Report

Deliverable 2.2.2: ***Description of harmonised data categories***

Deliverable 2.2.3: ***Definition of quality criteria and method of quality measurement and monitoring of collected data***

Deliverable 2.2.4: ***Proposal for an IT solution for provision of static and dynamic data for Member States not having a National Access Point in DATEX II format***

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List of abbreviations

AFI	: Alternative Fuels Infrastructure
AFID	: Alternative Fuels Infrastructure Directive
CNG	: Compressed Natural Gas
CPO	: Charge Point Operator
FCH-JU	: Fuel Cells and Hydrogen Joint Undertaking
GNSS	: Global Navigation Satellite System
HRS	: Hydrogen Refuelling Station
IDRO	: ID Registration Organization
ITS	: Intelligent Transport Systems (directive)
LNG	: Liquefied Natural Gas
LPG	: Liquefied Petroleum Gas
MSP	: Mobility Service Provider
NAP	: National Access Point
PSA	: Program Support Action
SGEMS	: Sub-Group on Electro-Mobility Services (Sustainable Transport Forum)

1. Introduction

The main objective of *activity 2.2* of the IDACS project is the provision of static and dynamic data related to the alternative fuels infrastructure for electricity, hydrogen and other fuels (LNG, CNG, LPG and biofuels) through the National Access Points (NAP) of the Member States in DATEX II format. To support the provision of data Member States will work collectively on the description of harmonized data categories and criteria for quality measurement and monitoring.

Further, in activity 2.2. the participating Member States will elaborate a proposal for an IT solution for provision of static and dynamic data for Member States not having a NAP in DATEX II format to be integrated through the NAP once they are operational. Finally, a proposal to the Commission will be developed for complementary data protocols to enable e-Mobility service provision and proposal for relevant standards.

2. Purpose of this document

This document aims to present the results of the abovementioned activities supporting the provision of data through the NAPs as conducted by the participating Member States between 2019 and 2021.

This document will present the final results of the following deliverables of activity 2.2:

2.2.2. Description of harmonized data categories across participating MS;
2.2.3. Quality criteria and method of quality measurement/ monitoring;
2.2.4. Practical solution for Member States without NAP with DATEX II format.

The remaining deliverables of activity 2.2. will be presented in separate documents at a later stage:

2.2.1. This deliverable will present the results of the actual data provision through the NAPs in DATEX II format. This will be evaluated at the end of the project and the results will be laid down in a separate document.

2.2.5. This deliverable on complementary data protocols to enable e-Mobility service provision and proposal for relevant standards is elaborated in a separate document.

2.2.6. This deliverable will present lessons learnt from the Nobil database solution in Norway. This will be elaborated at the end of the project and the results will be laid down in a separate document.

3. Methodology

The methodology used to support the data collection through the NAPs in DATEX II format follows the approach as described in the Grant Agreement. This means the following steps were taken by the Consortium members to prepare the provision of data to end users via the NAP:

Data categories

- To support harmonization the Consortium cooperated to determine a set of data categories for all fuel tracks across the participating Member States, based on the data categories as formulated by the Sustainable Transport Forum sub-group on electro-mobility services (SGEMS);
- The data categories were discussed within the Consortium as well as discussed with market parties such as alternative fuels infrastructure operators;
- These data categories are to be considered minimal standards. Member States are therefore free to provide additional data categories where relevant via the NAP.

Data quality and monitoring

- The Consortium cooperated to determine a set of quality requirements and a common method for quality measurement and monitoring aimed at ensuring the collected data is accurate and reliable;
- The requirements concern the freshness of data, the completeness and correctness of data and the consistency of data;
- These quality requirements are to be considered the minimal requirements that apply to the quality of the data that can be obtained from the National Access Points. Member States can therefore make stricter or more detailed requirements for their data.

IT solution for provision of static and dynamic data for Member States not having a NAP

- Even though there is a legal obligation under the Directive on Intelligent Transport Systems (ITS) to make data accessible through the National Access Points of the Member States, not all Member States have a NAP in place or operational. The Consortium cooperated to elaborate a practical solution to support these Member States in providing static and dynamic data through the NAP, once the NAP becomes operational in the future;
- The elaborated solution depends primarily on the chosen architecture of the NAP (database versus data register), as this determines how data can be made accessible in the mandatory DATEX II format;
- The Consortium has also developed an open source DATEX II conversion tool that can be used at the NAPs by CPOs or roaming platforms to convert data to DATEX II format.

4. Deliverable 2.2.2: Description of harmonized data categories across participating MS

4.1 Objective

This deliverable aims to develop a proposal for the harmonization of data categories across the participating Member States, based on the data categories as formulated by the Sustainable Transport Forum sub-group on electro-mobility services (SGEMS).

As many of the data categories of the different fuel types are the same and DATEX II data descriptions do not differ between fuels either, the Consortium and work package coordinators agreed to define harmonized data categories for all fuel tracks.

4.2 Public accessibility

The data categories refer to recharging and refuelling points that are publicly accessible. Due to the different interpretations of what 'public accessibility' entails in participating Member States, a minimum definition was agreed by the Consortium members that corresponds to the definition as mentioned in the Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure (AFID). Article 2 (7) of the AFID states that:

"a recharging or refuelling point accessible to the public' means a recharging or refuelling point to supply an alternative fuel which provides Union-wide non-discriminatory access to users. Non-discriminatory access may include different terms of authentication, use and payment".

The data categories are the minimum data for publicly accessible recharging and refuelling points that need to be accessible for (re-)use. The data categories are harmonised across the participating Member States, in order to get the same base level of information in the NAPs within the timeframe of the IDACS project.

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4.3 Data categories

In order for the whole Consortium to speak the same language, the Consortium members agreed to define the exact meaning of the categories for which data have to be collected and shared mandatorily.

For IDACS, the following data categories are required as a minimum:

Static data		**Electric Charging Points**	**Hydrogen**	**Other fuels**
1.	Location:	x	x	x
	• GNSS coordinates	x	x	
	• Address (street name, zip code, city,…)	x	x	
2.	Opening hours, identification and payment methods	x	X	X
3.	Contact info for owner/operator	X	x	X
4.	List of available charge-solutions (Power, Modes)	x		
5.	List of available connectors (plugs, sockets, induction plate...)	X		
6.	Full e-mobility code of the charging point (outlet)	X		

Dynamic data		**Electric Charging Points**	**Hydrogen**	**Other fuels**
1.	Availability (if the station is operational/ non-operational);	x	x	
2.	Occupation status (free, occupied)	x		
3.	Price for ad-hoc charging	x		

The Consortium has further developed these categories into precise definitions of data categories. The European Commission requires the data to be accessible through DATEX II or any machine-readable format fully compatible and interoperable with DATEX II. Therefore, the data categories as described in "Part 10: Energy Infrastructure Publication" of prCEN/TS 16157-10:2020, i.e. the DATEX II extension that covers (alternative) fuels infrastructures, should be aligned with the definitions used by the Consortium.[1]

[1] Dynamic data can only be collected for charging points which are digitally connected to a central station and cannot be collected from (so called) dumb chargers. Nonetheless, it is market standard that charging equipment provides interfaces for electronic communication and in some of the Member States this is a legal requirement. Therefore, the share of 'dumb' chargers is negligible. The same is true for hydrogen refuelling stations.

The mandatory data categories for IDACS have been further defined in more detail by the Consortium and are in line with corresponding DATEX II specifications, see below:

Static data categories

Location (GNSS coordinates/ street name)

- 'GNSS coordinates' means the geographical location of hydrogen refuelling points / charging points accessible to the public **determined by a Global Navigation Satellite System** (GNSS) consisting of a constellation of satellites and a global network of ground stations;
- 'Street name' means the address of a hydrogen refuelling point / charging point accessible to the public consisting of a **street name and**, if applicable, a **house number**, **postal code**, **city**, **country**

DATEX II:

"siteLocation" attribute of class "EnergyInfrastructureSite" of the "Classes" package of CEN/TS 16157-10

- Specify the site's location.

"address" of class "EnergyInfrastructureSite" of the "Classes" package of CEN/TS 16157-10

- [no definition given]

Opening hours

- means the **time period** in which a refuelling/recharging point is **accessible to the public**

DATEX II:

"openingTimes" attribute of class "EnergyInfrastructureSite" of the "Classes" package of CEN/TS 16157-10

- [no definition given]

" openingStatus" attribute of class "EnergyInfrastructureSiteStatus" of the "Classes" package of CEN/TS 16157-10

- The opening status of the site (open or not).

" regularOpeningTimesInForce" attribute package of CEN/TS 16157-6

- If true, regular opening times are in force (can be open or closed).

Identification and payment methods

- means the **way with which end consumers identify themselves** and the methods with which they can pay for the gaseous hydrogen dispensed as fuel on board motor vehicles / the electricity at the charging station

DATEX II:

"authenticationAndIdentificationMethods" attribute of the ”EnergyInfrastructureStation” package of CEN/TS 16157-10

- Information on what methods of identification and/or authentication are accepted

“acceptedPayments” of class “Payment” of the “Classes” package of CEN/TS 16157-10

- " openingStatus" attribute of class “EnergyInfrastructureSiteStatus” of the “Classes” package of CEN/TS 16157-10

Contact info for owner/operator

- means a valid **phone number** at which the operator of a refuelling/recharging point dispensing gaseous hydrogen used as fuel on board motor vehicles can be contacted
- EnergyInfraStructureSite operator organisationUnit.contactinformation telephoneNumber

List of available charge-solutions (Power, Modes)

DATEX II: attribute "chargingSolutionMode" of the class “ElectricChargingPoint” according to CEN/TS 16157-10

- Definition what charging solution is used

List of available connectors (plugs, sockets, induction plate...) / Type of charging interface

- list of available connectors at EVSE

DATEX II: attribute "chargingInterface" of the class “Connector” according to CEN/TS 16157-10

- Specifications of the charging interface type

Full e-mobility code of the charging point (outlet)

- unique ID of the Charging Point. This has to be delivered to identify (and book/reserve) the exact place or spot in the bigger pool of stations. (See IDACS deliverable 1.1.1. for correct format)

DATEX II: subelement " externalIdentifier" of the element “electricChargingPoint” according to CEN/TS 16157-10

Dynamic data categories

Availability

- means a status signalling whether dispensing gaseous hydrogen used as fuel on board motor vehicles at a refuelling point is possible / charging at a charging point is possible
  - “Available”: dispensing gaseous hydrogen at the refuelling point / charging is possible without restrictions
  - “Not available”: dispensing gaseous hydrogen at the refuelling point / charging is not possible
  - “Outside opening hours”: dispensing gaseous hydrogen at the refuelling point / charging is not possible as the refuelling/charging point is currently not accessible to the public
  - “No information”: there is no information available as to whether dispensing gaseous hydrogen / charging at the refuelling point is possible without restrictions

DATEX II: attribute "isAvailable" of the class “EnergyInfrastructureStation” according to CEN/TS 16157-10

- Information whether the specific station is available or not. It might be unavailable for example because of a fault, damage or maintenance. It does not inform if the corresponding refill/charging points are currently occupied or not.

Occupation status

- Occupation status is the up-to-date information about the occupancy status of a refueling/charge point, so that users know if the charge point is available to charge or if the charge point is already occupied.

DATEX II: attribute “Status” of the class "RefillPointStatus" according to CEN/TS 16157-10

- available
- blocked

- charging
- faulted
- inoperative
- occupied
- out of order
- out of stock
- planned
- removed
- reserved
- unavailable
- unknown

Price ad-hoc charging

- The ad-hoc price used.

DATEX II: attribute “pricePerUnit/pricePerMinute/pricePerHour” of the class "PricingPolicy” according to CEN/TS 16157-10

The above-mentioned categories are further specified in Annex I and Annex II. For Electric Charging Points these were aligned with the categories that are used in the most commonly used communication protocols in the sector (eMIP, OCHP, OCPI & OICP). As mentioned, this concerns the minimum required data categories that Member States within the Consortium should make available on the NAP. These were discussed within the Consortium as well as discussed with market parties such as alternative fuels infrastructure operators. Moreover, this means that Member States are free to provide additional data categories where relevant via the NAP.

The Energy Infrastructure publication of DATEX II offers a variety of further data fields such as the percentage of green energy, the cable type or the process protocol for hydrogen refuelling stations.

Of the data categories discussed as part of the IDACS Consortium DATEX II covers most of them. For the most part the description of the data fields does not contradict the definitions as part of the data categories agreed upon by the IDACS Consortium. However, there is no specific field for the phone number of the operator of the fuel infrastructure foreseen. The phone number should be made part of the address field though. Furthermore, the DATEX II data categories offer a limited number of statuses for availability: available, unavailable, faulted and occupied. For ad hoc prices the pricing field can be used.

5. Deliverable 2.2.3: Quality criteria and method of quality measurement / monitoring

5.1 Objective

This deliverable aims to define common quality criteria and a common method for quality measurement and monitoring aimed at ensuring the collected data is accurate and reliable.

To ensure a high quality of data the Consortium will:

- Keep the first responsibility of the data at the NAPs who are in direct contact with the source of their data;
- Use as much as possible (de facto) standard protocols to collect the data in the NAPs and in the EU Repository;
- Set up a quality process where issues concerning quality of data can be reported by users via an easy-to-use system (e.g. via a web-interface);
- Set up a working group of Consortium partners to discuss together with other stakeholders how to improve the quality of data;
- Prevent as much as possible storing redundant data, and use links to the NAPs where possible.

5.2 Data quality

There is not one all-encompassing definition of Data Quality, but in short it comes down to the quality of the data values or instances. It refers to the overall utility of a dataset(s) as a function of its ability to be easily processed and analysed for other uses. The usefulness, accuracy, and correctness of data for its application.

One of the most challenging tasks of data provision for alternative fuels is to ensure the reliability of high data quality at the National Access Points (NAPs). The main reasons why some data platforms fail, is linked to a large extent to (a lack of) data quality.

To illustrate this, the main reasons why data platforms fail are summed up below:

- The data provides no added value to the users
- Ensuring data quality is not considered (testing and continuous execution)
- Data is redundant (in comparison to other data sources)
- Processes and stakeholders have not been sufficiently considered
- A regulative framework (on the national or European scale) is missing
- Communication with stakeholders is missing
- Long-term financing and perspectives are missing

The first three reasons are directly linked to data quality. Consequently, it is of utmost importance that a high quality of data is ensured.

Process
The Consortium has looked at drawing up common quality criteria and a common method for quality measurement and monitoring. In the beginning, it proved challenging to draw up precise quality criteria and to come up with exact methods of quality measurement that all Member States would apply. Current quality measurement practices in the different Member States differ, as does the degree of maturity of the national e-mobility market.

Outcome
Despite the different national situations, a set of quality requirements and some guidelines for data measurement and enforcement have been established. Member States will use these and strive to ensure the collected data are accurate and reliable. Member States can use these guidelines for the national quality requirements of the data and also for possible reinforcement mechanisms. This is discussed in more detail in the following chapters.

In addition, a number of other matters have been agreed that are relevant to data quality. To ensure a high quality of data, the Consortium agreed to use as much as possible (de facto) standard protocols to collect the data in the NAPs. This is often already the case. Also, Member States will strive as much as possible to ensure that issues concerning quality of data can be reported. This may look different per Member State because the first responsibility of the data at the NAPs will differ per situation in a country. This responsibility can be with an organisation which is responsible for all the data collection, but can also be delegated (via legislation) to the source of the data: the alternative fuels infrastructure operators. Depending on the situation, a system can be set up with which issues can be reported. This can be done by users, for example with an easy-to-use system via the app/system where the data is displayed. But this can also be done via a point of contact at the organization responsible for the data collection, or at the organization responsible for monitoring that the correct data is shared. Within the Consortium we see these different options. The solution will therefore differ from country to country, depending on the architecture of the NAP and national legislation.

Regardless of which national solution is chosen, it is important that there are clear agreements or obligations with the alternative fuels infrastructure operators to get the requested data and to ensure that this data is correct. The Consortium has drawn up the following guidelines and principles for this.

5.3 Data quality requirements

The quality requirements mentioned below are to be considered the *minimal* requirements that apply to the quality of the data that can be obtained from the National Access Points. This means that parties that supply the data are responsible for the correct quality of the data. In addition to this IDACS guideline, individual Member States can make stricter or more detailed requirements for their data.

With regard to the data fields that are part of IDACS they are on a purely nominal scale. Therefore, at any point in time the correctness of the data can be established on a binary scale, i.e. the data is either correct or incorrect. However, data quality and correctness also have a temporal dimension which allows for certain degrees of correctness, e.g. data can be correct 97% of the time. The quality requirement will be discussed in further detail in the next sections.

The following three minimal requirements for data quality have been defined by the Consortium:

- Requirement 1: Freshness of data
- Requirement 2: Completeness and correctness of data
- Requirement 3: Consistency of data

The requirements are also based on the findings formulated by the Sustainable Transport Forum sub-group on electro-mobility services (SGEMS), as indicated in the Grant Agreement.

Requirement 1: Freshness of data

'Freshness of data' means how fast a change in reality is reflected within the data. How often data changes or how often new data is created in a source.

Parties will make sure that any update that is performed in the real world is reflected in the data at the NAP.

If possible, any change in the data attributes could be indicated in the "Last Evolution" attribute with value Upgraded and a correct Timestamp value. These values can be used by operators and integrators to use the data in a transactional way without having to load all data. This reduces data loads of communication systems or processing time in other processes.

As stated in the Grant Agreement the Consortium will also define how frequently the dynamic updating of data needs to happen, balancing the technical constraints of frequent updates with the user needs (e.g. if a charging/refuelling station becomes non-operational users should be informed swiftly). The Consortium has defined the update frequency of data per fuel track as laid down in table 1. This definition was based on the following assumptions:

- Static data is forwarded/retrieved on a periodic basis;
- Dynamic data can change very frequently, especially the availability status of charge points.

These data can either be retrieved by means of a "push-message" as often as the situation changes or can be retrieved via a direct link in the NAP data.

	Electric	**Hydrogen**	**Other Fuels**
Static data			
	within 1 day on change	on change	within 1 day on change*
Dynamic data			
availability	within 6 minutes	within 5 minutes	x
occupation status	within 6 minutes	x	x
ad hoc price	within 15 min	x	x

Table 1 – Minimum update frequency of data per fuel track as defined by IDACS Consortium

** In Belgium the static data for other fuels is being updated every 3 months. Poland, Austria, Spain, Belgium and the Czech republic have stated, that the data quality for other fuels in their Member State is sufficient. For France and the Netherlands it is yet unknown.*

These frequencies have been agreed on within the Consortium as minimum update frequencies. These are mainly based on the technical (im)possibilities that currently exist with regard to data exchange via the NAP in some Member States. This also depends on the NAP architecture and the burden it places on the alternative fuels infrastructure operators. From the point of view of the intermediary and end users (the EV driver or an app developer), a higher update frequency is preferable. The situation in practice can change quickly and the end user therefore benefits from getting the right information at the right time to avoid disappointment. The value of the

data provision is lower if the end user does not have access to up-to-date information. However, it is about a balance between what is desirable for the end user and what is possible for the operator.

Some Member States indicate that the systems of alternative infrastructure operators have their limitations and can only process a maximum of requests per hour. The higher the requirements for update frequency, the higher the burden (cost) for alternative fuels infrastructure operators becomes. A balance has been found with this minimum update frequency. In this regard, the requirements for data quality and update frequency may also depend on whether or not fees are charged for the data supply. Member States can make a distinction between data that is accessible for free (at a lower update frequency), and data that is accessible for a fee (high update frequency).

As part of contractual agreements for data deliveries with infrastructure operators, usually minimum operating times of the application programming interfaces (API) as well as certain service level agreements are defined. The minimum operating times of the API should be close to 100% not taking into account planned maintenance. In order to evaluate whether these operating times are met a certain number of requests per second (e.g. 6) needs to be defined. In a second step, the percentage of responses per number of milliseconds should be stated (e.g. the API will enable three responses in 500 ms, i.e. 50% of requests). Service levels define the severity of the inaccuracy (e.g. there is a grave mistake making the data unusable) and for each one of these levels establishes times in which the AFI operator needs to respond and correct the problem, i.e. ensure that data quality is fine again.

Requirement 2: Completeness and correctness

'Completeness' defines the amount of mandatory and optional data that is available in the data. Authorities will make sure that all mandatory fields shall have a valid value available and that optional values are added where possible.

'Correctness' defines that the data correctly reflects the situation in reality. Authorities will demand and strive to keep this quality as high as possible. For all data categories: correct/incorrect, except for "GNSS coordinates": a margin of error could technically be considered, question of exact coordinates of the HRS (e.g. point of entry)

Requirement 3: Consistency

'Consistency' is the process of keeping information uniform as it moves across a network and between various applications. It defines if the data categories are delivered as is defined in the IDACS data categories as laid down in paragraph 4.3 of this document, and eventually in DATEX II format.

Authorities will make sure that all data categories are delivered via the NAP and will strive to make sure all the data will be in DATEX II format or any machine-readable format fully compatible and interoperable with DATEX II. Authorities will have a contact available for any user of the data to indicate issues to the data or violations to the specifications.

Application of quality requirements

The abovementioned guidelines are the minimum frameworks for the Consortium to adhere to. Some Member States indicated that stricter rules would be challenging to implement considering the current market situation. Moreover, it is not always desirable because some Member States do not necessarily want to have the perfect data on the NAP, but want to give market parties the opportunity to enrich the data. There are also some concerns about whether (especially smaller) alternative fuels infrastructure operators can meet these requirements. Therefore, it is up to individual Member States to determine exact standards. This guideline ensures that there is a minimum quality standard for the available data. Member States are free to implement these more concretely and/or more ambitiously (e.g. in national legislation). It is also conceivable that, for example, scores will be assigned to the categories (for example, that 97% of the data must be "Complete").

5.4 Data quality measurement

The Consortium recognizes the importance of measuring and monitoring the quality of the data. At the same time, they also recognize the complexity of developing a common, unambiguous method that is applicable to all Member States. The entire data chain must also be considered here: it is a responsibility of the entire chain (from CPO to MSP).

Moreover, the different situations in Member States with different choices for architecture of the NAP makes it more challenging. Member States with a central database can perform (major) checks faster than Member States that have a register. The task of data monitoring and control can also be assigned to different organizations. Some national organizations have their own working methods (e.g. problem-based intervention only, sample-based measurement only) which makes it challenging to have a universal way of measuring quality.

A number of testing methods are identified for quality measurement. Looking at current practices in Member States, there are a number of common best practices.

- Test the veracity of the data that is provided (static data)
  Some Member States will do this check at the first technical inspection of the station. A periodic check is also an option.
- Random sampling (dynamic data)
  In order to be able to check the dynamic data as well, we see in some Member States the method whereby a random sampling is used to check to what extent the data corresponds to reality.
- Consistency checks
  The quality of data can also be checked remotely, e.g. by comparing zip codes and cities or streets in order to identify inconsistencies and flaws in the dataset.
- Problem based testing
  In case of reports about incorrect data, quality can be tested. A precondition for this is that there is a possibility where this can be indicated.
- Asking for customer feedback
  This requires a back channel to receive customer feedback. Some Member States has set up a low-threshold feedback channel for consumers and requires operators to reply to a check-list which is periodically sent to them.

5.5 Data quality enforcement

Testing the data for quality is one thing, but how do Member States ensure the data is and remains correct? For this, it must first be clear who owns the data and who is responsible. In many cases this is not the NAP, but the operators.

The data quality can therefore be enforced via various options:

- Legislative obligation to share data on the NAP, including quality requirements
  Here too there are various possibilities: it can be defined precisely or left more freedom in the legislation. Quality criteria can be stated in the legislation, but this can also be indicated somewhat less specifically and, for example, described as data that must be correct and with which the driver receives the correct information at all times.
- Service level agreements as part of data procurement contracts
  This can be an important link: as soon as there is procurement for charging/refuelling infrastructure, governments must be aware of the data issue. They can include requirements regarding data ownership, data provision, but also requirements for data quality.
- Sanctions
  To be agreed as part of a contract with a data provider, or as part of regulation. We see both cases within the IDACS Member States. The sanctions can vary from official warnings to fines.

6. Deliverable 2.2.4: Practical solution for MS without NAP with DATEX II format

6.1 Objective

This deliverable aims to elaborate a proposal for an IT solution for provision of static and dynamic data for Member States not having a National Access Point in DATEX II format – to be integrated through the National Access Points once they are operational.

6.2 Available solutions

Also for this topic, there is not one unambiguous solution that can be chosen. The IT solution for provision of data in DATEX II format depends on the architecture of the NAP.

- **Database**
  For databases, the solution lies with the organization that manages the database. They can make the translation of the data to the DATEX II format. The DATEX II working group has made a mapping between the IDACS data categories and the DATEX II categories. This allows organizations to see which data categories need to be converted and how. The mapping IDACS categories > DATEX II categories is the tool that organizations can use for this. Various member states have applied such a translation to the DATEX II format within their database: the data is converted in their own system.

  Because different formats and protocols can be used within the countries, there is no single solution for a conversion to DATEX II that can be applied for all countries that have a database.

- **Data register**
  With registers, the solution is more complex. First of all, there are registers that link to one (government) organization with a database. In this case, the above solution can be applied: the organization that runs the database will have to do the conversion to the DATEX II format.

  The second option is more complex. Some registers can link to multiple organizations or companies. Also in this case there is the option that the organizations that make the data available are responsible for the conversion to DATEX II.

  However, there is also another solution. A DATEX II conversion tool that is active on the NAP: the alternative fuel operator can convert its own data to DATEX II. The operator can use this tool when a data client asks for data in DATEX II. The Netherlands is developing such a tool for their NAP. Initially it is only suitable for electric charging points data and it is limited to the conversion of OCPI data to DATEX II (because all national CPOs can submit in OCPI). Since it is developed Open Source, the tool could be (partly) adopted by other Member States. With this solution, the operator remains the owner of the data.

6.3 Conclusion

Within the IDACS project the mapping has been made for the IDACS categories and DATEXII categories. Countries then went to work and came up with various solutions ranging from translation into the database system to a converter tool that operators can use to convert their own data.

With the knowledge that has now been collected within the IDACS project, it can be stated that there is not one IT solution that can be provided. There are roughly 3 options:

1. The conversion of data to DATEX II takes place at the organization that manages a database;
2. The conversion takes place with a conversion tool that operators can use themselves to make their data available in DATEX II;
3. Operators directly provide the data in DATEX II.

Because operators do not yet use DATEX II, the third option is not applicable. At the moment, the efforts of the countries are still ongoing to make the data available in DATEX II format via the other two options. This is also because the “Energy Infrastructures” publication, i.e. DATEX II v 3.2, has only been published in June 2021. To conclude, there is currently no single proposal to make for an IT solution for the provision of DATEXII data.

Also, whatever technical solution is chosen, there is a dilemma with every solution. For operators, there is no clear (national) obligation to use the DATEX II format for static and dynamic data. This requirement is only there from the IDACS project. Until this is the case, it is still unclear to what extent DATEX II will actually be used in practice by operators and/or service providers.

Annex 1 - IDACS Data categories Electric Charging Points

#	IDACS requirements	Static Data	Description
1	Location	GNSS	Latitude and longitude of the Charging Station. Latitude and Longitude should be in WGS84 decimal standard.
		Charging Station name	Name or number to identify station for reference purposes
		Street name	Street Name where the station l is located. If available, as not all locations have Street Names.
		House Number	The House Number where the Charging Station is located. If available, as not all Charging Pool locations will be close to a house number.
		Postal Code + Addition (if used)	Postal Code where the Charging station is located. This should be the main Postal Code + adddition (if used) and can include alpha/digit characters.
		City/Location	The City/Town/Location where the Charging station is located.
		Country	Country where the Charging Pool is located. This should be the ISO 3166-1 Alpha-2 Country Codes.
2	Available charge-solutions	Mode	Charging mode according to IEC-61851 terminology Cardinality 1..N (e.g. Mode1-AC-1p; Mode1-AC-3p; Mode2-AC-1p; Mode2-AC-3p, Mode3-AC-3p; Mode4-DC)
		Power	rated power level the EVSE is capable of delivering under normal operation conditions.
3	Available connectors	Type of charging interface	List of available connectors at EVSE (e.g. Type 2 "Mennekes", Combo Type 2)
4	Opening hours, identification and payment methods;	Opening Time	The time periods when a Charging Pool is open to the public. This could indicate the availability of a public charging station, but also indicate the times or days that a private station becomes a public station.
		Timezone	Timezone where the Charging Pool resides. This is used to make sure that the availability is shown correctly and also to make reservation possible in the future.
		Capabilities	available identification and payment methods described as a list
5	Contact info for owner/operator;	Charge Point Operator Name	Name of operator who operates the charging point as displayed in services
		Charge Point Suboperator Name	Name of suboperator who operates the charging point as displayed in services (if available)
		Telephone	Telephone number of the Helpdesk, contracted by the Charge Point Operator that is reachable during the opening hours of the Charging Pool. This can be used by end users to contact the operator in case of problems during charging, reservations etc.

6	Full e-mobility code of the charging point	Charging Point ID	unique ID of the Charging Point. This has to be delivered to identify (and book/reserve) the exact place or spot in the bigger pool of stations. (See IDACS deliverable 1.1.1. for correct format)
	IDACS requirements	**Dynamic Data**	**Description**
7	Availability	Availability	Up-to-date information about the accessibility of a charge point, so that it is clear whether a charge point is in operation or out of order (for example due to a defect or maintenance).
8	Occupation status	Occupation status	Up-to-date information about the occupancy status of a charge point, so that users know if the charge point is available or if the charge point is already occupied.
9	Price ad-hoc charging	Price ad-hoc charging	The ad-hoc price used. This is the price that a user pays to the operator for use of its charging point, without using a pre-registration, contract or subscription with a power supplier, charging point operator or service provider. If there is not 1 fixed ad-hoc rate, the price data that is necessary to calculate the ad-hoc price for a charging session must be provided (such as a price per kWh, a start rate and administration costs).

Annex 2 - IDACS Data categories and related DATEX II v 3.2 data classes

Generic Static Data	Mandatory/ Optional	description	DATEX II v3.2 Main Class	element	subelement	attribute
Refueling/Recharging Station Latitude	M	Latitude of the Refueling/Charging Station. This Latitude will be on the exact location of the Refueling/Charging Station itself. Latitude and Longitude should be in WGS84 decimal standard.	EnergyInfraStructureSite	locationReference	pointByCoodinates	pointCoordinates.latitude
Refueling/Recharging Station Longitude	M	The Longitude of the Refueling/Charging Station. This Longitude will be on the exact location of the Refueling/Charging Station itself. Latitude and Longitude should be in WGS84 decimal standard.		locationReference	pointByCoodinates	pointCoordinates.longitude
Refueling/Recharging Station name	M	Name or number to identify station for reference purposes		name		name
Street name	M, if available	Street Name where the station is located. If available, as not all locations have Street Names.		locationReference.facilityLocation.address	address.addressline	street
House Number	M, if available	The House Number where the Refueling/Charging Station is located. Optional as not all Refueling/Charging Pool locations will be close to a house number.				houseNumber
Postal Code + Addition (if used)	M, if available	Postal Code where the Refueling/Charging station is located. This should be the main Postal Code + adddition (if used) and can include alpha/digit characters.			address	postcode
City/Location	M	The City/Town/Location where the Refueling/Charging station is located.			address	city
Country	M	Country where the Refueling/Charging Pool is located. This should be the ISO 3166-1 Alpha-2 Country Codes.			countryCode	country
Opening Time	M	The time periods when a Refueling/Charging Pool is open to the public. This could indicate the availability of a public Refueling/Charging station, but also indicate the times or days that a private station becomes a public station. This is a complex type of data as it will include several different components to define the times when the Refueling/Charging Pool can be used.				operatingHours

Timezone	M	Timezone where the Refueling/Charging Pool resides. This is used to make sure that the availability is shown correctly and also to make reservation possible in the future.		locationReference	facilityLocation	timeZone
Capabilities	M	available identification and payment methods described as a list	EnergyInfraStructureStation			authenticationAndIndentificationMethods
Telephone	M	Telephone number of the Helpdesk, contracted by the Refueling/Charging Point Operator that is reachable during the opening hours of the Refueling/Charging Pool. This can be used by end users to contact the operator in case of problems during Refueling/Charging, reservations etc. Format should follow European Union style guide and contains the following elements: +Country code <space> complete number including the regional code (if there is one) in one separate block with the starting zero. Extension numbers will be added with a dash directly after the complete number. No other dashes, spaces or brackets can be used in the telephone number.	EnergyInfraStructureSite	operator	organisationUnit.contactinformation	telephoneNumber
Refueling/Recharging Point Operator Name	M	Name of operator who operates the Refueling/Charging point as displayed in services			OrganisationSpecification	name
Refueling/Recharging Point Suboperator Name	M, if available	Name of suboperator who operates the Refueling/Charging point as displayed in services		operator.suborganisation		name
Refueling/Recharging Point Operator Code	O	The Id of the Refueling/Charging Point Operator		operator	OrganisationSpecification	nationalOrganisationNumber
Refueling/Recharging Point Owner Name	O	Name of legal owner		owner		name
Refueling/Recharging Point Operator Website	O	Website URL of the Refueling/Charging Point Operator. This can be used by end users to find either contact details or more details regarding access and payment methods. This should be the web url without http:// or https:// and should consist of a www (or other subdomain). Maindomain. Country or type code.		operator	OrganisationSpecification	linkToGeneralInformation

Last-StaticData-Update-Timestamp	O	DateTime on which the static data has been changed or upgraded. This date can be used for transactional systems to only update those Refueling/Charging Stations that have changed data. This will limit the amount of data transferred through those systems. DateTime needs to be indicated according to ISO 8601 and All timestamps SHALL be in UTC.	EnergyInfraStructureSite	lastUpdated

Level	Dynamic Data	M/O	description	DATEX II v3.2 Main Class	element	subelement	attribute
3	Occupation Status	M	The Refill/Charging Point is able to start a new (charging) session.	EnergyInfrastructureSiteStatus	EnergyInfrastructureStationStatus	RefillpointStatus	status
3	Availability		Availability (if the station is operational/ non-operational)			isAvailable	
3	Price ad-hoc charging	M	Price for ad-hoc Refueling/Charging			electricEnergyMixOverride.energyPricingPolicy	pricePerUnit/pricePerMinute/pricePerHour
3	Last-DynamicData-Update-Timestamp	O	DateTime on which the dynamic data has been changed or upgraded. This date can be used for transactional systems to only update those Refueling/Charging Points that have changed data. This will limit the amount of data transferred through those systems. DateTime needs to be indicated according to ISO 8601 and All timestamps SHALL be in UTC.	EnergyInfrastructureSiteStatus			lastUpdated

EV Charging Infra Specifics					
Charging Point ID	M	unique ID of the Charging Point. This has to be delivered to identify (and book/reserve) the exact place or spot in the bigger pool of stations. See deliverable 1.1.1. for correct format	electricChargingPoint	externalIdentifier	
Mode	M	Charging mode according to IEC-61851 terminology Cardinality 1..N		connector	chargingMode
Power	M	rated power level the EVSE is capable of delivering under normal operation conditions.		availableChargingPower	
Type of charging interface	M	list of available connectors at EVSE		connector	connectorType
Energy Source	O	To be indicated as a percentage of green electricity. % electricity from renewable energy		EnergyMix	ElectricEnergySourceRatio
Max Power at Socket	O	The maximum amount of power that can be obtained from the Plug during a Charging session. This value should be defined in xxx Watt and can be used to calculate the maximum Charging time and to determine compatibility of the connector and vehicle.		connector	maxPowerAtSocket
Voltage	O	The maximum voltage that can be obtained from the Plug during a Charging session. This value should be defined in xxx Volts and can be used to calculate the maximum Charging time and to determine compatibility of the connector and vehicle.		connector	voltage

Current	O	Sum of the maximum current over all phases, reached during this ChargingPeriod: defined in A (Ampere).	connector	maximumCurrent
Connector format	O	The format of the connector, whether it is a socket or a plug.	connector	connectorFormat
H2 refueling infra specifics				
process protocol	O		hydrogenRefillPoint	processProtocol
refill solution	O			refillSolution
renewable sources ration	O			renewableSourcesRatio
AlternativeFuels infra specifics				
organic gas type	O		OrganicGasRefillPoint	organicGasType
bioethanol percentage	O		PetrolRefillPoint	bioethanolPercentage
bioethanol type	O			bioethanolType
octane	O			octane
petrol type	O			petrolType