name	x	x						x	
Proof for renewable energy plant (if applicable in target country)	x	x						x	
Type of plant	x	x						x	
Technology	x	x						x	

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	Biomethane plant operator 1 (legal entity - company)	Biomethane plant operator 1 (legal entity - natural person)	Auditor 1 (legal entity - company)	Auditor 2 (legal entity - natural person)	Trader 1 (legal entity - company)	Trader 2 (legal entity - company)	Trader 3 (legal entity - natural person)	CHP - electrification plant 1	Registry administrator
Date of commission	x	x						x	
Use of additives (e.g., propane)	x	x							
Network capacity (kW)	x	x							
Metering point	x	x							
Network capacity (kWh)	x	x							
DSO (Gas)	x	x							
DSO (Power)								x	
Meter device ID	x	x						x	
Company Affiliation	x	x						x	
ID number in gas market balancing system	x	x							
Energy Medium	x	x						x	
Plant Country of Origin	x	x						x	
Plant type	x	x						x	
Production Support	x	x						x	
Investment Support	x	x						x	
Tech Codes (GO)	x	x							
Location of Plant									
Plant street and number	x	x						x	x
Plant postal code	x	x						x	x
Plant city	x	x						x	x
Plant country of origin	x	x						x	x

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2.2.5 Trainings

Unfortunately, due to the COVID-19 pandemic, no personal workshops could be held. The active communication between task leader, target countries and national stakeholders was mainly performed through e-mail (using the support address **support-regatrace@agcs.at**) and web conferences.

Regular web conferences were held with each target country individually to track the progress of the step-by-step work plan (see Figure 6) to engage in personal contact and to answer individual questions.

2.2.6 Manuals and User Guides

To support the handling of data and certificates and getting acquainted with necessary business and settlement processes, the task leader provided written support documents to the target countries. The first one was the *Support Document: Business Process Guidelines for Registry System* (figure 3) and the second one was the *Support Document: User Manual Biomethane Registry Austria Backoffice* (figure 4). Both documents were created within the framework of Task 3.3 and provided to target countries as guidelines.

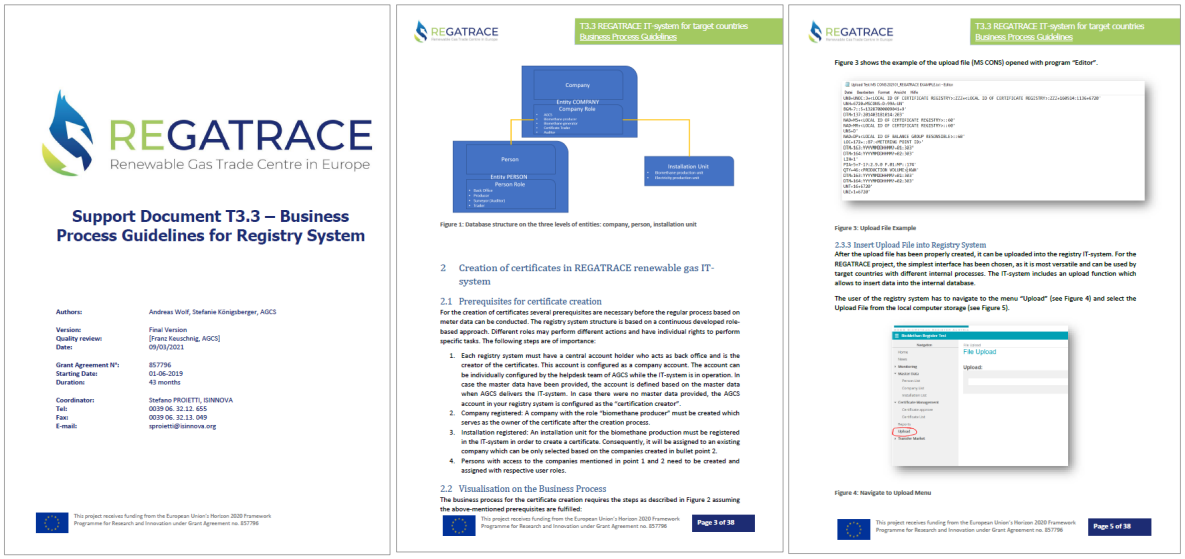

Fig. 3 View into Task 3.3 support document: T3.3 REGATRACE IT-system for target countries Business Process Guidelines

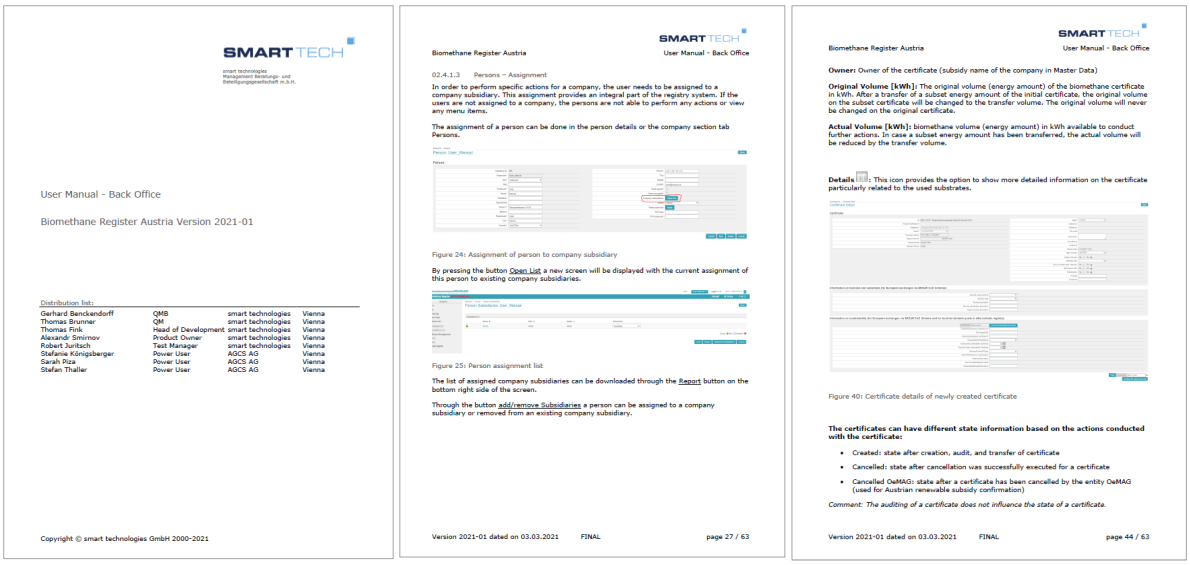

Fig. 4 View into Task 3.3 support document: User Manual - Back Office

2.2.7 Work Approach of Task 3.3

While each target country started its project work at an individual initial situation and has required individual advisory services throughout the project, a harmonized approach to supporting target countries to reach a certain level of development was necessary. AGCS thus developed a benchmark table for target countries (see Table 3) and a step-by-step work plan (see figure 5) for Task 3.3.

The actual market development and registry establishment is influenced by many external factors – as described in detail in Task 3.2 - such as the national stakeholders, the possible outreach and replication, political decisions and willingness and the availability of the necessary national, legal framework.

A step-by-step work plan was developed and communicated with all target countries to provide a structured work approach despite different levels of advancements of target countries. Figure 5 shows the five steps of the work plan, including specific To-Dos and activities for the task leader AGCS and for the target countries:

1 Kick Off
2 Status and Demand Analyses
3 Conceptualization
4 Development
5 Implementation

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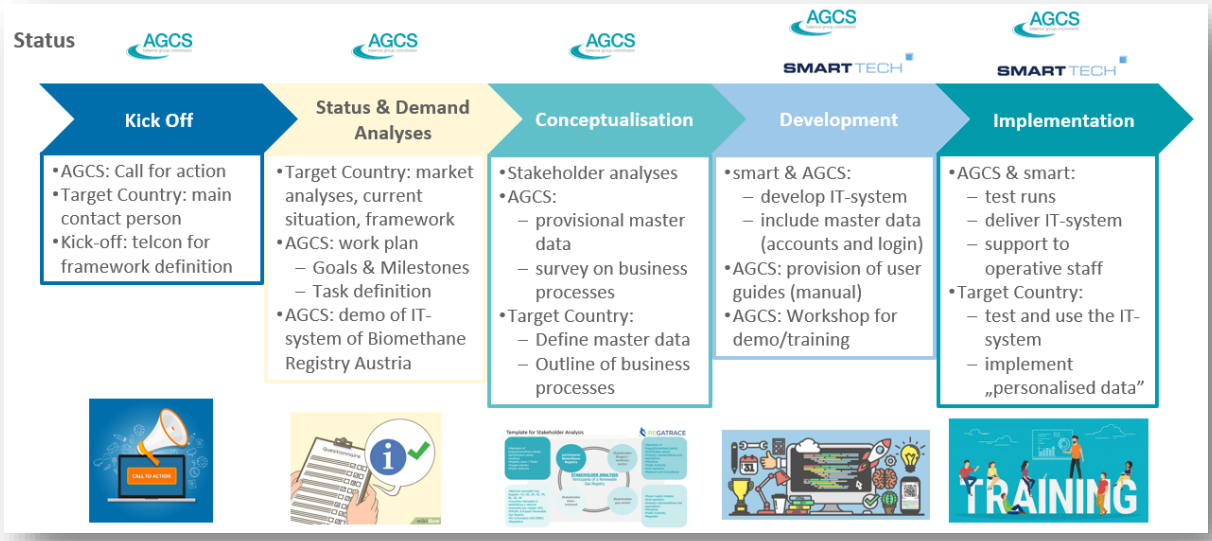

Fig. 5 Step-by- Step-work plan for T3.3 to guide work for IT-system implementation

In Table 3, the planned activities according to the Grant Agreement and the To-Do-points detailed by the task leader are listed. All listed activities were performed with target countries according to their status and framework.

Table 3: Planned activities according to the step-by-step work plan

Work plan	To Do points, activities	Kick Off	Status & Demand Analyses	Conceptualization	Development	Implementation
according to Grant Agreement	IT-test system			x	x	x
	manual			x	x	x
	training			x	x	x
	first-level support	x	x	x	x	x
services by AGCS, work with target countries	PPT-slides: requirements, needs, recommendations, introduction certificates, framework, work plan including steps for set-up, presentation definition of requirements and framework		x	x	x	x
	PPT-slides: to do on stakeholder analyses, definition of business processes, definition of requirements and framework			x	x	x
	kick off web meeting		x			
	regular web meetings		x	x	x	x
	PPT with guidelines and screenshots on business processes of the registry				x	x
	template to collect master data + provisional master data base			x	x	x

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Work plan	To Do points, activities	Kick Off	Status & Demand Analyses	Conceptualization	Development	Implementation
	creation and handling of provisional CoO				x	x
	limited number of account users				x	x
	implementation of real master data base (if possible / if provided by target country)				x	x
	creation and handling of real CoO (if applicable)				x	x
	active involvement of market participants via user accounts (if applicable)				x	x
	personal workshops (online) or web meetings with stakeholders if requested by target countries			x		x

A Call-for-Action was launched as a kick-off to clarify the main contact person and project teams of each target country. During a kick-off web conference, the framework conditions of the target country were analyzed, the template for national stakeholder analysis, the benchmark table and the step-by-step-work plan were presented and discussed. The kick-off was followed by Status and Demand Analyses, with questionnaires and a demonstration of the Austrian IT-registry system via web conferences. The Conceptualization Phase started with the national stakeholder analysis. AGCS provided a template for collecting master data of actual and potential market participants. For the case where no contact to market participants was given – e.g., no biomethane producers yet – AGCS developed provisional REGATRACE master data which could be used for testing all functions and roles of the registry system. A survey on business processes, developed by AGCS, helped target countries in outlining or defining their national business and settlement processes. The collaboration of target countries with the task leader fed into the categorization of target countries into the benchmark table (see Table 4).

After having gained good knowledge on the individual requirements of each target country, AGCS and subcontractor smart technologies entered into the Development Phase and the individual IT-systems with personal access were delivered to target countries. Two supporting documents providing written guidelines and screenshots making it possible for target countries to look up process steps and to train their national stakeholders were included (see figures 3 and 4).

The work plan comprised the Implementation phase during which target countries that had received the IT-system and supporting documents underwent a demonstration and training via a web conference. After delivery, the use and application of the REGATRACE IT-registry-system was within the responsibility of the target countries who chose different approaches. Country highlights related to the IT-systems are listed in the respective target country sub-chapters from Chapter 3. These highlights also include important milestones reached in the biomethane sector and/or in the setup of the electronic registry during the REGATRACE project.

At the task kick-off, estimations of the final status to be reached at project finalization were difficult to forecast. The benchmark table (see Table 4) was a remedy for this uncertainty, providing a suitable action plan for target countries, independent of their status and development.

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Table 4: Benchmark table for target countries in the framework of Task 3.3

#	System Type	Description
1	PROD System	target country requires a PRODUCTIVE System; registry should go live within project timeline; IT-system must be tendered in most cases;
2	TEST System	target country requires a TEST System; national stakeholders perform comparison of different IT-systems;
3	GAME System	target country requires TEST system to demonstrate and apply test runs with national stakeholders;
4	Market Design	target country wants to develop template for national market design; functions and tasks of a registry system should be demonstrated to national stakeholders;

Even if no legal framework and market conditions would be available or would be possible to establish, category #4 of the benchmark table would support the "Market Design" in the target country. Often, a pilot IT-system for demonstration to stakeholders and ministry representatives was necessary. For such cases, category #3 provided a "GAME system" individual to the target country.

More advanced countries needed a pilot IT-system to gain deep insights into the necessary business and settlement processes, required functions. Often, different IT-systems should be compared and the meetings with different IT-providers have to be prepared. Category #2 meant using the REGATRACE IT-system as "TEST system" with actual master data and providing trainings to future market participants.

Eventually, each target country will require the implementation and maintenance of its productive system – even if after the finalization project. The REGATRACE IT-system has been prepared for go live and was made ready-to-use for market participants during the project lifetime. Category #1 offered a so-called "PROD system" (productive system) for target countries, at least until project/task finalization.

Still, in most cases, registry operators are obliged to perform a public procurement for their investments into an IT-system. Target countries could gain knowledge and confidence during operation and maintenance of their individual REGATRACE IT-registry system. This supported their preparations for tender process and procurement.

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2.2.8 Progress within Task 3.3

The full timeline of the actions and steps within REGATRACE Task 3.3 is provided in figure 6.

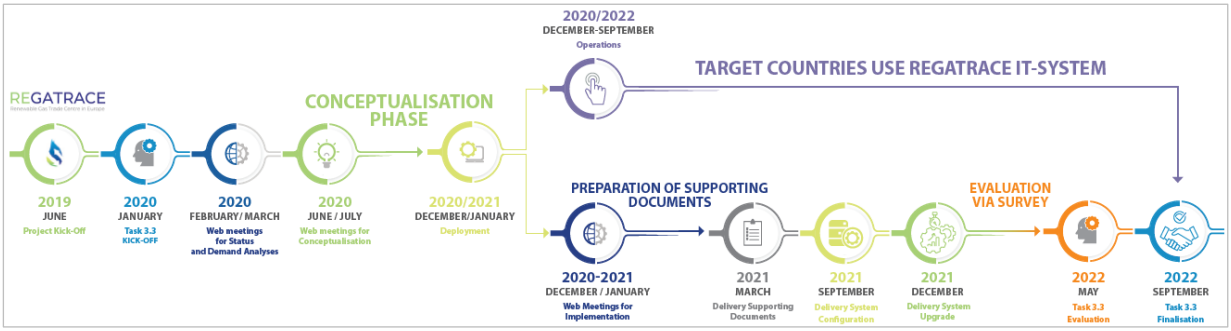

Fig. 6 REGATRACE Task 3.3 timeline

The preliminary work plan was presented to the target countries and the project partners during the REGATRACE consortium meeting on 4th December, 2019 in Milan, Italy. This was followed by the Call-for-Action, initiated via e-mail on 10th January, 2020; replies were collected by end of January 2020.

The first round of web meetings (Kick Off + Status & Demand Analyses) was held in February 2020. Some target countries requested follow-up meetings to discuss further details.

On 17th June, 2020, the conceptualization was initiated via an information mail. The detailed step-by-step work plan including planned milestones and the template to collect master data were circulated. Details were discussed in another round of web meetings between summer and end of 2020.

Over the year 2020, AGCS and smart technologies collaborated on the establishment of the required IT-systems (Development). Regular update meetings were held between the collaborators to stay updated on progress of Task 3.3.

Delivery dates of the REGATRACE IT-registry system (URL for access and login credentials), of system upgrades and of supporting documents are listed in Table 5. Since delivery of the IT-system, target countries were enabled to test all functions and processes, test rights of different user roles, issue, transfer and cancel different certificate types, get acquainted with the auditor role and functions and train national stakeholders if applicable. During the Implementation Phase, AGCS stayed available for support and to answer all kind of queries and questions from the target countries. The Implementation Phase also included a system configuration integrating an interface to a European renewable gas certificates scheme, as well as a system upgrade which provided an updated design of the Cancellation Statement in the English language.

The REGATRACE IT-system is based on the Austrian application of the Biomethane Registry, operated by AGCS which connected to the ERGaR Certificate of Origin Scheme in autumn 2021. The provision of interfaces was not an integral part of Task 3.3. However, task 2.4, led by ERGaR, provides support to REGATRACE target countries and third-linked parties in the establishment of an IT-interface to a European scheme but does not include any IT work on national registries per se.

As additional service within the project Task 3.3, the REGATRACE IT system configuration was extended by applying the interface function to the REGATRACE IT-systems as well. This provided target countries with a broader view on the functionalities of national registries and insights on the technical steps for connecting to the European market. Task 3.3 allowed target countries to gain some practical experience on imports and exports while information on European schemes is presented in different parts of the project:

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- Deliverable 4.2 Technical and operational comparison of the biomethane/renewable gas GO system and the electricity GO system (unique presentation and comparison of AIB EECS® rules, ERGaR Certificate of Origin scheme, CertifHy scheme, link to report)
- Task 2.4 Establish communication interfaces between IT-solutions of European Schemes and the participating national issuing bodies/ registries (support provided by ERGaR)

Table 5: Delivery dates within Task 3.3

Country list		Delivery dates				
Target country		Delivery IT system delivery	Delivery Access Data (personalized logins)	Delivery Supporting Documents	System configuration Interface to European scheme	System Upgrade Updated Cancellation Statement
BE	Fluxys	12/03/2021	12/03/2021	12/03/2021	16/09/2021	28/12/2021
ES	NEDGIA	12/03/2021	12/03/2021	12/03/2021	16/09/2021	28/12/2021
IE	RGFI	28/01/2021	12/03/2021	12/03/2021	16/09/2021	28/12/2021
IT	CIB	26/03/2021	12/03/2021	12/03/2021	16/09/2021	28/12/2021
LT	Amber Grid	27/01/2021	23/12/2020	23/12/2020	16/09/2021	28/12/2021
PL	UPEBI	10/02/2021	12/03/2021	12/03/2021	16/09/2021	28/12/2021
RO	ARBIO	12/03/2021	12/03/2021	12/03/2021	16/09/2021	28/12/2021
SK	SPP-D	29/01/2021	05/02/2021	12/03/2021	16/09/2021	28/12/2021

In 2022, the remaining months of the project were used to perform an evaluation of Task 3.3 and to define additional steps to provide support to target countries. To do so, AGCS developed a survey containing following areas of questions:

- General questions on the role of the organization in the target country to track any changes or developments during project lifetime
- Specific questions on Task 3.3 and the provided support, training, and timeline of Task 3.3
- Specific questions on working material Task 3.3 (power point presentations and slide decks, stakeholder analysis template, master data template, supporting documents and guidelines)
- Specific questions on the REGATRACE IT-pilot system
  - type of use, obstacles, hurdles, questions, stakeholder trainings;
  - getting acquainted with list of attributes and their specifications, such as substrates or energy amounts,
  - interface to European scheme;

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The replies to the surveys were followed up with another round of web conferences held in May and June 2022.

2.2.9 Use of IT-systems and achievements within Task 3.3

Table 6 provides an overview on the categorization of target countries into the earlier presented benchmark table (see Table 4). The overview shall help understand the countries' level of development achieved during the project's lifetime. A graphical representation of the level of progress in each target country is presented in the sub-chapters from Chapter 3.

Table 6: Status update of target countries, incl. categorization of benchmark table

Country & Organization	Benchmarking level	Status on IT-system	Comment
BE Fluxys	3 TEST System	Production registrar	Fluxys acts as production registrar to the Flemish issuing body, VREG
ES Nedgia	3 GAME System	Development: market design, legislative framework	ENAGAS was appointed as the entity responsible for the registry's operation in the Royal Decree 376/2022
IE RGFI	**1** PROD System	Registry & IB with simplified database	GNI acts as registry operator was officially appointed as the national renewable gas registry. It has been involved in the activities of Task 3.3.
IT CIB	3 GAME System	Development: market design, legislative framework	GSE has been appointed as issuing body but CIB plans to implement a voluntary registry to support market uptake.
LT Amber Grid	**1** PROD System	Registry & IB with simplified database	Amber Grid started IT-procurement within the REGATRACE project lifetime
PL UPEBI	3 GAME System	Development: market design, legislative framework	UPEBI, as association, will not take over the role of registry operator, but has trained national stakeholders on the operation and use of a national registry
RO ARBIO	4 Market Design	Development: market design, legislative framework	ARBIO stopped being a target country during the project's lifetime.
SK SPP-D	**1** PROD System	legislative framework, Registry & IB, database in development	SPP-D joined the project at a later stage. It was appointed as issuing body and finalized its IT-procurement in 2021.

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3. Overview of the target countries: development of the biogas/biomethane sector, Country Action Plan for setting up the gas GO registry, and country highlights

This chapter presents an overview of the biogas and biomethane sector in each target country since the project beginning, together with the development of the CAPs (Task 3.2) from the countries where the legal and regulatory framework favored the creation of one. Since the creation and implementation of the CAP largely depended on the legal and regulatory framework, an explanation of the development of such framework has been included as well. The chapter also includes the milestones reached in the sector over the course of the REGATRACE project and the ones reached under the umbrella of Task 3.3 for starting up the registries in the target countries.

The German Energy Agency engaged with each target country for helping them implement their CAP, but the majority of them were able to work independently. It also kept constant communication with them in order to follow-up on the developments in the biomethane sector and the related legal and regulatory framework. Finally, it is relevant to note that all the information regarding the situation of the biomethane sector, the development of the legal and regulatory framework and the implementation of the CAPs provided in this chapter was **directly delivered by the target countries**.

3.1 Belgium

3.1.1 Task 3.2 developments: Belgium

Belgium was a target country of the REGATRACE project since the beginning. The project partner was Fluxys (Belgian gas TSO) with whom the collaboration within Task 3.2 was always fruitful. The situation of the biomethane sector in Belgium is more complex compared to the other target countries. The reason for this is that each region (Flanders, Wallonia, and Brussels) is responsible for the energy policy within its boundaries and, hence, for the development of the registry for biomethane GOs. On the other hand, the federal government is responsible for the renewable fuels for transport applications (bio-LNG and bio-CNG) and, in the near future, RFNBOs and RCFs. To this end, biofuel volumes for transport applications and their sustainability (including GHG emissions) are recorded by means of a registration system using only a PoS, in order to be recognized for the biofuel obligations (related to RED II and FQD) of the fuel suppliers. There is no link between the GO system and the biofuel registration system.

The situation in each region in Belgium varied greatly at the beginning of the project and continues to do so. Below is a summary of the situation:

At the project's start there was only one small biomethane production plant in Flanders with a yearly production volume of 4 to 5 GWh. Nevertheless, the potential for biomethane at the national level is estimated at approximately 15 TWh of biomethane that can be injected into the gas grid, out of which 10 TWh could already be developed in the next 10 years. However, this is conditioned to regional and federal policymakers to fully embrace the activation of the sector. This means that the development of this potential highly depends on imposing relevant externalities (i.e., related to CO2 emissions, minimum quota, etc.) that can bring additional value and, where still necessary, facilitate adequate and balanced support mechanisms. Regarding production of hydrogen via power to gas technologies

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(PtG), there is one pilot plant planned for 2026 with a production capacity of 25 MW. The certification of renewable hydrogen is still under discussion in Europe. Still, future developments in the PtG sector will strongly depend on hourly electricity prices and the improvements in flexibility of the power grid, as well as on the European rulings (delegated acts) for green hydrogen.

The present regulatory and financial instruments for promoting the production of biomethane and hydrogen (in the future) vary depending on the region. In the case of Flanders, the existing yearly tender process for investment support (1 Mio. EUR maximum and up to 65% of investment costs) for upgrading biogas to biomethane has recently been put on hold by the Flemish Ministry of Energy. Thus, support for biogas at present is only possible for the electricity produced by local biogas-fired CHP plants (with an on-site digester) via green electricity certificates (per kWh_{el} produced) and CHP certificates (depending on overall efficiency). However, this support mechanism will end by 2025. CHP plants on the gas grid sourcing biomethane through GOs or certificates cannot claim green electricity certificates and, consequently, receive no support for using biomethane. Energy suppliers only need to comply with a quota of green electricity certificates, but there is no quota for biomethane or other green gases. Consequently, biomethane is not directly supported in Flanders today.

In Brussels, there is strong support through green electricity certificates for biomethane used in a CHP plant connected to the gas grid. As there is no biomethane production in Brussels, GOs for biomethane can only be imported, but this not possible due to the lack of a GO system for biomethane in this region. Energy suppliers must only comply with a quota for green electricity and up to 45% of investment costs can be subsidized for environmentally friendly and energy efficiency technologies. However, these subsidies cannot be combined with the support from the green electricity certificates.

Finally, in the case of Wallonia, biomethane (as well as biogas) produced within its borders is currently supported through the electricity produced in Walloon CHP plants via green electricity certificates. The biomethane/biogas producer receives the “label de garantie d’origine” (LGO, similar to a GO) that it can sell to a CHP plant. The producer then receives the support (as biomethane/biogas user) related to the economical context and the GHG reduction related to biomethane (based on a specific Walloon GHG calculation). This support is also applicable for CHP plants connected to the gas grid receiving LGOs for biomethane injected into the gas grid. As in Flanders, in Wallonia the system of green electricity certificates for CHP running on biogas and biomethane will end in 2023. The Walloon government is now reflecting on how the system of green electricity certificates can be replaced for supporting biomethane through other measures and that can be opened to other users as well. Still, up to 50% of the investment costs can be supported for small renewable energy plants (for electricity or heat).

The activities around the development of an electronic registry for biomethane and hydrogen GOs varied from one region to another when the REGATRACE project started. For the purpose of certification of the first biomethane plant in Flanders in 2018, a Belgian National Voluntary System “greengasregister.be” (link) was set up by Gas.be (collaboration between Fluxys as TSO and Belgian DSOs) and served as a national demonstration project for issuing Green Gas Certificates (GGCs).This registry was designed to issue both a GGC on a book & claim basis and a GGC with mass balance, the latter being issued in combination with a PoS and GHG emissions. Producers, traders/suppliers, auditors, and final consumers had electronic access to the tracing of the GGC and related documents. As this register was based on ERGaR standards, it was able to import green gas certificates from Vertogas (Netherlands). Additionally, it was designed for conversion and tracing of bio-LNG certificates under ISCC standards for the Zeebrugge LNG terminal.

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In Flanders, with the implementation of RED II through the Energy Decree in 2019, VREG (Flemish Regulator for Electricity and Gas) was appointed as issuing body. The greengasregister.be was therefore no longer allowed to continue issuing GGCs on a book & claim basis, as they were replaced by GOs according to Article 19 RED II for the Flemish producers. Although the greengasregister.be could still issue GGCs for other parts of the country, the lack of production made impossible for this registry to continue certifying green gases since 2020. The same Energy Decree appointed Fluxys as the production registrar for biomethane and hydrogen, taking over the part of the greengasregister.be tool that covered the production registration of these gases. This part of the tool was adapted to AIB's EECS Rules during the REGATRACE project (AIB also participated in it) and is now used for the production registration for GOs in Flanders. Each month the data is transferred electronically to VREG for the issuance of the GOs, so that they can be further traded and cancelled within Flanders. The production registrar tool also provides an extranet capability for producers and auditors. Although the Energy Decree also included the issuance of hydrogen GOs as from 2020 (the tool was also adapted for this purpose), VREG decided to put this function on hold until the CEN Standard EN16325 is finalized.

In Wallonia, the regional administration decided to wait for the publication of RED III to adapt its legislation. Most likely, as in Flanders, the Walloon GO registry will use AIB's EECS rules to at least facilitate transferability of GOs between both regions (and possibly Brussels too). Fluxys has already proposed the Walloon Administration to act as the production registrar (as in Flanders), but the decision was not taken because there was no injection of biomethane into the gas grid at that time (the first biomethane plant started operation in October 2020). There are three biomethane injection facilities in Wallonia, but the process of the registration is still performed directly with the Walloon administration (SPW Economy) and there is no electronic system behind this setup.

With regard to the transposition status of Article 19 RED II, the situation also varies among regions. Regarding Article 19 and, in the case of Flanders, the legislation had already been fully adapted. Fluxys was appointed as the production registrar, while VREG was appointed as the issuing body for gas GOs. In Wallonia, the further development and adaptation of the regulatory framework was put on hold until the publication of RED III, while in Brussels no adequate legislation for green gasses had been put in place yet.

Regarding compliance with Article 30 RED II (mass balance for biofuels, i.e., bio-CNG, bio-LNG and RFNBOs), the competency in Belgium remains within the federal authorities. The Federal Administration Economy and Energy is responsible for the quota obligations of renewable fuels, while the Federal Administration Health and Environment is responsible for sustainability and GHG emissions reduction (related to FQD). The latter Federal Administration is also providing the electronic registration for biofuels, which is only based on PoS issued by an EU-recognized voluntary scheme. The responsibility for hydrogen is still under discussion between the regions and the federal level. During the REGATRACE project, Fluxys proposed to the federal authorities to use the mass balancing functionality of the greengasregister.be for bio-CNG and bio-LNG. However, in the light of the announcement of the Union Database, the Ministry of Health decided to only adapt its existing electronic system for liquid biofuels by integrating bio-CNG and bio-LNG as a temporal solution. Fluxys also proposed to be appointed as production registrar for solving issues around double counting, but this is still under consideration within the federal authorities.

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As it can be deducted, in Belgium there is no single institution responsible for the creation of a centralized system registry for biomethane GOs or certificates (including PoS) for biofuels and ETS. Today, each region and the federal authorities are working towards the creation of their own registry for green gases. Nevertheless, Fluxys Belgium has been advocating for a centralized system approach as the most efficient solution to develop a well-functioning green gas market in Belgium that transcends the current regional and national boundaries, while facilitating international import and export of green gasses. At present, international trade is hardly possible because of the incompatibility of the systems (the Flemish registry is an AIB-based solution, while the other foreign registries are members of ERGaR). A centralized solution would also allow the production registrar to guarantee the single use of a certain production batch between the federal and regional levels. Today there is no such single-use control among the aforementioned levels, meaning a production batch could be sold twice as a GO and as a PoS for a biofuel or ETS certificate. Additionally, with the introduction of the Union Database for EU-compliant certificates, a centralized solution for registration of production (and seemingly also for consumption registration) will be needed. Continuing with the development of fragmented solutions in every region and on the federal level (different related to the use -biofuels, GO, ETS-, different for each energy carrier, and with different system rules) is to be avoided, as it might result in having more than 10 different registries in Belgium that then also need to be connected to ensure single use and consistent conversion between energy carriers. Therefore, a centralized system would certainly be less costly for all parties, while still being able to develop dedicated and complete reporting for the different competent authorities.

3.1.2 Country highlights: Belgium

- The Flemish registry for renewable gas GOs started operating on January 1, 2020. Fluxys acts as the production registrar, while VREG is the issuing body. Fluxys is responsible for the registration of production units, the metered data, and the calculation of the green part of the production batch, as well as for the relevant audits of the installations. The proof of origin (only indicating the origin and renewable character) is accredited by external auditors. It is electronically transferred on a monthly basis to VREG, together with the renewable amount. VREG then converts the data into a GO that is made available in its system for trading and cancellation. The producers, auditors and gas operators have electronic access to the data within their perimeter.
- The Federal Registry for Biofuels (link to user manual) was originally established for the registration of biodiesel and bioethanol volumes related to the Belgian legislation. It has been in operation since 2011. The registry is comparable to the German Nabisy and can also exchange with it certificates (with mass balancing) for biodiesel and bioethanol. From 2022 onwards, it will include bio-CNG and bio-LNG in order for these gaseous fuels to be counted towards the transport obligation from RED II and the GHG emissions reduction from the FQD.

3.2 Czech Republic

3.2.1 Task 3.2 developments: Czech Republic

The Czech Republic joined the project in June 2021 by replacing Romania as target country in the project. The partner institution in the project was designated to be the Czech Biogas Association (CzBA).

At the moment CzBA joined the REGATRACE project and, according to the answers to the initial questionnaire (Annex 5.1) it provided on 1 July 20, the Czech Republic had a biogas production of approximately 0.66 MWh per capita per year and only one biomethane plant with a yearly production

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volume of 7.6 GWh being injected into the gas grid. However, according to CzBA, there is a substantial potential for future growth, especially when considering the possibility to export the domestic biomethane production abroad. A large share of the biogas production originates from agricultural biomass (including energy crops), which is still not compliant with the sustainability criteria included in RED II. The biogas is currently used in CHP plants for power and heat production, but the heat is often not used, making the biogas production questionable. Legislative barriers were the main reason for the lag in the development of the biomethane sector. Until 2021, there was no related legislation in place and obsolete governmental decrees regulating the natural gas industry made it very difficult to inject biomethane into the gas grid. Nevertheless, the National Energy and Climate Plan from November 2019 recognized the potential of biomethane and highlighted its benefits when used in the industry and transport. Thus, the Czech Government has aimed for a modernization and transformation of the biogas sector where its upgrade to biomethane should play a major role.

The only support mechanism in place for biomethane was an 80% investment subsidy for pilot plants. There were also no activities in progress for developing an electronic registry for biomethane and renewable gases (including PtG). Nevertheless, the transposition of Article 19 RED II for establishing a competent body for guarantees of origin for renewable gases was in progress through the amendment of the national legislation regulating renewable energy. This amendment also included the transposition of Article 30 RED II for including a mass balance function in the biomethane registry. The state-owned electricity and gas market operator (OTE) was designated as the organization responsible for the setup and operation the electronic registry for biomethane certificates. In addition, the Ministry of Industry and Trade received the mandate to be the governmental institution responsible for the compliance of the provisions from RED II. CzBA´s role in the creation of the registry is of great important as it serves as the intermediary between OTE and the Ministry of Industry and Trade.

By March 2022 the preparation of the new legal framework for the development of the biomethane registry concluded with the finalization of the amendment to the Act on Renewable Energy Sources (RES Act). After the adoption of the RES Act, production and certification of biomethane, and the issuance of the related GOs will be possible from 2023 onwards. This allowed OTE to start with the activities required for setting up the registry. According to CzBA, the registry will play an essential role in preventing double sale and double counting towards national renewable energy goals and compliance with state aid. It will also be compliant with Articles 19 and 30 RED II.

There are no official overall targets for biomethane production and consumption in the Czech Republic. Nevertheless, the new RES Act sets an obligation to ensure a minimum share of biomethane in the natural gas delivered to filling stations for transport purposes starting on January 1 from each of the following years: 0.5% in 2023, 2% in 2025 and 40% in 2030. The Czech Government has also established a series of strategies and milestones for the development of the biomethane sector: 2022-2023, 2024-2030, and 2030 onwards.

Strategies for the development of the biomethane sector 2022-2023

- Creation of a stable regulatory framework to ensure the participation of national and foreign investors.
- Assessment of the potential of transforming the current biogas plants for biomethane production and propose targeted measures for their transformation.
- The new Act on RES brings operation support for biomethane in the form of Green Bonus and Guarantees of Origin for electricity, combined heat and power, biomethane, hydrogen and heat from RES.

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- The waste management legislation will be stricter regarding biodegradable waste collection and treatment in order for it to be used in anaerobic digestion sites for producing biomethane. Biodegradable waste shall be treated as a valuable resource.
- Government support for biomethane plants by introducing an obligation for the DSOs for purchasing gas volumes from biomethane plants connected to the grid.
- Support for off-grid biomethane production in remote biomethane filling stations (in case grid injection is not possible). The support will in the form of a green bonus (FiP) targeted to the off-grid biomethane production.

Strategies for the development of the biomethane sector 2024-2030

- Once all biomethane-related legislation is in place, the Czech Government expects a rapid sector growth.
- New biomethane plants are mainly planned in large cities like Prague and Brno among others. The reason for this is to reduce the production of mixed municipal waste through the separate collection of biodegradable and kitchen waste from households, as well as of gastro waste from restaurants and canteens and of expired food. These waste streams will no longer end up in landfills, but as a feedstock for biomethane production.
- Wastewater treatment plants (WWTP) with anaerobic sludge stabilization will switch to biomethane production approximately five years earlier than biogas due to the operational support for electricity generation.
- Specialized industrial biogas plants will produce biomethane from waste and by-products arising from the production of food, animal feed or in the processing of vegetable and animal oils and fats.
- The biggest challenge for this time period is setting the right conditions for the conversion of agricultural biogas plants producing electricity into modern units capable of processing more waste and producing biomethane from biogas.

Strategies after 2030

The future development of the biomethane sector will be highly dependent on the EU legislation.

Recognizing biomethane as an environmentally friendly renewable fuel will make a significant contribution to the energy security in the Czech Republic and in the EU.

The processing of bio-waste should become essential since the exemption of landfilling bio-waste expires in 2030. Hence, further development should be expected in this field.

The Czech Republic is aware that bio-waste could be highly demanded in the future because advanced material technologies (e.g., production of bioplastics and other organic high-value materials) might use biodegradable waste as a raw material and this could lead to a possible scarcity.

The Czech Republic recognizes the importance of ensuring the sustainable deployment of RES, but without risking a secure and stable energy mix and a smart use of resources. Biomethane production should then be seen as a possible solution to the energy supply and security rather than as a target.

By the time this report was written, the Czech Republic had already produced a CAP with a time plan (sent to dena on 17 March 2022) based on the guideline document developed by dena (Annex 5.2), with detailed milestones and tasks and a specific duration for each one of them. In June 2022, the Decree on Guarantees of Origin had been finalized by the Ministry of Industry and Trade and entered the legislative process for its approval by the Parliament. Once approved, the operation of the registry

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and the issuance of biomethane GOs could start on 1 January 2023. This was the latest decree needed to continue with the set-up of the electronic registry for GOs. OTE was designated as the issuing body responsible registry's set-up and operation. According to the time plan provided by the CzBA, the registry should be ready by the second quarter of 2024, but the RES Act requires it to be operational on 1 January 2023 and a substantial amount of work was done in 2022 to meet this deadline. From the last communication between CzBA and dena (10 October 2022), the registry should be operational as from May 2023 and will issue GOs retroactively from January 2023 onwards. It should also be able to issue hydrogen GOs, but there is still no hydrogen production in the Czech Republic.

Figure 7 shows a graphical representation of the development of the biomethane sector in the Czech Republic. Given the fact that it became a target country in June 2021, its progress has been notable. There is a strong political will from the Czech Government in transposing RED II into national legislation and promoting the development of the biomethane sector.

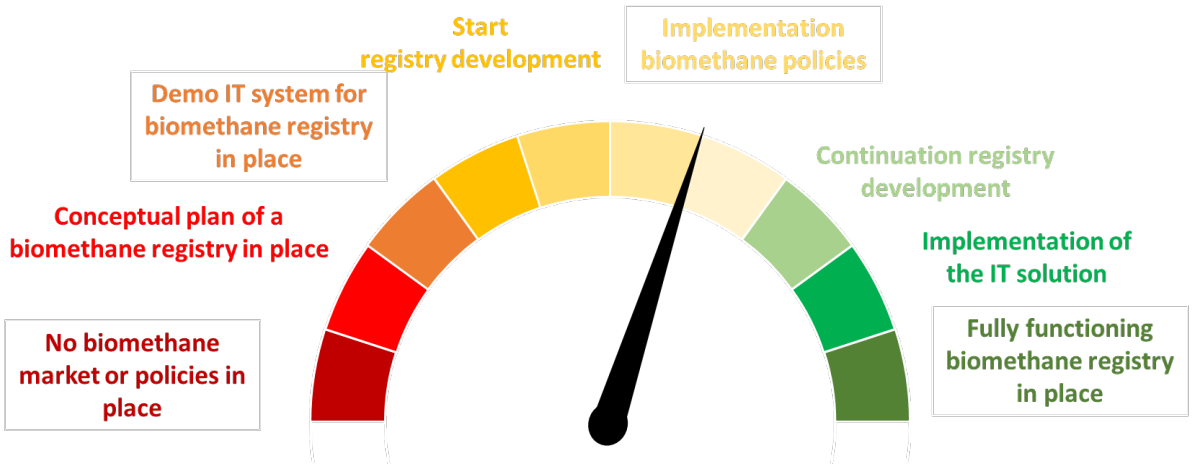

Fig. 7 Progress in setting up the Czech registry for biomethane GOs.

3.2.2 Country highlights: Czech Republic

- OTE was appointed as issuing body for gas GOs through the Decree on Guarantees of Origin from June 2022 (still in approval process by the Czech Parliament).
- The amendment of the RES Act made possible the production and certification of biomethane, and the issuance of the related GOs from 2023 onwards.
- Prague is planning to build a biogas plant able to process 50,000 tons of waste per year. Brno plans a similar facility with a capacity of 20,000 tons per year. Both cities want to use biomethane to fuel city buses and garbage trucks.
- The Central Wastewater Treatment Plant in Prague that is currently selecting suppliers of biomethane production technology. The biomethane production should start in 2024.
- The Brno-Modrice WWTP tested already the production of biomethane from sludge gas in 2018.
- The operation support for biomethane provided by the new Act on RES will be in the form of a feed-in premium (FiP) for the biomethane volumes injected into the grid. This FiP will be included in the price decision by the Energy Regulatory Office (ERO) and might be low because the natural gas commodity price has to be considered by the ERO. Thus, it seems that the GOs will be more interesting for the biomethane producers.

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3.3 Ireland

3.3.1 Task 3.2 developments: Ireland

Ireland was a target country since REGATRACE started in June 2019. The partner institution was Renewable Gas Forum Ireland (RGFI), which was established in 2014 as an industry forum to represent the interests of the renewable gas industry, with a mandate to advocate on behalf of the gas consumer in Ireland. When the REGATRACE project started in June 2019, Ireland had already been working in setting up a registry for biomethane certificates.

According to the answers provided by RGFI on 7 August 2019 to the initial questionnaire (Annex 5.1), Ireland had one biomethane production plant injecting into the gas grid. The production capacity of the plant was calculated at 39 GWh/year but was still not producing when REGATRACE started. The potential for future growth was up to 11 TWh of biomethane, which represents 20% of the gas volume in the Irish grid. There was only one governmental mechanism for promoting biomethane production and PtG technologies. This consists in giving support towards the cost of building an anaerobic digestion (AD) facility, if directly connected to an end-user for heat supply. This support mechanism, however, does not apply to grid-injected biomethane.

Back in June 2019, the process for transposing RED II into national legislation was soon to be started and the aim was that the biomethane GO registry would comply with both Article 19 (book & claim, GOs) and Article 30 (mass balancing) RED II. The organization responsible for setting up the registry is Gas Networks Ireland (GNI, Irish gas TSO and DSO). The solution developed by GNI was an interim one based on MS Excel, which would allow to issue GOs for grid-injected biomethane. Initially, GNI proposed implementing and operating this registry as a "proof of concept" for demonstrating to the national authorities how biomethane produced in Ireland can meet the requirements from RED I and RED II.

With regard to compliance with RED II, there are several institutions who share this responsibility:

- DCCAE: Department of Communications, Climate Action and Environment. Responsible for the telecommunications and broadcasting sectors. It also regulates, protects, and develops the natural resources of Ireland.
- SEAI: Sustainable Energy Authority of Ireland. Responsible for the implementation of government policy.
- CRU: Commission for Regulation of Utilities. Responsible for the supervision and regulation of energy utilities.

In June 2020, GNI's goal to finalize the biomethane registry by 31 December of that year were still valid and most likely to be reached. In fact, the registry's first version went live on 1 October 2020. This was based on MS Excel and only operated offline. The complete legal framework for biomethane was needed before proceeding for a more sophisticated IT solution. By November 2020 already 1 GWh of biomethane had been injected into the grid and 1000 certificates of origin (1 MWh each) had been issued by the registry. The legal framework for biomethane had been drafted and was within the DCCAE for its finalization, which would require approximately additional 6 to 9 months. The complete legal framework for biomethane was needed before proceeding to a more sophisticated IT solution.

By June 2021, Ireland was rapidly progressing and building momentum for developing an indigenous AD biomethane industry, with clear action points outlined in the Climate Action Plan 2021. The Irish Government had committed to implementing a statutory instrument that will officially recognize the Green Gas Certification Scheme in Ireland. RGFI was also very active and started working with a group of leading industrial gas consumers in approaching the Irish Government with an initiative and industry

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collaboration under the framework of Project Clover (link). RGFI also engaged with consumer groups from sectors, such as hospitality and transport, in making representation to the Irish Government to address their needs for renewable fuels in the pathway to decarbonization.

In October 2021, RGFI had continued working together with industrial partners to decarbonize their thermal demand for manufacturing and processing. In addition, two goals for biomethane were set. The first one being 2.5 TWh of biomethane to be injected into the gas grid by 2030 and the second one to produce 9.5 TWh of biomethane by 2050. Through further innovation, even possibly reach a biomethane production of 18 TWh by 2030. According to RGFI, the yearly demand of natural gas in Ireland is of approximately 24 TWh. This means that if the ambitious goal of 18 TWh of biomethane production by 2030 is reached, then up to 75% of the present natural gas demand would be covered with biomethane. This would certainly represent a huge leap in the Irish energy independence and an example to be followed by the rest of the EU Member States. By September 2021, the biomethane production in Ireland accounted for 3090 MWh and was already triple the production from the previous year. By the end of 2021, Ireland produced 4,965 MWh of biomethane. This showcases Ireland's commitment to decarbonize its economy. In fact, between January and August 2022 the biomethane production was already 19,072 MWh, which constitutes a major increase compared to the previous years.

By March 2022, the plans to transition to a more sophisticated software solution where still on hold until the legal framework (a Statutory Instrument) had been finalized. The latter had already been drafted and was within DCCAE for its finalization. The Government Climate Action Plan included the missing legislation as an Action with a completion date of Q2 2022. The GNI registry was still operating in its original platform (MS Excel). A funding request was presented to CRU for a new IT solution to be procured over the next revenue control period (2022/23 to 2027/28). Three other companies had requested to open accounts in the existing biomethane registry and were granted access in August 2022. Meanwhile, the same biomethane plant continued injecting its production into the gas grid and GOs were issued for it. The missing Statutory Instrument was finally approved in August 2022, which formally appointed GNI as the national renewable gas registry.

Due to the fact that Ireland was already ahead in the development of the biomethane registry compared to the rest of the target countries in the project, it was not necessary to create a country action plan. Nevertheless, the guideline document for creating one (Annex 5.2) was sent to RGFI in order for them to identify the possible elements that might be missing during the development of GNI's registry. Additionally, the parties involved in leading Task 3.2 were also in constant communication with RGFI for any kind of support that might be needed.

The level of development that Ireland had at the time this report was written is shown in figure 8. This graphical representation is based on development of the policy framework for biomethane; the availability of production, transmission, and distribution infrastructure for biomethane, as well as on the determination from politicians, the private sector and civil society for promoting the production and use of biomethane.

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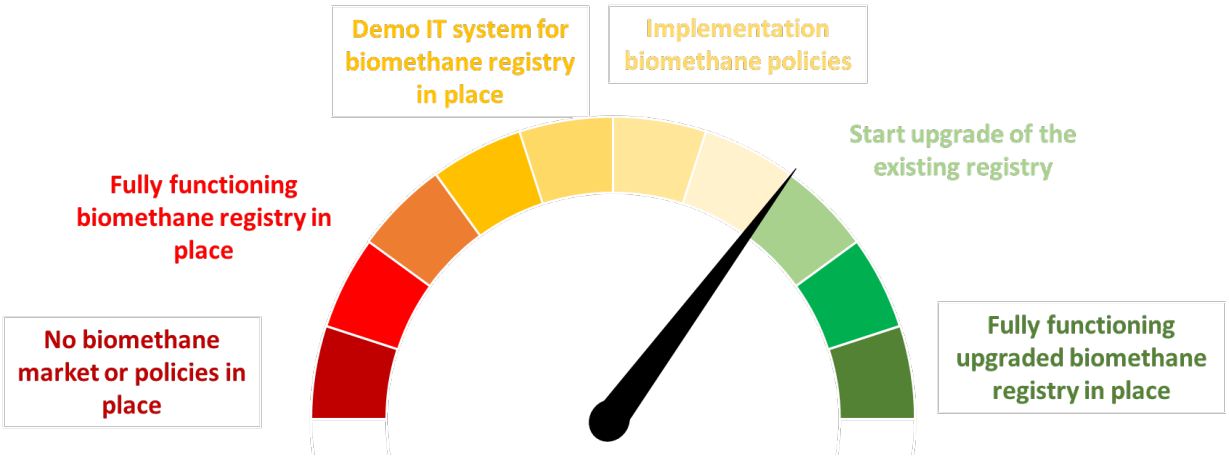

Fig. 8 Progress in setting up the upgraded Irish registry for biomethane GOs.

3.3.2 Country highlights: Ireland

- RGFI is the project partner representing Ireland in the REGATRACE project. However, GNI was in charge of developing and operating the voluntary biomethane registry. In this regard, RGFI ensured good contact to GNI. Both organizations acted as equal partners in REGATRACE and were able to achieve good exchange and collaboration.
- RGFI enabled representatives of GNI to receive access to the IT-registry system via personalized accounts. The demonstration and testing of the REGATRACE system allowed them to gain deep insights into required business and settlement processes which was useful for the comparison of different IT-options.
- The first version of the biomethane registry went live on 1 October 2020. It is a MS Excel-based solution and only operates offline. The complete legal framework for biomethane is needed before proceeding for a more sophisticated IT solution. The registry is able to issue certificates of origin (book & claim, compliant with Article 19 RED II) and proofs of origin (mass balancing, compliant with Article 30 RED II0.
- Gas Networks Ireland was officially appointed as national renewable gas registry in the Statutory Instrument from August 2022.
- Project Clover. This industry led initiative aims to produce 2.5 TWh of biomethane via 125 agri-based feedstock AD plants by 2030. The initial phase would comprise eight AD plants (20 GWh each) by 2025, a proof-of-concept phase, procurement procedures, standardized approach, and ongoing support to ensure efficiencies and continuous improvements using innovative technologies. Additional revenue streams will be exploited in developing a circular bio economy. A dedicated AD biomethane fund of €200 million is to be established and a specialist fund manager would be appointed to manage it. This is expected to happen to coincide with further developments at Government level in announcing the Renewable Heat Obligation Scheme (Article 23 RED II).

3.4 Italy

3.4.1 Task 3.2 developments: Italy

Italy was a target country since the beginning of the REGATRACE project. The partner institution was CIB (*Consorzio Italiano Biogas*). CIB plays an important role as a stakeholder of the Italian biogas and biomethane sector. It actively participated in relevant projects such as Green Gas Grids and BIOSURF and is a member of ERGaR. The decision to make a government-mandated registry or a voluntary one changed several times during the course of the project. For the first option, GSE (Manager of Energy Services) would have been the responsible organization for the registry´s development. For the second

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one, CIB would have been responsible. When this report was written, the latest decision was that CIB would be in charge of developing a voluntary registry.

According to the information provided by CIB in the first questionnaire (Annex 5.1) and in further communications, Italy is the second European country in terms of installed biogas plants, only after Germany and the fourth in the world after Germany, China and the USA. There were 8 biomethane plants in Italy plus approximately 15 more in construction that would become operational during 2019. The active biomethane plants had an approximate production volume of 10,000 m^3/hour.

The main instrument for promoting biomethane production and PtG technologies in Italy is the biomethane promotion scheme proposed in the Biomethane Decree from 2 March 2018.

Biomethane Decree from 2 March 2018. It is valid until 31 December 2022 and sets a production limit of 1.1 billion m^3 of biomethane per year. It gives subsidies only in case biomethane is used in the transport sector. Due to the presence of more than 1 million natural gas vehicles in Italy, investments of over €4 billion were expected in the following four years after the Decree's publication. Among the main innovations from this decree is the introduction of specific measures dedicated to advanced biomethane, which is considered as such if it derives from certain biomass types. The development of advanced biomethane should be ensured by the presence, within the definition of mandatory quotas for biofuels, of a percentage dedicated to advanced biofuels. In this regard, advanced biomethane becomes mandatory in the transport sector. Supported biomethane also includes the fuel produced through hydrogen methanation processes obtained from RES and the CO_2 present in the biogas destined for the production of biomethane or produced by biological and fermentation processes. The obligation of release for consumption of biofuels was set at 7% of the total production of fossil fuels (gasoline and diesel), with 0.6% must be from advanced biofuels. In 2020 the obligation was raised to 9%, of which at least 1.85% must be covered by advanced biofuels. Biomethane can thus offer an important contribution because it is considered an advanced biofuel and is expected to pave the way for low-carbon transportation in Italy.

With regard to the activities for setting up an electronic registry for biomethane and renewable gases, at the start of the project the responsible institution was GSE, but no work had started yet, and it remained so for several months. The same is valid for the transposition of Article 19 RED II into national legislation and the establishment of a competent body for GOs of renewable gases. The transposition of Article 30 RED II for using a mass balance system for biofuels, bioliquids and biomass fuels started off with the creation of a delegation to the Italian Government, but no public documents with more detailed information were available. In this sense, the Ministry of Economic Development, with the support of the Ministries of the Environment and of Agriculture are the governmental institutions responsible for the activities needed to comply with the requirements from RED II.

By April 2020, no further progress regarding the transposition of Article 30 RED II was made. Neither were there still any activities for setting up an electronic registry for biomethane. At this point in time, the responsible institution for it was supposed to be GSE, but there was not progress yet. CIB tried to get GSE more involved into REGATRACE and keep the possibility open for the creation of a voluntary registry managed by CIB. In December 2020, there was still no information about the intention of establishing a governmental delegation for transposing Article 30 RED II into national legislation. CIB also strengthened the discussions with GSE for the development of a voluntary registry, but unfortunately there was no progress in this field. It remained unknown whether GSE would actually implement a registry or if it would favor CIB's idea of creating a voluntary one. Despite the uncertainty for setting up the registry, the number of biomethane plants in operation increased to 23 by the end of 2020.

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By May 2021, CIB had decided in April of that year that it will establish and manage a voluntary biomethane registry. CIB started talks with AGCS (leader of REGATRACE Task 3.3 "Provisional IT system for start-up of registries") for developing the test software needed for the electronic registry. CIB also started working on the creation of a business plan, which was still a preliminary draft. CIB also appreciated dena's continuous offer to help in setting up the Italian registry but indicated would come back to dena once CIB had met with other stakeholders in Italy for gathering more information. By June 2021, CIB had finished the business plan for the Italian registry and had it sent to its board of directors for approval. Prior to the creation of the registry's business plan, CIB organized a workshop with stakeholders from the biomethane sector. It helped CIB understand if a biomethane registry was feasible and had a place in the future and, indeed, the LNG sector showed great interest in its creation.

By October 2021, CIB's board of directors had already approved the registry's business plan. Its purpose will be compliance with Article 19 RED II and will be managed by CIB or one of its subsidiaries (e.g., CIB Services srl.). Nevertheless, CIB was waiting for the approval of the new Biomethane Decree (it will include electricity) for moving forward with setting up the registry. The present Decree only covers the transport sector, while the new one is expected to also include electricity. The approval date of the new decree was still unknown. The number of operational biomethane plants increased despite the delay of the new Biomethane Decree and accounted for 27 plants by the end of 2021.

In February 2022, CIB was still waiting for the new Biomethane Decree to be published. The delay hindered the setup of the registry due to the lack of clarity in the sector despite the registry being independent from the decree. The registry will issue "certificates of origin" and not "guarantees of origin" because CIB has not been officially appointed as issuing body by the Italian Government. Additionally, CIB has the intention to join the ERGaR CoO Scheme in the future when the registry enters operation.

The new decree was officially signed on 15 September 2022. This positive announcement would allow CIB to continue with the setup of the voluntary registry for biomethane CoOs. In the meantime, the Italian Government published an extension of 12 months to the Decree of 2 March 2018. This one should have ended on 31 December 2022, but it will be extended for one additional year. Biomethane production plants who obtained the authorization to build their installation by 19 August 2022 can still benefit from this Decree. The number of biomethane plants becoming operational increased rapidly during 2022. CIB estimates that there will be approximately 50 operational plants by the end of 2022.

The new Biomethane Decree introduces subsidies to foster the use of biomethane and bio-LNG for non-transport applications (the previous decree focused on transport uses). It also establishes different tariffs according to: (1) the plant size; (2) the fact that biomethane will be produced by new plants or existing biogas plants converted to biomethane; and (3) the type of feedstock (the organic fraction of municipal solid waste will receive a lower tariff, while agricultural residues and by-products will receive a higher one). Finally, there is also an incentive for the construction of the biomethane plants.

As it can be seen, the setup of the registry in Italy encountered several obstacles. First was the lack of decision-making of whether to establish a registry with a governmental mandate or a voluntary one, together with the institution (GSE or CIB) that would be responsible for its development. Second was the continuous delay in the official publication of the new Biomethane Decree that would include support for biomethane for non-transport applications. Despite this delay, the interest of the sector's stakeholders increased continuously. This was reflected in the increasing number of biomethane plants becoming operational. It went from having eight plants in 2019, to 23 in 2020 and to 27 in 2021. Moreover, the communication with CIB was always very effective and constantly provided information

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regarding the developments of the Italian biomethane sector. Additionally, the parties involved in Task 3.2 constantly sought to offer support and even attempted to establish a CAP without specific dates, but the offer was not accepted due to the lack in clarity that the absence and delay of the new Biomethane Decree brought to the biomethane sector.

The level of the registry's development in Italy at the time this report was written is portrayed in figure 9. This graphical representation is based on development of the policy framework for biomethane; the availability of production, transmission, and distribution infrastructure, as well as on the determination from politicians and the private sector for promoting the production and use of biomethane.

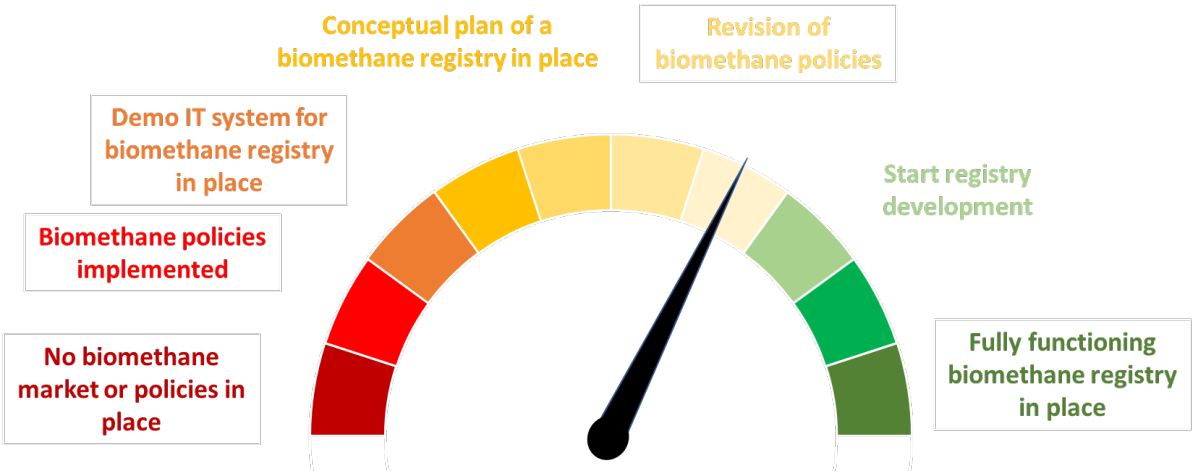

Fig. 9 Progress in setting up the Italian registry for biomethane certificates.

3.4.2 Country highlights: Italy

- Biomethane promotion scheme. It is based on the allocation of certificates of release for consumption (CIC, *Certificati di Immissione in Consumo di biocarburanti* in Italian). The CIC will be provided to those subjects who release non-renewable fuels for consumption. The number of CIC that they are obliged to hold must be enough to cover the share of energy corresponding to the obligation to release for consumption of biofuels. The obligation is revised every year. One CIC is assigned to the fuel producers for every 10 Gcal of biomethane produced and released for consumption. One CIC is assigned for every 5 Gcal if the biomethane derives from biogas produced from particular matrices (Annex 3 of the Ministerial Decree from October 10, 2014). Once a biomethane production facility starts operation and has successfully passed the qualification process from GSE, the CIC allocation period is not subject to time limits and is available until the compulsory quota mechanism for biofuels is operational. The Decree from March 2, 2018 also introduced an additional amount of CIC for the construction of new filling stations for bio-CNG and bio-LNG. If the producer sustains a certain share of the infrastructure cost of a new filling station (at least 51% individually or together with other producers), this will increase the allocated CIC up to 70% of the cost of the entire built infrastructure or at most €600,000 per CNG filling station or €1,200,000 per LNG filling station. The statistics show that the availability of refueling points stimulates the purchase of natural gas vehicles. This mechanism presents an interesting multiplier effect for increasing the use of biomethane in the automotive sector.
- The New Biomethane Decree was officially signed on 15 September 2022. It introduced subsidies to foster the use of biomethane and bio-LNG for non-transport applications.

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3.5 Lithuania

3.5.1 Task 3.2 developments: Lithuania

Lithuania was a target country since REGATRACE started in June 2021. The project partner was Amber Grid, Lithuania's gas TSO. At the project's start and, according to the information provided by Amber Grid, Lithuania had no biomethane production plants connected to the gas grid. Nevertheless, there is an estimated production potential of approximately 12 GWh per year to be injected into the natural gas grid in the second half of 2020. A production potential of close to 41 GWh from 2023 onwards is also considered.

In August 2019, Litgrid (Lithuanian electricity TSO) and Amber Grid were in the process of elaborating a study that, among other topics, would identify the need and potential for PtG technologies and applications in Lithuania. The study was completed by in December 2020 and is available in this link. There were still no subsidy or support schemes for biomethane production, except for a 40% discount for the connection fee to the gas grid. Its application had yet to be agreed with the European Commission as part of the renewable support scheme. In the end, the discount mechanism was replaced by investment support that was introduced from the Climate Chang Plan, and the Recovery and Resilience Facility. Some other support mechanisms might come up in the following years, but the drafting process of such mechanisms was in its initial phase and not available for consultation with stakeholders yet. Lithuania already had a registry for biomethane certificates when REGATRACE started and Amber Grid had been designated as its administrator. Technically, the registry was created using MS Access as a database with an interface for data entry. It could not be accessed online and did not have a login function for the participants. Hence, all actions had to be performed by Amber Grid as registry's administrator. Amber Grid was officially designated as issuing body for gas GOs in June 2019 and was therefore responsible for setting up the national biomethane registry. The transposition of Article 19 RED II into national legislation was accomplished in 2019. With respect to the transposition of Article 30 RED II, the process of amending the Renewable Energy Act was in public consultation and it was expected to be completed by mid-2020.

The responsibility for RED II compliance lies within several governmental institutions in Lithuania:

- Ministry of Energy
- Ministry of Transport and Communications
- Ministry of Environment
- National Energy Regulatory Council

After the project's start, dena held a phone call with Amber Grid on 27 August, 2019 to deepen into the answers from the initial questionnaire (Annex 5.1). The information collected during this phone call greatly contributed to better understand the situation of the Lithuanian biomethane sector. The first biomethane plant to be interconnected to the natural gas grid was entirely financed with private means and its interconnection was expected in the second half of 2020. There were 41 off-grid biogas production plants. Their production is used for power generation (33.4 $MW_{eletric}$ total capacity) with a feed-in tariff scheme, as well as for heat production (9.5 $MW_{thermal}$ total capacity). There was good political will from the Lithuanian Government to support biomethane production and the creation of an electronic registry for renewable gas GOs. There was considerable interest from all stakeholders in the creation of a European GO market for biomethane because the national market is too small. In this respect, Lithuania perceived itself as a very pro-European country wishing to reduce its energy dependence from the Nordic countries and, especially, from Russia (70% of electricity is imported from these countries). Thus, the promotion and support for biomethane production has a higher priority compared to other renewable energy technologies for final use in the transport sector.

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On 19 November, 2019 Amber Grid sent the CAP for setting up the Lithuanian biomethane registry. It was based on the guideline document developed by dena (Annex 5.2). According to it, the biomethane registry in Lithuania would be finalized during the second quarter of 2022. However, several events delayed reaching the milestones included in the CAP, as it will be explained in the paragraphs below. The registry's purpose will be for compliance with Articles 19 and 30 RED II, i.e., consumer disclosure (book & claim) and mass balancing, respectively.

On 24 April 2020, Amber Grid informed dena that the tasks corresponding to Q1 2020 from CAP were completed on time:

1. Market assessment
2. Assessment of regulatory and/or financial instruments for promoting the production and/or utilization of biomethane and other renewable gases.
3. Stakeholder identification for the development of a biomethane registry

By this time, the coronavirus pandemic had already hit Europe. Amber Grid and its stakeholders were working remotely from home and did not consider the pandemic would have a big impact on the CAP's timeline. Nevertheless, it remained unclear the impact the pandemic would have on the country's economy, which could also have repercussions on the biomethane sector and the development of the registry.

During the first half of 2020, Amber Grid worked very closely with the Ministry of Energy for transposing Articles 19 and 20 RED II into national legislation. According to the time plan from the CAP, on June 2020 Amber Grid was on time regarding the definition of the registry's purpose. However, the development and submission to the Ministry of Energy of a draft discussion paper for upgrading the registry's current IT solution encountered some obstacles. The Ministry introduced in Q2 2020 the concept of a Renewable Fuel Statistical Units System (RFSUS) to start operating in the second half of 2021. The idea behind it is that fuels produced from RES and consumed in the transport sector would obtain a statistical unit of 1 MJ that could be used to prove certain share of green fuels in the fuel mix. From Amber Grid's perspective, the GO registry would need to be integrated into this system up to a certain degree that was still unclear. Therefore, Amber Grid considered too early to discuss with the Ministry of Energy upgrading the IT solution for the biomethane registry.

The second public consultation of the Alternative Fuel Act was announced during May 2020. The Act's main goal is to achieve a 15% share of RES in the transport sector by 2040. It is foreseen that natural gas, together with biomethane will be on the top 3 main drivers of this transformation. In 2030, biomethane and green hydrogen shall account for at least 5.2% of total energy consumption in the transport sector and, together with natural gas, they will make up to 32%. Support will be provided for biomethane production along with increased opportunities for injecting biomethane into the natural gas grid. Additionally, support will be provided for gas-powered vehicles with the obligation to purchase biomethane.

By 3 December, 2020, the draft of the Alternative Fuel Act was within the Lithuanian parliament for discussion and approval aiming at having it adopted by 30 June, 2021 because of the requirement imposed by Article 36 (1) RED II. The Act would officially establish the RFSUS, which would help create demand for biomethane in Lithuania. On the other side, there were still no biomethane producers to actually cover the possible demand. Since biomethane supply and demand were still nonexistent, there were no potential registry users envisioned for 2021. At this time, there was no clear understanding how to integrate the GO-registry into the RFSUS. For these reasons Amber Grid decided the best solution was to postpone the registry's time plan for six months with the aim of also finding

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an adequate financing solution once the panorama became clearer. Additionally, the first Lithuanian biomethane producer encountered some obstacles developing its production plan and decided to postpone the project for a couple for years.

On 7 June 2021 Amber Grid contacted dena for advice regarding dena's conditions and requirements for transferring biomethane certificates (including sustainability and mass balance) with foreign registries. The request came because in the last months Amber Grid had been receiving an increasing number of enquiries from GO market participants about the possibility to export biomethane GOs for the transport sector in Germany. It its response, dena replied to Amber Grid that GOs, as defined in Article 19 RED II, are purely for consumer disclosure and work exclusively on a book & claim basis. That is, no mass balance is involved because the green property of the gas is separated from the physical product when it is injected into the grid. Both are then reunited when the gas is extracted from the grid and the interested party buys the corresponding GOs for the gas quantity (measured in energy content, MWh) that has been withdrawn from the grid. Additionally, in Articles 25 to 29 RED II it is mentioned that, in order for renewable fuels to be taken into account for the transport sector targets, a PoS must be provided. This means that a mass balance system has also been used for proving the transport of the renewable fuel in question (Article 30 RED II). That is, a GO would not be enough to consider the energy amount of a certain gaseous fuel to be counted towards the targets in the transport sector. In the case of Germany, renewable fuels are only counted towards the national targets if they have been produced within Germany. Dena also clarified that the institution responsible for documenting the fuels' sustainability information is the Federal Office for Agriculture and Food through their Sustainable Biomass System (Nabisy, link). In case German biomethane certificates were to be used in Lithuania for the national targets in the transport sector, then Amber Grid would need to check the Lithuanian legislation regarding the recognition of gas certificates imported from overseas (specifically Germany) for such objective. The dena Biogasregister issues certificates for biomethane both on a book & claim (analogue to the GOs from Article 19 RE II) and mass balance basis. Both could be exported to Lithuania provided that the Lithuanian legislation allows them to be recognized for the transport sector. For that purpose, the interested parties in Lithuania would need to follow the procedure included in this link for registering in the Biogasregister.

On 26 March 2021 Amber Grid informed dena that the Alternative Fuel Act had been approved by the parliament on 23 March 2021. This Act established the link between GOs and the transport sector, i.e., GOs accompanied by a PoS could be used in the transport sector by the gas supplier for complying with its obligations to supply certain amount of renewable gases in the final energy mix. The fuel supplier must ensure that the mass balance methodology has been applied when using GOs with PoS in the transport sector. The accompanying legislation to the Act establishing the rules and designated body for administering the RFSUS was not ready yet, but at least the link between GOs and the transport system had been established. By 14 June 2021 the accompanying legislation to the Alternative Fuel Act was still missing. The Ministry of Energy was in charge of drafting this legislation but could only start doing so when the body for administering the RFSUS had been designated. The selection process for this designation started during the second week of June 2021 and was expected to be finalized by the end of summer 2021. The first biomethane producer experienced some problems during its project development and set a new date for connecting to the gas grid by 2023. Amber Grid, in its character as gas TSO and administrator of the renewable gas GOs, perceived rising interest from the market participants by receiving 11 inquiries (10 for biomethane and one for hydrogen) from potential renewable gas producers asking for the conditions to connect to Amber Grid's transmission system. In addition, an agricultural company was planning to produce biomethane from manure and use it for its tractors and other vehicles. The waste remaining from the production process would be used as a fertilizer.

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By 11 October 2021 significant process had been made that would allow Amber Grid continue with the development of the new IT solution for the Lithuanian registry. Baltpool (link) had been selected by the Lithuanian Government to administer the RFSUS. The drafting process of the accompanying legislation to the Alternative Fuel Act had already started and was in the second round of informal consultations with stakeholders. The estimated completion date was December 2021. A probable possibility for using GOs with PoS was included in the draft. This would allow GOs with PoS disclosed for the transport sector and matched with actual consumption to be converted into fuel statistical units. The supplied will use these units to cover its obligations or transfer them to other suppliers to cover theirs. The statistical units could be used to cover both gas and liquid fuel obligations fur fuel suppliers. The number of enquiries from potential renewable gas producers for connecting to Amber Grid's transmission system also increased from 11 to 14 (13 for biomethane and 1 for green hydrogen), but no formal connection agreements had been signed. Due to the fact that Amber Grid decided to postpone the activities of the CAP, the documents for tendering the new IT solution for the registry were being prepared. The tender was planned to be announced by the end of 2021 and the new IT solution to be in place by Q1 2022.

By 16 March 2022 the Alternative Fuel Act and related by-laws that establish the rules for the RFSUS had been finalized. This would enable the use of gas GOs together with PoS for compliance of fuel supplier obligations. The RFSUS had been operating since the beginning of 2022. There was a delay in the procurement process of the new IT solution for the registry, but the tender had been recently announced. In an optimistic scenario, the contract with the tender's winner would be signed by mid-April and the new IT solution was expected to be ready by mid-summer 2022. Amber Grid also expressed interest to ERGaR for joining its CoO Scheme and had already a first meeting with the ERGaR Secretariat for discussing the necessary steps. A deadline for joining the Scheme was not set because the new IT solution of the Lithuanian registry must be first put in place in order to comply with ERGaR's requirements. Nevertheless, Amber Grid started working in parallel in other tasks for joining the ERGaR CoO Scheme and to speed up the process.

On 16 June 2022 Amber Grid informed dena that the procurement process of the IT solution for the new registry had been finished. In fact, the contract with the tender winner was signed in July 2022. According to the contract, the registry should had gone live by September 2022. However, a technical problem arouse that delayed the registry's official launch, but it will most likely go live before the end of 2022. Finally, the first Lithuanian biomethane producer still had a goal date of finishing its production plant and connect to the gas grid during Q1 2023.

The level of development that Lithuania had at the time this report was written is shown in figure 10. As it can be seen, despite the delays in preparing the legislation, the Lithuanian Government has shown good political will and great interest in developing the biomethane and renewable gases sector. Even though the first Lithuanian biomethane producer is planning to finish its production plant and connect it to Amber Grid's gas grid by 2023, there is growing interest in Lithuania from potential biomethane and renewable gases (i.e., green hydrogen) for connecting to the gas grid. This will enable the Lithuanian Government's goal of reducing energy dependence from both the Nordic countries as well as Russia.

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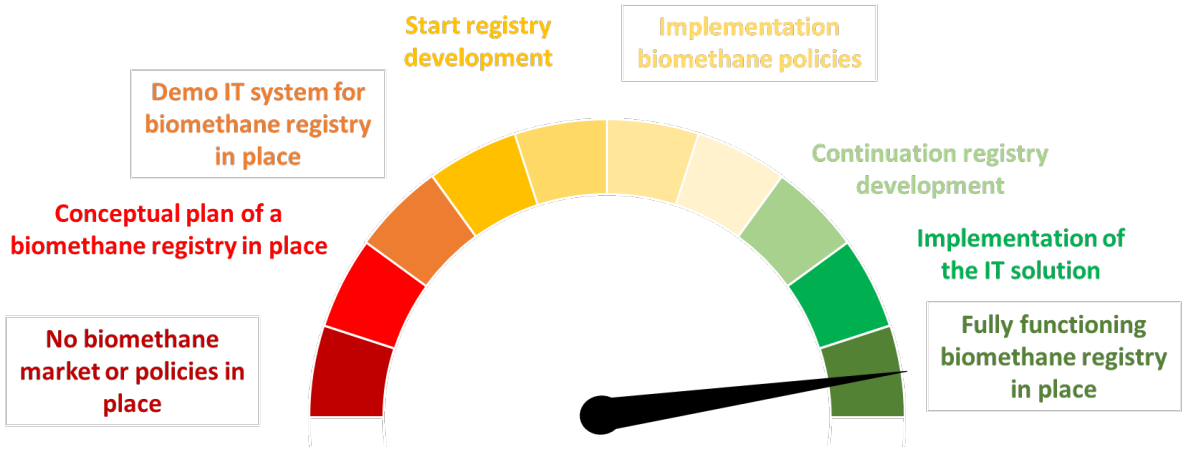

Fig. 10 Progress in setting up the Lithuanian registry for biomethane GOs.

3.5.2 Country highlights: Lithuania

- Amber Grid was officially appointed as issuing body for gas GOs in June 2019 through the Order on the Issuance, Transfer And Revocation of Gas produced from Renewable Energy Resources, Guarantees of Origin and the Supervision and Control of the Use of Guarantees of Origin, as well as the approval of the Rules for the Recognition of Guarantees of Origin issued by other States In the Republic Of Lithuania (link, only in Lithuanian language).
- Amber Grid provided the CAP for Lithuania on 19 November 2019. It contained detailed activities and milestones linked to a timetable for setting up the biomethane registry.
- The demonstration and testing of the REGATRACE system allowed gaining deep insights into required business and settlement processes, which was useful for the comparison of different IT-options. The timeline of the task was sufficient, and the proposed steps were helpful to guide through the set-up of a registry system.
- Amber Grid decided to train their own staff on the REGATRACE IT-system and use the supporting documents internally. Amber Grid decided to not train national stakeholders on the REGATRACE IT-system since they expected their own productive system to go live within the REGATRACE project lifetime and they did not want to confuse their national market participants.
- The gained insights were used as basis for the development of their IT-procurement documents for which Amber Grid brought a few specific questions to discuss within Task 3.3. The knowledge and practical insights gained from REGATRACE Task 3.3 were of high value to Amber Grid as they were keen on an efficient and quick tendering process without repeating any mistakes other registry operators had done earlier. Amber Grid had a clear idea for a future-proof IT-system and concept and thus put high value on establishing an IT-system which is in line with EU regulations and afterwards adjust for national requirements and not the other way around. During the project, they have learned that implementing national requirements first national and afterwards adapting to EU requirements can be more difficult and time-consuming.
- As a public entity, Amber Grid procured IT-services publicly and awarded the winner of its procurement in July 2022. The development and implementation were requested to be performed until the end of 2022.
- Lithuania, with the project partner Amber Grid, is a highly valuable example and lighthouse for the REGATRACE project. With good external conditions (quicker development of legal framework than other countries), Amber Grid specified, procured, and is close to finally launch its productive registry IT-system within the REGATRACE project lifetime, even with a considerable amount of time before the first biomethane plant is expected to be connected to the Lithuanian natural gas grid.

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3.6 Poland

3.6.1 Task 3.2 developments: Poland

Poland participated in the REGATRACE project represented by the Polish Union of Producers and Employers of Biogas Industry (UPEBI). It is an association established in 2012 for integrating the biogas industry in Poland and acting together for the benefit of the Polish biogas sector. It seeks to improve the conditions of the biogas industry by ensuring that the legislation and other regulations act in benefit of the biogas industry.

When the REGATRACE project began in June 2019, there were no biomethane production plants in Poland, but UPEBI estimated a potential of 3 to 4 MW based on 80 to 110 locations with a total production potential of 600-800 million m^3/year. There were neither any support instruments in place for promoting biomethane and PtG technologies, and also no activities for developing a registry for renewable gases. The transposition of Articles 19 and 30 RED II had not started yet, but the Ministry of Energy and the Ministry of Environment had been designated as the ones responsible for the RED II transposition into national legislation. However, the situation regarding support mechanisms for biomethane changed rapidly with the introduction of a zero-excise tax for CNG, LNG, biomethane, biogas and hydrogen on 14 August 2019. Additionally, the Fund for Low Emissions Transport was introduced, which foresees investment support for alternative fuels infrastructure, natural gas vehicles. It also includes support for local authorities investing in clean public transport, which opens the possibilities for the local use of biomethane.

Even though there were no production of biomethane and no activities for setting up the biomethane registry in Poland, UPEBI had already been active doing the following activities:

- lobbying at all governmental levels and promoting biomethane production and use;
- giving support to the Ministry of Energy for legal issues concerning biogas and biomethane; and
- preparing the ground for setting up a national biomethane registry.

After the project´s start, dena held a phone call with UPEBI on 7 August 2019 to gather more details from the answers to the initial questionnaire (Annex 5.1). During this call, UPEBI informed that the investment for biomethane from agricultural products/waste was considered in the Renewable Energy Act (RE Act) only for power generation. According to UPEBI, this had to change to allow for further investments and a greater governmental support. The RE Act considered a share of 10% of RES in the transport sector by 2020, but this goal was unfortunately not reached (6.58% of RES in the transport sector in 2020). The RE Act also introduced the brown certificates as a support mechanism for investments to upgrade the existing biogas and natural gas infrastructure in Poland. Since these certificates were not successful, an auctions mechanism was proposed but it was not approved by the parliament. Nevertheless, UPEBI considered feasible that the auctions mechanism for biomethane and natural gas could be approved by the new government after the elections in October 2019. In addition, there was interest regarding a new legislation that would consider biomethane production to be used as a fuel for freight transport. This became a reality by the amendment of the Act on Bio-components and Liquid Biofuels.

UPEBI also mentioned that there was big interest from the biogas producers for establishing an electronic registry to trade biomethane certificates with other European countries. The Green Gas Poland Conference from October 2019 served as a platform to start discussing the future of the Polish biogas and biomethane sector. The stakeholders included biogas producers, development banks, industry associations, government representatives, among others. During this conference, an official

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presentation of Poland's participation in the REGATRACE project took place. This served as a very good strategy for reaching the Polish policy makers with regard to the importance that biomethane and renewable gases will have in the future energy supply in Europe and worldwide.

On 27 September 2019 dena sent UPEBI the guideline document for the creation of the CAP (Annex 5.2), but UPEBI decided to wait until the election of the new Government to start working on it. A draft CAP with clear tasks and responsibilities was submitted to dena on 21 November 2019. A tentative date for the implementation of the IT solution was given between January and May 2021, followed by capacity building and public awareness activities scheduled to be held between June and December 2021. For several reasons these deadlines were not held during the development of the project, as it will explained in the following paragraphs.

The election of a new government culminated in November 2019. Therefore, the process of setting up a national biomethane registry only started on January 2020. The Ministry of Energy, together with the Ministry of Environment were UPEBI's partners in this endeavor. In November 2019, UPEBI, together with the National Biofuel Chamber (KIB), started to build the Biomethane Coalition comprising all stakeholders interested in the uptake of the biomethane sector in Poland. The Coalition's first activity was the elaboration of a Biomethane White Book identifying the barriers faced for the development of the biomethane sector and assessing the regulatory and financial instruments for promoting the production and utilization of biomethane.

The newly elected government created the Ministry of Climate by joining responsibilities from the former Ministries of Energy and of Environment. The creation of this new Ministry had a strong support from the new Prime Minister Mateusz Morawiecki. UPEBI started working with the Department of Renewable Energy from the Ministry of Climate and also became an active member of several working groups within it. The Polish Government had (and still has) great interest in new application areas for biogas (the last two having the greatest priority):

1. energy clusters and cooperatives with a special focus on biogas as a key stable supplier of energy;
2. injection of biomethane to the gas grid; and
3. use of biogas and biomethane in the transport sector.

Even though there was still no biomethane production in Poland, the government saw it (and still does) as a key element for the decarbonization of the transport sector and fulfilment of the EU requirements regarding RES shares in this sector (RED II). In this regard, the agri-food sector (especially the poultry industry) is interested in using green gas for transporting its products, thereby reducing its GHG emissions. The energy and fuel industries also planned investments for mobility based on gas and electricity. However, in order to move forward with the interests from the industrial sector, an adequate legal framework must be in place.

In May 2020, the following legal framework for the promotion of biomethane and biogas was present:

1. National Framework for Alternative Fuel Infrastructure Development Policy (2017). This included the definition of alternative fuels (natural gas, CNG, LNG, biomethane and hydrogen) and the requirements concerning the infrastructure location for alternative fuels.
2. Act on Electromobility and Alternative Fuels (2018)
3. Act on Bio-components and Liquid Biofuels (latest amendment on 19 July 2019). It introduced biomethane as a new biofuel for fulfilling the national indicative target (NIT), which is defined as the annual minimum percentages of biofuels and other renewable fuels in the total amount

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of liquid fuels. The NIT levels are determined every three years for a period of 6 years by the Council of Ministers.

On 8 May 2020 UPEBI informed dena that the Coronavirus pandemic had a negative impact on the biogas sector. The biogas production plants suffered from the shortage of substrates because the processing plants stopped working and faced logistics problems. Additionally, there was a decrease in the sales from biogas plants because their regular gas customers stopped working or reduced their workload. There was also a fall in the energy prices due to the reduction in the energy demand, so several biogas production plants closed as a result of the pandemic.

Despite the pandemic's negative impact, UPEBI managed to move forward with some of the activities from the CAP: Activity 1 "Analysis of the state of the art" and Activity 2 "Stakeholder identification for the development of the biomethane registry. The latter was part of the Biomethane White Book. Activity 3 "Defining the purpose of the registry" was postponed due to the coronavirus pandemic.

The Biomethane White Book was published in July 2020 and served as roadmap for the biomethane sector by identifying the barriers and assessing the regulatory and financial instruments for its development. UPEBI organized a webinar within the framework of the Biomethane Coalition on 25 July 2020, which gathered stakeholders from the public sector, industry, and scientific institutions. According to UPEBI, the representatives from the public sector showed great interest in the subject, which was a positive sign for the creation of the legal framework needed for the promotion of biomethane.

Regarding the CAP, UPEBI informed on 30 November 2020 that the Activity 3 "Defining the purpose of the registry" had been finalized. The final decision was that the Polish biomethane registry will solely be for compliance with Article 19 RED II. Activity 4 "Creation of commitment from the government and/or the industry to develop a biomethane registry" had already been finalized. With regard to the latter, UPEBI organized workshops and bilateral discussions with industry representatives (including biogas producers and potential biomethane producers) and governmental institutions, such as the Electricity Market Operator (TGE), National Agricultural Support Center (KOWR), and the Energy Regulatory Office (URE).

In October 2020 UPEBI and the Ministry of Climate signed the "Letter of Intent to establish a partnership for the development of the biogas and biomethane sector and the conclusion of a sectoral agreement". The letter was also signed by PGNiG, ORLEN, PSG, and GAZ-System. It declared the readiness to undertake joint actions for establishing and implementing the "Agreement on cooperation for the development of the biogas and biomethane sector". As a result of this letter, seven working groups were established by the ministry for preparing the input of a long-term strategy for the development of the biomethane sector. The stakeholders included Polish, Lithuanian and Italian companies. They worked on the following topics (one per working group), where UPEBI coordinates WG6 and participates in WG2:

1. local distribution networks for biogas;
2. bioLNG and bioCNG and injection of biomethane into the national gas distribution network;
3. supply chain and local content;
4. bio-waste and use of digestates as fertilizers;
5. identification of barriers to the development of the biogas and biomethane market and proposals for their removal;
6. support and promotion mechanisms, including personnel development and education system; and

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7. emissions trading system.

The results from these working groups were delivered to the Ministry of Climate in July 2021 and were used for the identification of barriers hindering the development of the biomethane sector. The results were also used as background information for the amendment of the RES Act.

By November 2020, the Ministry of Climate was already working on the development of regulations enabling the production and sale of biomethane, as well as the introduction of support mechanisms to ensure a stable demand and funding for approximately 1 billion m^3 of biomethane per year. Changes were planned to the following regulations:

- Energy Law
- Act on Bio-components and Liquid Biofuels
- Act on Electromobility and Alternative Fuels
- RES Act

The planned changes to the Energy Law were the following:

- Change in the definition of gaseous fuel.
- Introduction of quality parameters for biomethane (change of gas system regulation).
- Distribution tariffs: enabling inclusion in justified costs of the functioning of the gas system operator (and inclusion in the tariff).
- Process of issuing connection conditions

Likewise, the changes being considered for the Act on Bio-components and Liquid Biofuels were the following:

- Include possible uses of biomethane in the transport sector based on the current implemented program for supporting the use of natural gas in this sector.
- Usage of substrates unsuitable for the food industry to produce biogas. These comprise stillage (21%), residues from fruit and vegetable processing (21%) and slurry (27%). Using these substrates on a mass scale for biogas production could help achieve the national indicative target without the need to import substrates from abroad.
- Proposal of a gradual increase of the national indicative target (NIT), while maintaining the goals set for 2021 and 2022 at 8.7% and 8.8%, respectively. This should help enable the gradual development of markets for second generation biofuels and electricity used in the transport sector. Furthermore, defining specific goals until 2030 will allow for the planning of investments needed to ensure the achievement of the NIT.

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Year	Planned NIT (%)
2021	8,70
2022	8,80
2023	9,00
2024	9,50
2025	10,00
2026	10,50
2027	11,50
2028	12,50
2029	13,50
2030	14,80

- Determination of the minimum share of advanced biofuels in the implementation of NIT in 2030, including biomethane for the production of hydrocarbon fuels. The draft document specified a share of at least 3.5% of advanced biofuels of the total amount of liquid fuels used in the road and rail transport. In this regard, a minimum share of biomethane for the aforementioned target is set at 1.75%.

The proposed approach for the Act on Bio-components and Liquid Biofuels aims to indicate the directions necessary for attracting investments and ensuring a stable biomethane demand in order to achieve the NITs and the national emissions reduction targets. In addition to the measures proposed in it, the use of other low-emission energy carriers, including renewable electricity, recycled carbon fuels and renewable fuels of non-biological origin (RFNBOs) will be considered for achieving the NITs. The discussion of this Act also includes the rules necessary for certifying PoS broken down for agricultural and forest biomass, as well as ensuring the application of PoS and the GHG emissions reduction in relation to bioliquids and biomass fuels for the transport sector and for complying with the RED II provisions. The proposed changes should contribute as well to the provisions included in the Act on Electromobility and Alternative Fuels, which require gas TSOs to provide CNG and LNG refueling points along the Trans-European Transport Network (there are currently 28 CNG and 4 LNG refueling stations in Poland).

Similarly, the most important change of the Act on Electromobility and Alternative Fuels related to biomethane is imposing local governments the obligation to provide a certain number of zero-emission buses for the public transport fleet (municipalities with a population of less than 50,000 inhabitants are excluded from this obligation). Buses powered by biomethane will be considered without emissions (just like electric buses) and will be counted towards the implementation of this obligation. It is worth noting that, at the end of 2020, there were 10,725 CNG/LNG-powered vehicles operating in Poland out of which 800 buses were powered with CNG. The proposed required share of zero-emission buses for public transport is as follows:

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- 5% from 1 January 2021
- 10%, from 1 January 2023
- 20%, as of 1 January 2025
- 30% from 1 January 2028

Finally, the planned changes to the RES Act included the following:

- **Introduce a guarantee of origin for biomethane and extend the scope of the subject "register of guarantees of origin" to include data on GOs for biomethane.**
- **Introduction of a definition for biomethane and consider it as a gaseous fuel.**
- Exclusion of the definition of "agricultural biogas" from the definition of "biogas".
- Definition of the rules for conducting business activities in the scope of biomethane production: for biomethane produced from agricultural biogas, the responsible registration authority would be KOWR, while URE would be for biomethane produced from biogas.
- Extend the field of activity of energy cooperatives with the possibility of producing biomethane.

As it can be concluded, the revision of the RES Act is essential for legitimizing the existence of the national registry for biomethane GOs in Poland. It will also contribute to the development of the goals indicated in the several country's strategic documents, such as the Strategy for Responsible Development, the National Renewable Energy Action Plan and Poland's energy policy until 2040. The proposed changes to this act are expected to encourage investors to make decisions regarding the construction of installations for the production and purification of biogas or agricultural gas, the production of biomethane, and the expansion or reconstruction of the existing gas networks for enabling biomethane production.

On 10 February 2021, UPEBI held a phone call with dena in which UPEBI informed that the discussion regarding the relation between GOs and PoS had not started yet in Poland. This topic would be addressed by the seven working groups established in October 2020. Despite the fact that it was decided that the Polish biomethane registry would solely be for compliance with Article 19 RED II, the Ministry of Climate would like to leave the option open of including sustainability criteria in the biomethane registry, especially in view of the latest developments of the revision of the CEN Standard EN16325. As a conclusion of the phone call, dena sent the Criteria Catalogue from its Biogasregister (link) to UPEBI. This catalogue summarizes the legal framework conditions for the promotion of biomethane in Germany and currently comprises 50 criteria for the German market that cover all evidence for all legal utilization routes. By documenting a biogas/biomethane volume on the basis of criteria, it remains open for the end user in which form this gas volume will be ultimately used, i.e., for the benefits of the EEG market, the heat market or for emissions trading.

The exchange of information between UPEBI and dena continued throughout the project lifespan. On 1 March 2021 UPEBI contacted dena to enquire detailed information about several topics that included the support mechanisms available in Germany for the production and use of biomethane, the relationship between GOs and PoS, and the possible linkage between GOs and ETS. Dena provided an extensive answer to the list of questions sent by UPEBI, highlighting the experience from the German biomethane market.

By June 2021, the Ministry of Climate had decided that GOs would be issued by the President of the Energy Regulatory Office. UPEBI had also been cooperating very closely with TGE, which is the present operator of the national registry for electricity and CHP GOs, and it would most likely also operate the biomethane GO registry. Additionally, UPEBI had also been in contact with URE and KOWR as potential

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national issuing bodies for biomethane GOs. In this regard, KOWR would issue GOs for the production coming from agricultural biogas plants, while URE for the rest of the biogas and biomethane production in Poland. UPEBI also informed dena that they had been doing trainings together with TGE for using the pilot IT system delivered by AGCS within the framework of Task 3.3 from REGATRACE. Regarding the CAP for setting up the biomethane registry, there was an adjustment in the dates due to the impact of the coronavirus pandemic. Activity 5 "Cost calculation and financing of the registry: analysis of different options" was initially planned from April to June 2020 but had been rescheduled from February to June 2021. Nevertheless, no work had started yet in June 2021. In the same way, Activity 6 "Development of a concept and basic principles for setting up the registry based on the present situation and future production technologies for renewable gases" was initially scheduled from September to October 2020 but had to be shifted to start in February 2021 with an estimated finish date in June 2021. However, this activity was still under discussion with the responsible bodies in June 2021.

In October 2021 there was little progress regarding the setup of the biomethane registry: Activities 5 and 6 were still under development. It was also decided that UPEBI would not implement Activity 5, as this could be better performed by TGE based on its experience as operator of the national registry for electricity and CHP GOs. Similarly, TGE would take the lead in Activity 6 and UPEBI would offer support by working together with the relevant stakeholders on the content of biomethane GOs and sharing the knowledge produced within REGATRACE.

The changes to the RES Act were still under discussion by the Government with the aim of having them ready by the second quarter of 2022. UPEBI improved even more its relationship with URE and TGE and reported that it had been invited by both to give them several presentations on different GO concepts in October and November 2021. The good news came when the Biogas and Biomethane Sector Deal was signed on November 23, 2021. Its key points are summarized below:

- Current domestic consumption of natural gas is over 18 billion m^3 and its domestic extraction covers only approximately 22% of the demand.
- The potential for biogas and biomethane production in Poland using domestic raw materials is relatively high. Agriculture and the agri-food industry have a very high substrate potential in the form of biomass, agricultural by-products and waste.
- Estimates of Polish research institutions: 120-150 million tons of useful waste can be used for the production of 13-15 billion m^3 of biogas per year, yielding to an annual production of almost 8 billion m^3 of biomethane.
- An increase in the volume of the biodegradable fraction of municipal waste collected separately is expected in the coming years. The production potential has not been determined yet.
- The specific characteristics of the operation of biogas installations may become a key element in the balancing of electricity and gas grids, particularly for the increasing role of solar PV and wind power plants.
- Current installed capacity of biogas production plants: ca. 256 MW (Energy Regulatory Office, 2020) of which approximately 120 MW is attributable to agricultural biogas installations.
- The parties recognized the importance of the biogas and biomethane industries for increasing the country's energy security and reducing the dependence on imported energy sources by using locally available biomass to be used as feedstock in biogas and biomethane plants.
- Increasing the use of agricultural biogas for biomethane production using agricultural biomass (including liquid and solid livestock excrements and waste from agri-food processing) will contribute to the diversification of the farmers' income by using previously unmanaged residues

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with energy potential, while increasing competitiveness and strengthening the basic function of domestic agriculture, i.e., food production.

- The development of biogas plants and biomethane plants can also bring tangible benefits for reducing the costs of public utilities management in municipalities through the management of selectively collected biodegradable waste.
- The Parties expressed their willingness to cooperate for the development of the biogas and biomethane sector in Poland, to support the maximization of local content and promote the export of goods and services of enterprises from the local supply chain on foreign markets.
- The Parties agreed on the following list of key areas for the development of the biogas and biomethane sectors:
  1. Development of local biogas and biomethane distribution networks
  2. Biogas and biomethane management methods
  3. Supply chain and local content
  4. Management of biomass from agriculture and agri-food processing and the use of post-fermentation substance for fertilizing.
  5. Regulatory environment
  6. Support and promotion mechanisms, development of the staff and the education system
  7. Avoided emissions allowance trading
- The Parties will establish a Coordination Board for the development of the biogas and biomethane sector. This Board will be responsible for (1) monitoring the implementation of the Parties' abovementioned agreements; (2) appointment of working groups to ensure the Parties' cooperation in key areas; (3) monitoring the level of local content attained by investors and entities participating in the supply chain for the biogas and biomethane sector; and (4) preparing annual reports on the implementation of the Sector Deal.
- The Coordination Board shall be composed of at least 21 members appointed by the minister responsible for climate from among candidates proposed by the Parties. Meetings of the Coordination Board shall be held as needed, but at least every six months.

On 21 February 2022 UPEBI informed dena that the revision of the RES Act was still in process and so was the discussion onhow to implement the issuing bodies for biogas and biomethane GOs in Poland (shared responsibility between URE and KOWR). There was also no progress in Activities 5 and 6 from the CAP for setting up the biomethane GO registry. After the third REGATRACE Workshop on January 28, 2022, UPEBI established new contacts with the Polish Ministry of Climate, who expressed big interest in the cross-border transport of biomethane in Europe. Despite the lack of progress in the setup of the Polish biomethane registry, UPEBI remained in constant communication with TGE as the potential future biomethane registry operator. TGE had a positive impression of the Lithuanian biomethane registry (operated by Amber Grid) and would most probably follow a similar path. This shows that the knowledge generated, and experiences shared within REGATRACE were useful for the target countries and could be replicated with other countries once the project comes to an end.

By June 2022, the RES Act and the Act on Bio-components and Liquid Biofuels were still under revision, so there was little progress in the implementation of the CAP for setting up the registry for biomethane GOs, as well as on the decision on how to determine which institution will be designated as issuing body. In September 2022 there was little progress in the approval of the required legislation. However, the seven working groups established in October 2020 continued working together with the Ministry of Climate and an additional one was established for covering the topic on financing of biogas and biomethane projects. The second input of these working groups is expected in October 2022 and will be used for the further development of legislation and the National Biomethane Strategy.

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As it can be inferred from the information previously presented explaining the situation of the Polish biomethane sector, the implementation of the CAP for setting up the registry for biomethane GOs and the update of the current legislation for renewable gases and RES, there is interest from the Polish Government and a great interest from the industrial sector to develop the biomethane market in Poland. Nevertheless, the negative effects of the coronavirus pandemic and the slow approval of the several laws related to renewable gases hindered the creation of the electronic registry for biomethane GOs during the lifespan of the REGATRACE project. Despite this situation, there is good momentum in Poland, which can be summarized schematically in figure 11.

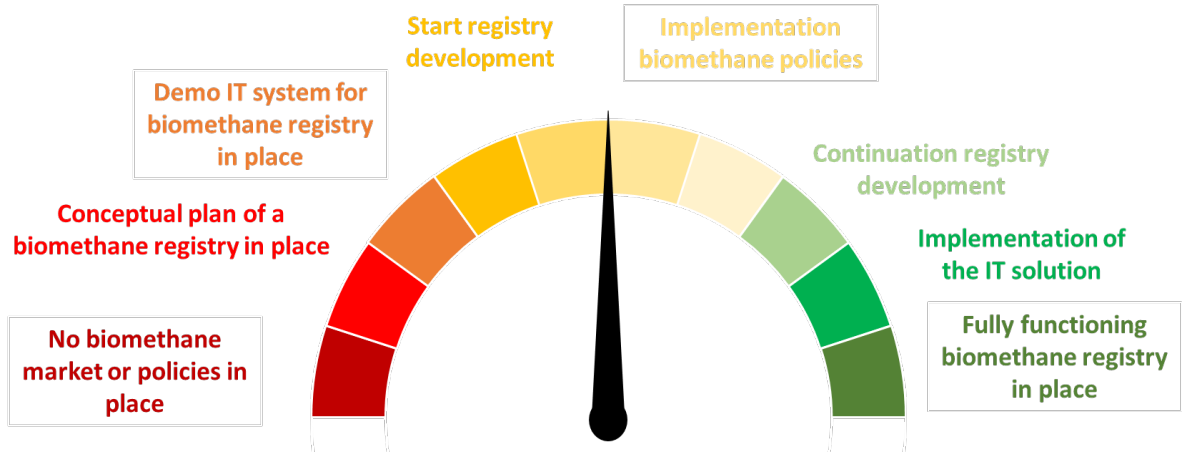

Fig. 11 Progress in setting up the Polish registry for biomethane GOs.

3.6.2 Country highlights: Poland

- Poland entered the REGATRACE project without any biomethane activities. However, UPEBI and its members showed high interest in developing their national market and connecting it to a European market as soon as possible. Although it was clear that UPEBI would not become operator of a registry system, UPEBI was always the proactive leader in bringing together the relevant stakeholders and educating them on required steps for market development.
- UPEBI representatives were very eager and motivated to study the necessary functions and framework of a registry and get trained on business and settlement processes. The intense testing of the REGATRACE system enabled them to perform demonstration activities and trainings of their national stakeholders. UPEBI also strongly engaged with all relevant stakeholders such as URE, TGE and KOWR.
- Most likely there will be two issuing bodies for biomethane GOs in Poland: (1) KOWR for biomethane produced from agricultural biogas and (2) URE for biomethane produced from biogas
- TGE operates the current registry for electricity and CHP GOs. It will most likely operate the biomethane GO registry as well based on the issuance information from URE and KOWR. TGE participated in all REGATRACE project workshops hosted by UPEBI.
- This system of collaboration between URE, KOWR and TGE for renewable gas certificates has been indicated by the government. Next steps will comprise defining a holistic certificate system for biomethane, which also includes the link from the energy sector to the biofuels sector.
- The contact with KOWR, the National Agricultural Support Center, responsible for the national biofuel quota, has also been initiated already.
- Despite not establishing a productive registry system during the project lifetime, UPEBI registered actual Polish market participants as system users in the REGATRACE pilot IT-system and performed test transactions together with them.
- The task goal of limiting the administrative burden to specify their national IT-system and to gain understanding for business and settlement processes was clearly achieved by UPEBI.

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3.7 Romania

3.7.1 Task 3.2 developments: Romania

Romania participated as a target country since REGATRACE started in June 2019. The partner organization in the project was the Romanian Association of Biomass and Biogas (ARBIO), which showed great interest in the project and in the development of the Romanian biomethane sector. However, for reasons external to the project, Romania was not able to continue as a target country since September 2021. Its place was taken by the Czech Republic represented by the Czech Biogas Association. Nonetheless, ARBIO provided dena with very valuable information from the Romanian biogas sector and its potential for the production of biomethane in the future. This information is summarized in the following paragraphs.

Back in June 2021, ARBIO reported (through the questionnaire from Annex 5.1) that Romania had 12 operational biogas plants with a total installed production capacity of approximately 21.5 million Nm^3. Most of the biogas is burned for power generation due to the lack of an adequate national legislation promoting the production of biomethane and then injecting it into the gas grid. There was also a lack of support for biogas itself to be considered a renewable energy source for electricity generation. According to ARBIO, there is a minimum production potential of 350 million Nm^3 of biomethane per year based on the unexploited sources of biomass in Romania. There was only one regulatory instrument for the promotion of the biomethane market at the national level, which is the Law 123/2008 of Electricity and Natural Gas. It simply mentions that the new registered capacities for gas production, including biomethane, do not need a setup authorization prior to the implementation phase. In addition, during the time that Romania was a target country, there were no active financial instruments for promoting and supporting the production of biomethane and PtG technologies. There were either no activities for developing an electronic registry for biomethane and renewable gas certificates. The National Energy Regulatory Authority (ANRE) as the regulatory body for energy issues had not yet received any mandate for developing a registry for biomethane certificates. The governmental institutions responsible for the transposition of Articles 19 and 30 RED II into national legislation are the Ministry of Energy and ANRE but had not started any activities yet for this purpose. In this sense, ARBIO approached both institutions based on the high potential Romania has for biomethane production from domestic substrates. The members of ARBIO requested the existence of an adequate legislation recognizing the opportunities for the sector development, as well as the designation of authorities capable of understanding the importance of the implementation of RED II on the energy future of Romania and Europe.

On 26 September 2019, dena sent to ARBIO and all country partners involved in Task 3.2 the guideline document for the creation of the CAP (Annex 5.2). There were several attempts to create a CAP for Romania, but neither was successful due to the lack of a legal framework supporting the biomethane sector and the slow progress in the Parliament for voting the “Law for the establishment of the system for the production of electricity and/or heat using biomass processing technologies, biogas, biomethane, bioliquids, waste fermentation gas and sludge fermentation gas and other types of bioenergy” (further called “Bioenergy Law”). This law was modified between October 2019 and March 2020 to match the current market and economic conditions. It proposes the use of waste for productive applications (e.g., energy generation) instead of transporting it to a landfill. It also includes the following proposals:

- Investment support for building new biomethane plants.
- Legal framework for heat and power generation through CHP plants.

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- Legal framework for injecting biomethane into the gas grid.
- Legal framework for selling electricity generated from biomethane, which would be placed in the electricity market through PPAs.

The Law was passed by the Energy Committee from the Romanian Parliament, but the Environmental Committee raised significant doubts and rejected it. For this reason, the Bioenergy Law could not be approved before the elections from 6 December 2020. Thus, ARBIO had to wait for the new government and the new parliamentary Environmental Committee to be formed after the elections to restart its support.

ARBIO informed that the coronavirus pandemic did not have a direct impact on the biogas sector because it is too small, and all its production is absorbed by the local energy market. Nonetheless, ARBIO had to stop its activities and so did the Romanian Parliament, leading to an increased delay in the approval of the Bioenergy Law.

By February 2021, the federal budget was still being discussed in the parliament, so no commitment from the government could be expected for supporting the biomethane sector and setting up a registry for biomethane certificates. ARBIO also informed dena that Romania was currently facing penalties from the EU Commission for not complying with waste disposal regulations. Seven trials were going on and the final decision could include the payment of penalties by the Romanian government. On the positive side, the new Environmental Committee showed greater eagerness to approve the draft Bioenergy Law, which would also bring benefits to the waste disposal sector, as it would give an economic value to waste. Nevertheless, ARBIO also informed that the current financial situation in Romania could shift the governmental support to areas with a higher priority for budget distribution. In fact, three of the top ten Romanian state companies with high debts were related with district heating (RADED Bucuresti, RADET Constanta and Apaterm).

On 25 March 2021, ARBIO contacted dena with a series of questions regarding the procedure for injecting biomethane into the grid, successful examples of biomethane sector development and its impact on local society, EU support programs for biomethane as well as subvention schemes for biomethane in other countries. Dena provided the answer to all these questions based on its experience, but also with the help from the European Biogas Association for the examples related to the development of the biomethane sector and its positive impact on local communities.

Romania (represented by ARBIO) continued to be a target country in the REGATRACE project until September 2021. Nonetheless, dena remained in contact with ARBIO until the end of its participation in the project. By June 2021, the political parties and their members in the Parliamentary Committees had reached consensus regarding the Bioenergy Law, meaning that they supported its publication. However, the approval process continued in the Parliament. According to ARBIO, once voted and approved, the Bioenergy Law will bring the necessary clarity and legal framework to the biomethane sector. It will help make the projects bankable, which is a crucial parameter for the sector's success. In addition, once approved, ANRE would need to promptly finish drafting the rules that would allow biomethane to be injected into the gas grid. ARBIO continued supporting the development of the biomethane sector by proposing that bioenergy plants could receive an attractive fee for every ton of biodegradable waste they handle. This proposal would be cheaper than the present cost of sending the waste to landfills. ARBIO also continued convincing companies and investors to enter the biogas and biomethane sector in Romania, especially with the opportunities opened by RED II and REGATRACE. Finally, Romania's proposal to the European Commission regarding the National Plan for Recovery and Resilience clearly confirms the future grants of support for investments in the biomethane sector. This shows that Romania is taking the right direction by supporting bioenergy, but

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more political agility and better finances are needed in order to further develop the biomethane sector.

3.7.2 Country highlights: Romania

- Romania entered the REGATRACE project without any biomethane activities. However, ARBIO showed high interest in developing their national market and explained the high potential of biomethane production from the agricultural sector. It also highlighted its importance for creating value and new jobs in the country.
- Exporting biomethane to other European countries could be highly interesting for Romania since the production costs might be lower than in other countries.
- Regular contact was held between Task 3.3 leader AGCS and ARBIO until summer 2020. Although ARBIO had to leave the project at an earlier stage and the collaboration could not be finalized, the IT-system and its upgrades as well as the supporting documents were delivered to ARBIO for their information.

3.8 Slovakia

3.8.1 Task 3.2 developments: Slovakia

The Slovak Republic joined the REGATRACE project as a target country in January 2021 represented by the SPP Distribúcia, who is the largest gas DSO in Slovakia. It manages and operates more than 33,000 km of gas network and successfully fulfills the tasks of the Slovak National Gas Dispatch and the Gas Market Operator. It covers 94% of the population and its gas distribution network is the second densest in the EU. SPP Distribúcia is partially owned by the Slovak Government (51%) and by private investors (49%). At the time Slovakia joined the project, there were no biomethane production plants in the country. However, the Slovak Biogas Association estimated a production potential of approximately 178 million m^3 per year plus additional 13 to 35 million m^3 per year in case the full potential of biodegradable waste is used.

The support for biomethane production in Slovakia is made by redemption prices of electricity from cogeneration. If the investment support for the construction, reconstruction or modernization of the biomethane production facility came from EU funds, then the redemption price should be reduced according to the Act No. 209/2009. This Act sets out the details for the promotion of RES, high-efficiency cogeneration and biomethane production. According to the Decree No. 18/2017, the price of electricity produced from biomethane is 95.95 €/MWh. For comparison, the price of electricity from biogas combustion ranges from 90.02 to 102.00 €/MWh, depending on the installed capacity of the biogas plant.

SPP Distribúcia was officially appointed as the entity responsible for setting up and operating the biomethane registry in Slovakia, as stated in the Act No. 309/2009. It was also appointed as the issuing body for gas GOs by the Ministry of Economy. The main purpose of the registry will be for complying with Article 19 RED II. In this regard, the Ministry of Economy, the Ministry of Environment and the Slovak Hydrometeorological Institute are the governmental institutions responsible for complying with the provisions from RED II. At the time Slovakia joined REGATRACE, the respective legislation in Slovakia had already transposed Article 19 RED II, clearly recognizing SPP Distribúcia as the issuing body for GOs of renewable gases. Regarding the transposition of Article 30 RED II, the Slovak Hydrometeorological Institute was preparing a registry for biofuels that would cover the mass balance system.

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dena held a phone call with SPP Distribúcia on 2 February 2021 to gain more detailed information from the answers provided to the initial questionnaire (Annex 5.1) that dena sent to SPP Distribúcia on 20 January 2021. In this regard, the first biomethane production plant will have an estimate capacity of 300 m^3/h and will sell part of its production for transport applications as bio-LNG. The mass balance system being prepared by the Slovak Hydrometeorological Institute will be based on the Austrian biofuels registry. In addition, the biomethane GO registry will not cover GOs for hydrogen and PtG products. As a conclusion to the phone call, dena sent SPP Distribúcia information about the functioning of the German Biogasregister, as well as the requirements that its users must fulfill. This information helped SPP Distribúcia gain a better understanding on how a biomethane registry should work based on dena's experience operating the Biogasregister. Finally, dena sent SPP Distribúcia the guideline document (Annex 5.2) for creating its country action plan on 25 January 2021. SPP Distribúcia delivered the CAP for setting up the Slovak biomethane registry on 10 February 2021, which included a finalization date in March 2022 but for a delay in the tendering process it was not possible to finish on the date initially planned.

Dena's support to SPP Distribúcia in setting up the Slovak registry continued throughout the project. There were several information exchanges in March 2021 regarding the audit process for biomethane production plants. The main concern was that the Slovak National Accreditation Service does not provide accreditation for the ISO Standard 20675: 2018 "Biogas production, conditioning, upgrading and utilization – Terms, definitions and classification scheme" and its implementation would take a long time. SPP Distribúcia made use of the results from REGATRACE Deliverable 3.1 in which it is mentioned that several organizations in Germany are able to do the inspection of the biomethane plants. In this regard, dena explained the two types of audits needed in the Biogasregister: (1) initial plant audit and (2) production batch audit. Dena also provided the list of auditors accepted by the Biogasregister and explained that they are certified by one or more certification schemes (Greencert, TÜV Süd and TÜV Nord). In addition, dena explained the three level of auditors recognized in Germany: (1) auditor, (2) environmental auditor (*Umweltgutachter*) and (3) environmental auditor with sustainability accreditation (*Umweltgutachter mit Nachhaltigkeitsverordnung*). "Auditor" is the most basic one and can check most of the criteria related to the plant's operation. For biomass related criteria, auditors must be registered and approved by the German Accreditation and Licensing Body for Environmental Auditors (DAU) to have an accreditation as "environmental auditors" (*Umweltgutachter*). As for sustainability criteria, an additional registration with the German Federal Office for Agriculture and Food (BLE) is necessary. BLE is responsible in Germany for rules of biofuel quotes. This leads to the third category: auditor with sustainability accreditation (Umweltgutachter mit Nachhaltigkeitsverordnung). In January 2022, SPP Distribúcia contacted dena and ERGaR regarding the registration fees for their registries per user type (e.g., biomethane producer, trader, buyer, etc.), the average number of transactions per year and the fees per transaction. dena and the ERGaR members with active registries (AGCS, Energinet, GRDF, REAL Vertogas and VSG) provided the respective answers, which were very for SPP Distribúcia in moving forward with the design and setup of the Slovak biomethane registry.

SPP Distribúcia worked rapidly on the implementation of the CAP for setting up the registry. By June 2021 the following activities were already finished:

1. Stakeholder analysis.
2. Definition of the registry's purpose.
3. Identification and selection of the best IT solution from a technical and financial perspective.

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4. Gap analysis of the legal and regulatory framework.
5. Identification and definition of the information needed for the verification of biomethane and renewable gases production.
6. Cost calculation and financing of the registry.

A delay during the tendering process made it impossible to choose a service provider for the IT solution in June 2021, but SPP Distribúcia continued pushing the works for having an operating registry as soon as possible.

By 20 December 2021, there were good news regarding the setup of the Slovak biomethane registry. SPP Distribúcia had signed the contract with the selected IT provider on 17 December 2021. A kick-off meeting was held on 12 January 2022. The registry license includes a future integration with the ERGaR CoO Scheme (link). In addition, SPP Disitribúcia also informed that the first biomethane plant in Slovakia (located in the city of Jelšava) had officially started supplying biomethane to the gas grid on 26 November 2021. In fact, by the end of November 2021, the Slovak gas grid had been supplied with 76 MWh of biomethane. Furthermore, the transposition process of RED II into national legislation continued by means of Act No. 309/2009 on the Promotion of RES and High Efficiency Cogeneration. The comment procedure phase among ministries and associations started on 11 November 2021 and it was approved by the Slovak Government on 26 May 2022 and then passed on to the Parliament for reading and voting. The expected date of entering into force was 1 October 2022 but it was postponed to 1 November 2022 because the first reading in the parliament happened until 15 June 2022 (the first reading was expected to take place in May 2022). The cause for this deferral was a shift in priorities due to the conflict in Ukraine. With relation to the support mechanisms for biomethane, the Slovak Ministry of Economy announced in February 2022 an approved state aid scheme as part of the Slovak Recovery and Resilience Plan regarding support for electricity production from renewable energy sources. The Ministry also published an indicative list of calls, including two for modernization of existing biogas plants.

1. First call: 20 million EUR from August 3 to October 30, 2022. The half of the funds will be allocated to biomethane upgrade and the other half to repowering of biogas production units.
2. Second call: 26.14 million EUR from April to May 2023, with focus on biomethane upgrade.

As it can be seen, there was always good political will in transposing RED II into national legislation that eventually had a positive impact on the biomethane sector and on the setup of the registry in Slovakia.

SPP Distribúcia continued working on the setup of the registry, but also participated in several events for its promotion. Together with the Slovak Biogas Association, it organized a workshop on 20 April 2022 about the current biomethane support mechanisms in Slovakia. Information about oncoming EU subsidies and support instruments of SPP Distribúcia for connecting biomethane plants to the gas grid was shared among the participants. In this regard, SPP Distribúcia offers a free pre-feasibility study to biomethane plants wishing to connect to the gas grid. The company also covers 75% of connection-related costs topped to 250,000 EUR. It had already prepared studies for more than 40 biogas plants in the previous 12 months. Afterwards, on 22 April 2022, SPP Distribúcia organized a demonstration session of the biomethane registry for the Ministry of Economy, the Ministry of Economy, the Short-term electricity Market Operator (OKTE) and Slovak Hydrometeorological Institute. It also participated in the conference “Security, Reliability and Operation of Gas Systems” held in Prague on 7-8 June 2022

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and in the conference "Operational reliability and safety of important pipeline systems in Slovakia" held on 16-17 June 2022 in Žilina, Slovakia. In both events SPP Distribúcia participated with the topic "Register of renewable gases in Slovakia and possibilities of GO use" for raising awareness among the sector's stakeholders of the importance the biomethane registry will have for the Slovakian energy industry.

SPP Distribúcia moved very fast in the creation and implementation of the CAP for setting up the biomethane registry. In fact, in June 2022, SPP Distribúcia informed dena that it will be legally authorized to issue biomethane GOs as from October 1, 2022. Nevertheless, this was postponed to 1 December 2022 (registry's legal/official go-live) due to the fact that the approval of the RES Act was also postponed to this date. As it can be inferred, the registry's official operation depends on the official publication of the RES Act, but it will most likely go live before the end of 2022.

Despite the postponement in the registry's go-live, the fast development in Slovakia was largely in part due to the good political will from the Slovak Government in transposing RED II into national legislation and the quick recognition of the high value biomethane will have in the energy, industrial and transport sectors in Slovakia and in Europe.

A graphical representation of the combination of the elements that made possible this success is summarized in figure 12.

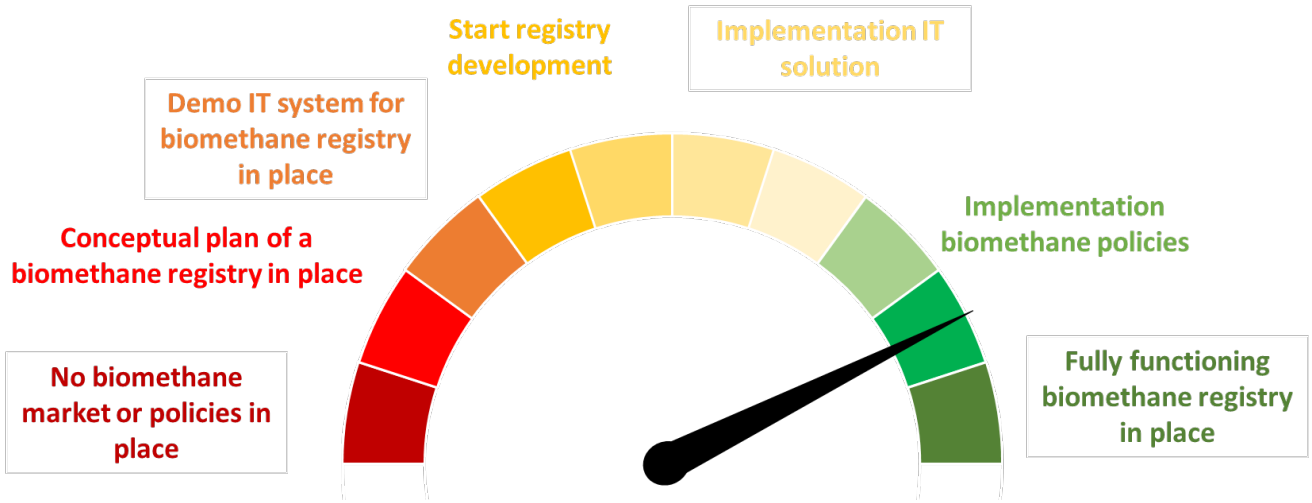

Fig. 12 Progress in setting up the Slovak registry for biomethane GOs.

3.8.2 Country highlights: Slovakia

- Slovakia joined the REGATRACE project after its official start in June 2019. Nevertheless, SPP Distribúcia performed all tasks of the work plan at a fast pace and in a short time since it had been preparing to become operator of the national registry and has received a mandate to become the issuing body for biomethane GOs. AGCS and smart tech established a dedicated REGATRACE IT-system for SPP Distribúcia and enabled a demonstration and testing phase of the REGATRACE system. SPP Distribúcia gained deep insights into required business and settlement processes, which were useful for the comparison of different IT-options.
- The good external conditions and the favorable and fast legal framework development allowed SPP Distribúcia to work on the establishment of their national registry within the REGATRACE project lifetime. As a public entity, SPP Distribúcia is obliged to procure IT-services publicly and could award the winner of its procurement process on 17 December 2021. The knowledge and

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practical insights gained from REGATRACE Task 3.3 were used to prepare tender documents and enabled an informed decision on the winner of the procurement.

- The first biomethane plant (located in the city of Jelšava) started supplying biomethane to the gas grid on 26 November 2021.
- SPP-D will most likely go live with their productive registry IT-system before the end of 2022.
- Slovakia, with SPP Distribúcia as project partner, was a highly valuable example and lighthouse for the REGATRACE project and its achievements could be used as best-practice examples for other countries.

3.9 Spain

3.9.1 Task 3.2 developments: Spain

Spain was a target country since the official start of REGATRACE and, as such, benefited from the full support of the project. Spain has a great potential for biomethane production, and the private sector is willing to develop this industry. Nedgia was the project partner, which is also the leader gas DSO in Spain responsible for the development, operation and maintenance of the more than 52,400 km of gas network connected to more than 5.4 million supply points in 1,200 municipalities. Nedgia's infrastructure contributes to the supply of 70% of gas consumers in Spain and is present in 11 of the 17 autonomous communities.

At the beginning of the project, Spain only had one operational biomethane plant in Vlademingómez, located within the Madrid municipality. Back in June 2019, Spain had a yearly production of 90 GWh of biomethane that was being injected into the natural gas grid. The potential for growth, as reported by Nedgia, was substantial nearly totaling 200 TWh per year. This potential stems from organic waste (34 TWh/y), biomass (120 TWh/y) and PtG (45 TWh/y).

When REGATRACE started, there were no regulatory or financial instruments for the promotion of biomethane production in Spain. There was also no official mandate from the federal government for developing a registry for biomethane GOs. In this regard, Nedgia took the lead and proposed to the Ministry for Ecological Transition a voluntary scheme for developing an electronic registry. The proposal would serve as an initial step towards a full registry for renewable gas GOs in the future. In this sense, Nedgia also considered the REGATRACE project as a key element for pushing forward the development of the biomethane sector inSpain, together with the corresponding legal framework and the subsequent creation of an electronic registry for biomethane GOs.

The efforts for transposing Articles 19 and 30 RED II into national legislation started with the proposal of the Law for Climate Change and Energy Transition in November 2018. The Ministry for Ecological Transition is the designated governmental institution for this transposition. As the leading Spanish DSO, Nedgia is committed to the decisive contribution of biomethane to achieve the most efficient decarbonisation of the Spanish economy and is willing to use its existing natural gas network for this endeavor. To that end, Nedgia strongly supports the use of biomethane as a sustainable and competitive affordable option for establishing a decarbonized energy system and fighting climate change.

Dena held several phone calls with Nedgia for better understanding the situation of the biomethane sector in Spain. The first one was held on 13 August 2019 to gain more insight to the answers provided by Nedgia to the initial questionnaire prepared by dena (Annex 5.1). During this call, Nedgia informed that there was still no domestic market for biomethane GOs in Spain due to the sector's slow development. It also made clear that, without the approval of the Energy Transition Law, it was nearly

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impossible to work on the creation of a national registry for biomethane GOs. By April 2020, Nedgia had finished the proposal for the creation of a voluntary GO scheme for biomethane, which was jointly elaborated with ERGaR. This highlights again the importance of cooperation and knowledge sharing among the partners involved in the project. A meeting with the Ministry for Ecological Transition was requested to present this proposal, but the reply was delayed due to the Covid-19 pandemic. In this regard, Nedgia found too early to assess the pandemic's impact on the development of the biomethane sector and the setup of the registry. On the positive side, Nedgia informed dena that the pilot plant in Butarque started injecting biomethane into the natural gas grid in November 2019. The Butarque plant is located within the Madrid municipality and received support from the ECO-GATE Consortium, which was co-financed by the EU's Connecting Europe Facility (CEF). The importance of the Butarque plant is to present it as part of a real-life example of a GO system. Nedgia expected to use the requested meeting with the Ministry for Ecological Transition to explain this project and assess the next steps to follow in the creation of the country action plan for setting up the registry. Of particular importance for Nedgia was presenting the Butarque project and the proposal for a voluntary GO scheme to three units within the Ministry: (1) Energy Unit, (2) Industry Unit and (3) Climate Change Unit, being the latter responsible for GHG emissions reduction policies. The meeting took place on 11 November 2020, where the Ministry communicated that it was expecting to publish a biogas roadmap, which would serve as a first step for establishing a gas GO system in Spain, but there was still no official publication date.

On 26 September 2019, dena sent to Nedgia the guideline document for creating the country action plan for Spain (Annex 5.2). There were several attempts for working on it, but these efforts were postponed at the request of Nedgia for several reasons: (1) the Energy Transition Law was still under discussion; (2) waiting for the outcomes of the meetings with between Nedgia and the Ministry for Ecological Transition; (3) the creation of a Biogas Roadmap by the Ministry for Ecological Transition. The Roadmap´s objective is to promote the production and use of biogas in Spain due to the important role it could play towards climate neutrality in 2050. The development of the biogas industry will also bring environmental, economic, and social benefits, such as the circular economy. Its publication was delayed several times, which also hindered the creation of the CAP for Spain. Nedgia preferred to wait for the Roadmap publication before proceeding with the CAP.

The exchange of information between the Ministry for Ecological Transition and Nedgia continued throughout the project in an effort to push forward the biomethane sector. Nevertheless, this exchange also suffered from the restrictions imposed by the covid-19 pandemic by slowing it down substantially. This, in turn, had a negative impact on the creation of the CAP for setting up the biomethane registry. By March 2021, the draft Energy Transition Law had not been approved yet and it was expected that the Biogas Roadmap would be published in April 2021. The Spanish Government also showed interest in creating a national (not voluntary as in Nedgia's proposal) scheme for biomethane GOs. Nedgia also informed dena that the technical committee had already sent the Roadmap draft to the Interministerial Commission seeking the document's political approval and that it might be published in May 2021, causing a one-month delay from the previous April deadline. Even though the legal framework for biomethane was still in preparation, the biomethane sector kept ramping up in Spain. A third biomethane plant started operation during the second week of June 2021 in Parc de L'Alba, Barcelona. It injects biomethane (produced from landfill waste) into Nedgia's gas grid at a rate of 12 GWh per year. The strong interest from the private sector for rapidly developing the biomethane industry contrasted with the slow pace in the approval of the respective regulatory instruments. Nonetheless, the Energy Transition Law (link) had been approved by the Deputies Chamber and officially published on May 21, 2022, confirming Spain's commitment to the use of renewable gases, including biogas, biomethane and hydrogen. The Law does not establish annual

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targets for the penetration of renewable gases in the sale or consumption of natural gas, but included the following measures:

1) Creation of a certification system that allows the supervision and control of the obligations established by the law.
2) Regulations that favor the direct use of renewable gases in industry and in the transport sector, as well as their injection into the natural gas grid.

The Spanish Biogas Roadmap was published by the Ministry for Ecological Transition on 15 July 2021 and was available for public consultation until 15 September 2021. All relevant stakeholders were invited to communicate their opinions before that deadline. The publication date of the first version already had a 3-month delay from the one initially intended. The final version was published short after the EU Commission officially presented the REPowerEU Plan on 18 May 2022. The Roadmap is ought to be updated every three years to incorporate the latest developments of the biogas/biomethane and renewable gases industry. Below are its main key points:

- Objective of biogas production: 10.41 TWh/year by 2030, out of which 45% will be used for heat and electricity generation. The remaining 55% will be upgraded to biomethane for substituting natural gas in other applications (especially transport).
- By 2030: at least 1% of gas consumption from the gas grid will be biomethane.
- By 2030, biogas and biomethane will contribute to Spain´s renewable energy objective of 28% in the transport sector.
- Biogas and biomethane will contribute to reach the goals from RED II of advanced biofuels of at least 0.2% by 2022, 1% by 2025 and 3.5% by 2030.
- The Roadmap considers positive synergies in four main areas: (1) circular economy, (2) agrarian policy, (3) environmental policy and (4) energy policy.
- Biogas production capacity in 2019: 300 MW
- Biogas estimated production in 2020: 2.74 TWh
- The Roadmap centers itself in the biogas produced by anaerobic digestion due to its technological maturity. Thermochemical processes for biomass gasification are therefore not considered.
- The Law of Residues and Contaminated Soils includes concrete objectives for establishing separated pickup of materials, with a specific reference to bio-residues.
- The biogas can be used as a resource for producing green hydrogen through processes like steam methane reforming (SMR), partial oxidation (POX) or autothermal reforming (ATM).
- The digestate is considered in Spain as an organic biodegradable residue that can be used for the production of fertilizers.
- Chapter 4 addresses the creation of the Spanish GO system for renewable gases. Its aim is the verification of the energy quantity contained in renewable gases in a supply chain or in the energy supplied to consumers.
- The gas GOs will be issued to all biogas produced in Spain, regardless of if it is used directly as biogas or if it is upgraded to biomethane and injected into the gas grid.
- The Ministry for Ecological Transition will be responsible for the development and management of the registry of the GO system under the principles of transparency, objectivity, operation efficiency and no discrimination among involved parties. The Ministry can designate a responsible entity for these tasks, but always respecting the aforementioned principles.

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- The GOs will be compliant with RED II or any other future directive/regulation substituting RED II.
- The Ministry will analyze the possibility of including sustainability accreditation information in the GOs.
- The Spanish Government will seek to simplify the administrative procedure for the authorization and construction of biogas production plants. It will also standardize the administrative procedure in all provinces, so that the project developers encounter less obstacles.
- For the purpose previously mentioned, the Spanish Government will elaborate a catalogue with the requirements and procedures to be followed for the construction of new biogas plants. This catalogue should serve as a guide for the competent administrations and the project developers for clarifying the authorization process.
- The Government will seek to create in the midterm a mechanism for promoting the use of biogas through the establishment of obligatory objectives for the sale and consumption (quota), indicating the obliged parties.
- The certificates of sale/consumptions would be the documents issued (at request) to certify the sale/consumption of a specific biogas quantity in a specific year.
- The certificate issuance for the producers might differentiate among the raw materials used for the biogas production, so that certain waste treatment processes are favored on top of others.
- The Government will develop a calculator for the reduction of GHG. This instrument will discriminate between different substrates or combinations of them. Technological centers and certification entities, among others, will participate in this project.
- The Government will adapt the SICBIOS tool for including renewable gases in the present obligations system for sale and consumption of biofuels in the transport sector.
- The use of biogas/biomethane will be prioritized in municipal services and in the means for the production and transportation of biogas, such as waste recollection trucks.
- The use of biogas for the production of green hydrogen will be prioritized over electrolysis, whenever it is more economically efficient and better for the environment.
- Support will be granted for heat grids using biogas, especially in industrial areas where there is agroindustry.
- The Government will promote the creation of local energy communities in the agricultural sector. The goal is to facilitate the investment and optimize the size of the agribusiness waste treatment plants, considering the economic and environmental costs of the transport.
- Forecast 2030: biogas production of 10.41 TWh/year. This means multiplying by 3.8 the estimated production from 2020.

According to the comments made by the relevant stakeholders to the Biogas Roadmap, its first edition leaves several gaps and open issues between policy and technical implementation. For instance, there are no binding objectives for establishing a share obligation in the production and consumption of biomethane. It does not establish either any methodology for reaching the production goals of renewable gases in Spain. In this regard, Nedgia prepared a response document pinpointing the areas that needed attention and amendment. In preparing this document, Nedgia looked forward to continuing working together with the Ministry for Ecological Transition in order to formulate adequate policies that would quickly boost the development of the biogas and biomethane industries. Nedgia's response included specific objectives, lines of action and activities to reach them. This response was based on the work done in Task 6.2 "Support for national strategic visions and roadmaps", which highlights the importance and interlinkage of the tasks done under the REGATRACE project. The

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German Energy Agency helped Nedgia prepare its response to the Biogas Roadmap by having a Spanish native speaker among its workforce, who proposed improvements to the initial response document. Nedgia identified the following elements that need to be addressed by the Biogas Roadmap in its future editions:

- Stable regulatory framework and long-term foresight to attract investments. This shall include a mandatory increase of annual biomethane consumption targets backed up by GOs.
- Economic and financial mechanisms for the support and promotion of renewable gas projects. These could be in the form of FIT, FIP, tax incentives, direct subsidies, among others. Having these mechanisms would create certainty and confidence among investors.
- Streamlining and reduction of response times by the governmental administrations in the processing of authorizations and permits for new biomethane projects.

The development of the legal framework for biomethane continued throughout the course of 2021. The Royal Decree for the Partial Transposition of RED II (link) was open for public consultation from September 23 to October 14, 2021. Regarding biomethane, it established the following provisions:

- Recognition of the need for creating a GO system for renewable gases.
- Designation of the technical manager of the Spanish gas system (Enagás) as the entity responsible for the system of GOs for renewable gases, as long as the Ministry of Ecological continues lacking in human and material resources.

This represented a good starting point for the development of the Spanish registry for GOs of renewable gases. Nevertheless, the stakeholders from the biomethane sector continued working on an alternative roadmap, which established more specific targets for gas traders (obliged parties) over final gas consumption. These proposals were presented during the third REGATRACE Participatory Workshop that took place in January 2022. The following specific points were highlighted:

- A 10% share of biomethane over gas consumption by 2030.
- A 100% share biomethane over gas consumption by 2050.
- Progressive annual compliance with starting targets in 2023 and establishing new ones every two years.
- A minimum penalty fee of €100/MWh for non-compliance. The penalty fee shall also be updated every two years.

Additionally, the alternative roadmap included strategies for the development of the biomethane sector broken down into time horizons with specific activities, as follows:

Main strategies 2022-2023:

- Establish a reasonably stable regulatory framework and long-term planning to attract investment for fostering demand and supply of biomethane. This will be aligned with the European Green Deal commitment and the European priorities identified in the recent Gas Package.
- Establish a system of financial and fiscal incentives for the development of projects. France is a successful example of such (CAPEX, FiT, FiP, tax benefits, etc.).
- Urgently implement a system of guarantees of origin, including information on compliance with sustainability criteria and reduction of GHG emissions in the production process of biogas.
- Set increasing annual targets, with focus on marketing for final consumption.

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- Implementation of appropriate policies to make better use of the energy potential of biomethane for the producers: prioritizing biomethane injection into the gas grid, adopting other solutions where the grid is not accessible, investment aid for biomethane producers wishing to connect to the gas grid.
- Synergy creation in the Public Administration by establishing an interministerial roundtable, including the Ministry for Ecological Transition, the Ministry of Agriculture and relevant intersectorial stakeholders for a more fruitful collaboration.
- Obligation for the municipalities for revalorizing all municipal waste as feedstock for the production of biomethane. In the case of waste watertreatment plants, an obligation to implement strategies avoiding burning the biogas through a flare.
- Obligation for the municipalities for using the digestate as a biofertilizer. This includes a simplified harmonization of its management/use in municipalities, with the adaptation of best practices to optimize its quality.
- One-stop management: standardized and equal procedures nationwide in all Regional Public Administrations for simplifying the administrative burden of new projects and accelerating the response times for authorizations and permits.

Main strategies 2024-2030:

- Continue with the establishment of a stable regulatory framework that includes clarification of the use of digestate as a biofertilizer.
- Need for a research of the evolution of the gas market, with intersectoral participation of producers, traders, consumers, the public administration, and technology centers.
- Establishment of awards for biomethane production plants with the best practices in areas like waste management, operation, biofertilizer management. Public acknowledgment will help promote, encourage, and develop the biomethane sector in Spain.
- Fasten the regulatory framework on nutrient recycling: obligations, rights, financial incentives for the use of recycled nutrients.
- Consider business areas as the CO_2 prices increase, together with the biomethane demand accordingly.

Main strategies 2030-2035:

- The biomethane sector will need to be adjusted to the future energy market and regulatory conditions.
- Consider the globalization of GHG monitoring of diffuse emissions sectors. This involves a GHG diffuse emission sectors analysis with a global monitoring and updating of these sectors, in order to adjust their issues and the biomethane solutions.

The Ministry for Ecological Transition published the Royal Decree 376/2022 on May 17, 2022 (link), which had been open for public consultation between 23 September and 14 October 2021. The Decree's final version regulates the criteria for sustainability and reduction of GHG emissions of biofuels, bioliquids and biomass fuels. Title II of the Decree determines creation of a system of guarantees of origin applicable to renewable gases (biogas/biomethane and green hydrogen). It establishes the definition of these guarantees, their content, and the conditions for issuing them. Additionally, it confirmed the provision from the initial draft Decree authorizing the designation of an entity responsible for the system's management and operation, which is the technical manager of the Spanish gas system (Enagás). In this regard, Nedgia proactively offered Enagás the possibility to work

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together in the registry's development, as well as the knowledge and expertise generated in REGATRACE.

The partners of Task 3.2 (dena, AGCS, ERGaR), together with Nedgia, had a videocall with Enagás on 29 June 2022. During this meeting Enagás informed that it had made already relatively good progress with the setup of the registry for gas GOs. The development is mainly divided considering two elements: (1) revision of the national legislation and (2) international trade of gas GOs from April 2023, for which Enagás was already in contact with ERGaR. Enagás gave a presentation during the Target Workshop in Madrid on 15 September 2022 in which it explained that the registry will be complaint with Article 19 RED II. The registry is expected to start working with the basic functions (issuance, transfer, import/export and cancellation of GOs) by April 2023 and will be capable of issuing GOs for biogas, biomethane and green hydrogen.

As it can be seen, the setup of the Spanish biomethane GO mostly took place outside the framework of the REGATRACE project. This was in part due to the long times needed for the approval of the Energy Transition Law, Biogas Roadmap and Royal Decree 376/2022. The latter legitimized the creation of the registry and designated Enagás as the entity responsible for its management and operation. Nevertheless, Nedgia's participation in the REGATRACE project and the collaboration it had with the Ministry for Ecological Transition will surely set the path for major improvements in the future editions of the Biogas Roadmap, with the aim of rapidly developing the Spanish biomethane sector and exploit it to its full potential. Figure 13 graphically summarizes where Spain currently is in the development of the biomethane registry.

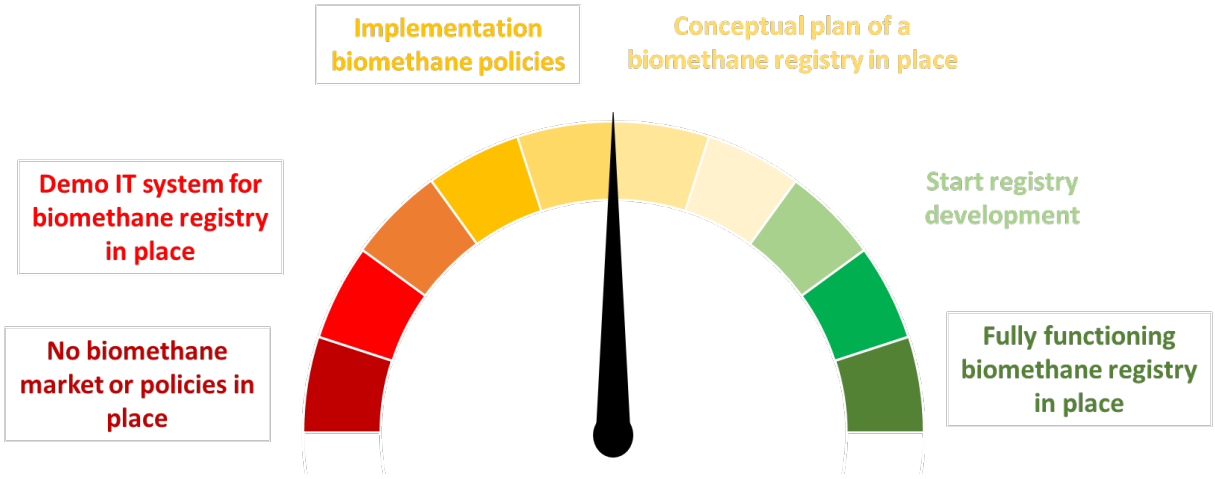

Fig. 13 Progress in setting up the Spanish registry for biomethane GOs.

3.9.2 Country highlights: Spain

- On 27 January 2021, Nedgia organized an online workshop with national stakeholders, including the Spanish Ministry for Ecological Transition. The requirements and main functions of a national registry system were presented and the specific framework conditions for Spain were discussed. The challenge of establishing a certification and registry system, which may address several renewable gas types and cover different gas application purposes, was discussed in depth. With a demonstration of the REGATRACE IT-registry system, the national stakeholders and ministry representatives could gain insights into the operation and functions.
- The final version of the Biogas Roadmap was published in May 2022 after receiving comments from all relevant stakeholders. This roadmap sets the path for the evolution of the Spanish biomethane sector and will be revised every three years to incorporate the latest developments in the sector and renewable gases industry.

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- The Royal Decree 376/2022 legitimized the creation of the registry and designated Enagás as the entity responsible for its management and operation.
- The knowledge and practical insights gained from REGATRACE Task 3.3 will be of value for a planned IT-procurement to be performed by Enagás.

3.10 Sweden

3.10.1 Task 3.2 developments: Sweden

Sweden participated in REGATRACE as a third-linked party (TLP) from two sides: ERGaR, with Nordion Energi (Swedish gas TSO) as LTP, and EBA, with Energigas Sverige (Swedish Biogas Association) as TLP. The work with Sweden was brief due to the fact that the Swedish Energy Agency has been designated as the issuing body for gas GOs and it was waiting for the final publication of the CEN Standard EN16325 before proceeding with setting up the GO registry for renewable gases. Additionally, the biogas/biomethane industry in Sweden is more developed than in other target countries from the REGATRACE project. Nevertheless, there was exchange of information and experiences between the Task 3.2 partners (ERGaR, AGCS, dena) and Nordion Energi and Energigas Sverige.

Dena sent to both partners the initial questionnaire (Annex 5.1) to get to know more about the biomethane sector in Sweden. According to the information provided by them on 3 May 2021, there were some small pilot plants for e-gases that were still in the research phase, but without real production volumes and, hence, no statistics were yet available. Projects for hydrogen production from water electrolysis were in the planning phase or under construction and still few years away being fully operational. The green hydrogen production could be used for fossil-free steel production and by some refineries. Regarding biogas, there were 280 production plants out of which 68 upgrade its production to biomethane. The yearly biogas production volume accounts for 2.1 TWh from which 64% is upgraded to biomethane. Biogas is mainly produced from different types of bio-waste and residues in co-digestion plants (49%) and from sewage sludge (35%) in wastewater treatment plants. The use of biomethane for transportation increased rapidly over the last 10 years, whereas the use for heating had decreased. In fact, the biomethane produced in 2019 was mainly used as a transport fuel. The reason for this is that the transport sector has the highest environmental taxes and biomethane has found a natural application there for cost reduction. In this regard, there is rising interest in using biomethane in the maritime and freight transport sectors, but the biggest potential in the short run will be in industry as a replacement for natural gas. There was one bio-LNG in operation and producing 51 GWh. More bio-LNG plants are planned in the near future.

According to the Swedish partners, the short-term realistic biogas production potential sums up to approximately 10 TWh by 2030. This potential is also a national goal from which 7 TWh will be produced by anaerobic digestion and the remaining 3 TWh from other technologies (mainly gasification of forest waste and residues). There is also a big potential for e-gases because there are no resource constraints, but no estimations have been done yet, although the potential for wind power expansion is also big in Sweden.

Regarding regulatory and/or financial instruments for promoting renewable gases, there were still no special policies for e-gases, except for the investment support and the general rules within the EU ETS and the electricity tax. With regard to the investment support, there are two types: the first one is linked to the GHG emissions reduction, while the second one is linked to the investment for transitioning to low-carbon fuels. There is also a green electricity certificate system, but it is being phased out because it is no longer needed due to the fact that the renewable electricity targets for 2030 will be reached by 2023. Thus, the price of the certificates will go down to nearly zero (e.g., wind

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electricity is now equally competitive with its fossil counterpart). The main drivers that helped decarbonize the electricity sector since the 90s (high CO_2 and energy taxes on fossil fuels) are the ones currently driving the development of biomethane. In the case of industries using natural gas, the taxes for not using RES are generally lower compared to the transport sector in order for the industrial sector to be competitive against other countries at the European and international levels (nevertheless the companies must still comply with the EU ETS). However, during the last 2 to 3 years biomethane demand in industry has risen dramatically due to subsidized imported biogas (mostly from Denmark) that makes it more competitive than natural gas. Biomethane profits from the following incentives:

- Fiscal incentives: CO_2 and energy tax exemption for biomethane used in the transport sector is approved by the EU Commission until the end of 2030. Biomethane for heating applications is also exempted from the CO_2 and energy tax.
- Production support/premium: support for manure-based biogas and biomethane for reducing methane emissions from manure. There is also a temporary biomethane production support in place since October 2018, which is given to biomethane producers for upgraded biogas from various substrates for transportation. Biomethane from sewage sludge, landfill or food and feed crops is excluded.
- Investment support:
    - Local climate investment program supporting all types of investments or measures leading to a high GHG emissions reduction from 2015 to 2026. The budget for 2021 was 2.4 billion SEK (ca. 0.24 billion EUR). A significant part of the investment support so far has been granted to biomethane investments (40+ biogas plants, several bio-CNG and bio-LNG filling stations, and bio-LNG trucks), but also to other measures such as charging infrastructure for electric vehicles.
    - 180 million SEK support 2018-2021 for the establishment of a bio-LNG innovation cluster: aims at the promotion and demonstration of the production and innovation chain in a region for bio-LNG for heavy road and sea transport.

The activities for developing an electronic registry for renewable gas GOs were nonexistent for two reasons. The first one was that a legal act was needed for extending the functionalities of the already existing electricity GO system to cover renewable gases according to Article 19 RED II. The second one was that the Swedish Energy Agency (SEA), was waiting for the final publication of the CEN Standard EN16325 before proceeding to add the functionalities of gas GOs to the electricity GO system. In addition, the current software of the electricity registry will be replaced by a more modern one, but the legal and normative framework needs to be in place beforehand. SEA is the issuing body and governmental institution responsible for the transposition of RED II in Sweden. Regarding the transposition of Article 30 RED II for using a mass balance system, the existing national sustainability criteria scheme for transport biofuels was expanded to biomass fuels for all energy uses as from 1 July 2021. In this sense, the supplier (in the case of transport applications) or the user (for production of electricity, heat, or cooling) must have a Sustainability Decision issued by SEA for biogas or other biomass fuels to be eligible for tax exemption or emission factor zero within EU ETS starting 1 January 2022.

Energigas Sverige, in its role as the Swedish Biogas Association, advocates for a national biomethane registry for GOs of renewable gases and is helping authorities (SEA and governmental offices) with proposals and information for the GO system to be relevant for the gas industry. As an industry member association, Energigas Sverige represents approximately 160 companies producing, supplying, distributing, or using energy gases, including technology providers. It is also involved in the

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revision of the CEN Standard EN16325. In this regard, SEA greatly benefits from the input Energigas Sverige can provide by communicating the needs of the industry, in order to create a GO system for renewable gases that considers these needs.

The partners from Task 3.2 (dena, AGCS, ERGaR) had a video call with Energigas Sverige, Nordion Energi and the Swedish Energy Agency on 27 September 2021 to discuss future collaboration efforts within the framework of REGATRACE, especially Tasks 3.2 and 3.3. During the video call, it was again explained by SEA that it is waiting for the final publication of the CEN Standard EN16325 to proceed with the added functionalities for gas GOs to the already existing electricity GOs registry. A follow-up meeting was held on 11 November 2021 in which AGCS presented the pilot IT system that it developed for the target countries during the REGATRACE project. The Swedish partners again mentioned that SEA will wait for the final publication of the aforementioned Standard before proceeding with the gas registry.

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4. Conclusions

The development of the biomethane sector varied in each target country since the beginning of the REGATRACE project in June 2019. This diversity in the sector's development continued throughout the course of the project and was reflected in the setup of the respective registry for biomethane GOs. Despite this diversity, all of the target countries were able to define the registry's purpose (compliance with Articles 19 and 30 RED II) during the project lifetime, which is summarized in table 7.

Table 7: Summary of the registries' purpose in the target countries.

Target country	Registry's purpose (compliance)
Belgium	Flanders: Article 19 RED II Federal registry: Article 30 RED II
Czech Republic	Articles 19 and 30 RED II
Ireland	Articles 19 and 30 RED II
Italy	Article 19 RED II
Lithuania	Articles 19 and 30 RED II
Poland	Article 19 RED II
Slovakia	Article 19 RED II
Spain	Article 19 RED II

Ireland, Lithuania and Slovakia were the most successful countries. In the case of Ireland, the registry went live on 1 October 2020 even though it was a manual system based on MS-Excel. Nevertheless, the Irish biomethane sector developed quickly and steadily increased its production from 1,013 MWh in 2020, to 4,965 MWh in 2021 and then escalated vigorously with a production of 19,072 MWh between January and August 2022. In the case of Lithuania and Slovakia, the government's commitment to the deployment of renewable energy sources and the consequent interest in the development of the biomethane sector allowed the fast creation of the respective country action plan with detailed milestones and activities, which in turn benefited the setup of the registry for biomethane certificates. In fact, most likely the Lithuanian and Slovak registries will go live before the end of 2022. As for the rest of the target countries (i.e., the Czech Republic, Italy, Poland, Romania, and Spain), the common factor that slowed down the registry's setup was the approval of the required legal framework. In the light of the current situation between Russia and Ukraine, with its impact on the energy supply in Europe, the prompt approval of the legal framework for the deployment of RES, including biomethane and renewable gases, is a crucial element for the energy security in the region. Moreover, the development of the biomethane sector brings further benefits, such as job creation, technology innovation, revalorization of waste and residues and a contribution to the circular economy. With respect to Belgium, the complex situation of the biomethane and renewable gas sector due to the regional policies can be used as an example for the future of the certification and verification of renewable gases in Europe. The call for a harmonized system in Europe is evident based on the Belgian experience if EU policy makers wish to have a smooth certification and verification system that efficiently prevents the double (or even multiple) counting of biomethane and renewable gas consignments.

The Union Database (UDB) has the aim of preventing multiple counting of renewable fuels at the EU level for ensuring their transparency and traceability, especially when volumes are traded cross-border. The question that remains open is how gas GO registries will interact with the UDB in the future in order to avoid multiple counting of the same biomethane volume. The link between the UDB and GOs is currently being discussed, i.e., if a cancelled GO shall be transferred to the UDB or if the

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GO shall still be active ("live") in the UDB until the volume is consumed. The UDB also stores PoS at the EU level and is expected to be launched by the end of 2022. A first version is currently being tested by market players.

Figure 14 summarizes the development of gas registries in Europe during the lifetime of REGATRACE and is updated up until June 2022. The color coding indicates the registry status in each country, as described in the upper left corner. The countries in turquoise are the ones who already had an operational registry (national or voluntary) in 2019, while the ones in light blue are the ones who were able to setup one during the timeframe of REGATRACE (Ireland, Lithuania, and Slovakia). The ones in gray that also participated in the project (Czech Republic, Italy, Poland, Spain) do not have one yet, but are in the implementation process.

Fig. 14 Development of operational registries in Europe. The color coding show the status of the respective country.

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Finally, figure 15 summarizes the development of biomethane production in Europe from 2019 to June 2022 per country. Countries in green were already producing biomethane in 2019, while the ones in turquoise (Ireland, Latvia, and Slovakia) joined the list of biomethane-producing countries during the REGATRACE lifetime.

Fig. 15 Development of biomethane production in Europe 2019 - 2022 (June)

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5. Annex

5.1 Questionnaire: present situation of biomethane and power-to-gas (PtG) documentation and registration in target countries

1. What is the present situation (status quo) of the market for biomethane and renewable PtG (hydrogen from renewable electricity and synthetic methane from hydrogen and CO2) in the target country?

   a) Number of production facilities

   b) Production volume on a yearly basis

   c) Potential for future growth

2. Are there any regulatory and/or financial instruments for promoting and supporting the production of bio-methane and PtG? If so, please name them and give a brief explanation of each instrument.

3. Are there any existing activities in the development of an electronic documentation system (registry) for bio-methane and PtG? If so, please indicate which institution is responsible for the registry's set- up and operation, and what is the purpose of it.

4. What is the current status of transposing the Renewable Energy Directive from December 2018 (RED II) with regard to define/establish a competent body that manages and supervises the issuance, transfer and cancellation of guarantees of origin for renewable gases (Article 19)?

5. What is the current status of transposing the Renewable Energy Directive from December 2018 (RED II) with regard to economic operators using a mass balance system according to Article 30 (1)?

6. Which ministries and/or governmental institutions are responsible for the activities needed to comply with the requirements from RED II?

7. Please describe the role of your institution in the set-up of a national biomethane registry.

This project receives funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation under Grant Agreement no. 857796

5.2 Guideline and Draft Structure for National Action Plans

1. Introduction

The main objective of a registry for guarantees of origin (GO) for biomethane and/or renewable gases is to facilitate the standardized and trustworthy documentation of the origin and the production volume, as well as the quality of the produced gas according to certain criteria for it to qualify as a renewable gas. The purpose of the registry, the national legal framework and the involved stakeholders are key elements that need to be analyzed and considered for the successful implementation of a national biomethane registry. The present document aims to serve target countries as a guide for the development of a properly structured Action Plan (AP) in order to initiate and accelerate the process of setting up a national biomethane registry.

Even though the energy policy in each target country is in line with the EU targets of renewable energy by 2020, the situation in each one of them varies strongly and requires an individual approach for each country. The biomethane registry will serve several uses, as described in deliverable 3.1 from the REGATRACE project. Among them, the provision of harmonized and transparent electronic documentation of injected biomethane consignments is an important element for supporting national authorities and market stakeholders with regard to renewable energy quotas and support schemes for renewable gases. In this sense, the following actions and key elements will serve to the development of an AP that will facilitate the creation of an electronic registry that will support reaching the national renewable energy goals. It is important to highlight that the actions and elements contained in this document are neither comprehensive nor mandatory, but rather a collection of important activities to be considered for the development of the AP and the creation of a national biomethane registry.

2. Provisional Elements of an Action Plan

2.1. Situation Analysis

2.1.1. Market Assessment

a) Description of the current and predicted production volume
b) Potential for future growth

2.1.2. Assessment of regulatory and/or financial instruments for promoting the production and/or utilization of biomethane and other renewable gases

a) Identify what kind of verification and documentation is required for national and European framework conditions, in light of the regulations contained in RED II.
b) Define the character of the national support mechanisms: production support and issuing of renewable gas GO for disclosure or support for the utilization of renewable gases (mass balance).

2.2. Stakeholder identification for the development of a biomethane registry

a) Identify stakeholders and describe the responsibilities and interests of each stakeholder and stakeholder group, respectively:
   - Industry: biomethane producers and traders, utilities, car industry, distribution and gas grid operators, industrial associations
   - Ministries and governmental institutions responsible for the implementation of RED II
   - Non-governmental organizations (NGOs)
b) Building up the interests of the stakeholders

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- Organize and collect support amongst industry participants and submit a position paper to the government

2.3. Defining the purpose for a registry

a) Define, together with national stakeholders, the purpose of the biomethane registry:
   - The central task of a domestic biomethane/renewable gas registry is to generate confirmations for the products included in the scope of their activities (upgraded biogas, renewable gases from PtG technology, biomethane from biomass gasification, carbon dioxide, etc.).
   - Issue GO for disclosure according to Article 19 RED2
   - Mass balancing system according to Article 30 RED2
   - Provide harmonized and transparent electronic documentation of injected biomethane/renewable gas consignments meeting the requirements of the market stakeholders.
   - Controlling, auditing, reporting and verification during injection and withdrawal.
   - Support national authorities and services in data management in relation to renewable energy quotas and support schemes.
   - Provide a platform for market participants to generate, exchange and redeem electronic documents representing biomethane consignments.
   - Prevent double sale and double counting towards national renewable goals and compliance with state aid rules (double compensation).
b) Develop a draft discussion paper on the purpose and functionalities of the biomethane registry

2.4. Creation of commitment from the government and/or the industry to develop a biomethane registry

a) Organize workshops and/or bilateral discussions with governmental institutions and/or industry representatives.
b) Accelerate decision-making processes providing information and materials on registries from REGATRACE (Deliverable 3.1 will be finalized soon) and BIOSURF deliverables.

2.5. Cost calculation and financing of registry

a) Elaborate cost calculation for the development, implementation, and operation of the biomethane registry.
b) Evaluate financing schemes: the role of private and development banking institutions, as well as from the government for the registry's implementation and operation.

2.6. Development of a concept and basic principles for setting up the registry based on the present situation and future production technologies for renewable gases.

2.6.1. Identification of the production technologies that should be covered by the registry

a) Identify the production technologies present today in the country.
b) Assess the potential production technologies that would be technically and economically feasible based on the country's feedstock, natural resources, and infrastructure.

2.6.2. Identification of the information and the entities to provide the information for the verification of biomethane and other renewable gases

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a) Define the information needed for the verification of biomethane and renewable gases production
b) Identify the institutions responsible for reporting the information needed for the verification process

2.6.3. Development of a concept for collecting information according to 2.6.2 in a reliable and efficient manner

a) Create consensus among institutions responsible for reporting information, in order to deliver the required data in an accurate and timely manner.
b) Develop standards for delivering the required information, e.g., an XML file.
c) Create an electronic information repository or hub for collecting the delivered information.
d) Define who will administer this information repository.

2.6.4. Develop a verification architecture for the biomethane registry

a) Identify and assess which kind of entities are suitable or defined by law to verify data (EMAS, national authorities, certification bodies which are accredited by European certification schemes, any other)
b) Establish verification standards and schemes for the production of biomethane and renewable gases
c) Determine who and how the accreditation and inspection of auditors is ensured

2.7. Gap analysis of the legal and regulatory framework

a) Identification of improvement areas and processes in the present legislation for the successful development and implementation of the biomethane registry.

2.8. Identification and selection of the best IT solution from a technical and financial perspective.

a) Identify and assess the most cost-effective solution based on national and European cybersecurity standards.
b) Ensure a user-friendly interface for all registry users.
c) Ensure interoperability with other European registries in terms of communication standards.

2.9. Implementation of the selected IT solution.

a) Elaborate a call for proposals for the selection of the registry developer
b) Select the best proposal based on cost, quality, and service (during development and post-development)
c) Implement the selected proposal
d) Conduct tests and correct possible mistakes and/or software bugs

2.10. Capacity building and public awareness: workshop to raise awareness and acceptance and trainings for using the registry.

a) Organize workshops to raise awareness and acceptance among the stakeholders.
b) Offer trainings to potential users on the use, benefits, and advantages of the registry.

3. Action plan schedule with responsibilities and tasks for each stakeholder.

a) Elaborate a detailed action plan schedule with clear tasks and responsibilities for each stakeholder.

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