

**Support Document to Deliverable D2.4** 

Demand Response Registration Digital (D2RD) framework for DR programs models, including the short and real-time DR models conceived and developed in the scope of DREAM-GO – Final release







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## Demand Response Registration Digital (D2RD) framework for DR programs models, including the short and real-time DR models conceived and developed in the scope of DREAM-GO – Final release

This document has the purpose of supporting the Demand Response Registration Digital (D2RD) framework for Demand Response (DR) programs and models, including the short and real-time DR models conceived and developed in the scope of DREAM-GO, which is envisaged in Task 2.3, and the output of Deliverable 2.4. This document results from an evolution of the tool presented in Deliverable 2.2. The new version takes advantage of more detailed properties for the considered entities and uses them for more sophisticated DR models' conceptualization and simulation. The DR registration framework is developed to include the short and real-time DR programs and models conceived and designed in the scope of the project. This deliverable is important to support the project execution and the outcomes of the subsequent work packages with a strong conception and modelling approach provided by this task. It is also important because it allows considering the feedback from the simulation and experimental studies in the models resulting from the project and the incorporation in the D2RD framework of the most updated and adequate models.

The D2RD framework was developed as a component of Tools Control Center (TOOCC) system, described in Deliverable 3.1. An architectural perspective of the D2RD integrated into TOOCC is represented in Figure 1. The diagram shows the interaction of the several components for register the consumers information, such as the other entities, and simulate DR models. The framework takes advantage of the use of real tariffs and real-time pricing. When the model is prepared, the DR manager can execute the DR algorithm and then proceed to the simulation in real-time in a laboratory which is able to simulate a house and its appliances. In this way, it is possible to analyse the impact of different entities and models under DR management.



Figure 1 – Architectural model representation of D2RD integration in TOOCC

The developed framework presents an interface between the user and the DR programs implemented in the scope of DREAM-GO. The conception of the program and models is based on the definition of a set of attributes that are used to characterize the DR programs and presented in Deliverable 2.3. For each identified characteristic, a range or a set of possible assigned values are identified. This tool supported the subsequent conception and development of the DR programs and models, which are classified in several types according to the set of characteristics they present.

The DR programs are modelled considering the participating entities (Independent System Operators (ISOs), curtailment service providers, aggregators including Virtual Power Players (VPP), consumers of several types, Balance Responsible Parties (BRP), and Energy Communities), the ways that can be used for their interaction in short and real-time DR events, the required technologic means, and the DR contracts and consumer remuneration methodologies.

Figure 2 shows the consumer's registration interface page, which allows to register new consumers and edit the existing ones. The registration of new consumers considers the consumption profiles that will be used by DR manager to apply the existing DR models. This and other profiles can be imported from a file (Figure 3), simplifying the introduction of values, especially in cases when the required information is extensive.

Consumer Details					
Name	Cons	umer 1			
Consumer Type	House	eholds			\$
Consumption Profile D	etails				
Power Unit	kW				ŧ
Profile		🗁 Import From Ex	cel	X Delete Profile	
	49	12:00:00	12:14:59	445,8603387	
	50	12:15:00	12:29:59	448,5323019	
	51	12:30:00	12:44:59	455,5885428	
	52	12:45:00	12:59:59	460,1421702	
	53	13:00:00	13:14:59	463,8678654	
	54	13:15:00	13:29:59	460,1892118	

Figure 2 – Consumer's registration interface page

Import Profile	×
Select Profile File (.json)   Escolher ficheiro Nenhum ficheiro selecionado	
	Close Import

Figure 3 – Importing consumption profile from a file

The Figure 4 shows the creation and configuration page for producers. These producers can be considered as prosumers, by associating their information to an existing consumer.

Producer Details		
Name	Producer 1	
Consumer	This producer is also a registered consumer?	
Correspondence	Yes	
	No	
	Select the Consumer:	
	Consumer 4	\$
Tariff	Tariff 1	\$
Production Technologi	ies Details	
X Elolic Technology	X Production Technology 2	
Name	Elolic Technology	
Technology Type	Eolic	\$
Technology Type Maximum Power Production	Eolic 10 © kW	¢ \$

Figure 4 – Producer's registration interface page

One producer can have one or more production technologies, which can be from different types (e.g., wind, photovoltaic, etc.). For each one, information must be filled about the maximum production capacity and the production profile that will also be considered by the DR manager.Figure 5 shows an interface where the DR Aggregators can manage their DR Programs, according to the characteristics referenced in the previous deliverables, which allow the execution of the conceived models in the project scope.

Name	Program 1							
Description	Description							
Program Type	Personalized						4	
DR Provider	Algoritm MaxSORP					3		
Minimum Flexibility Size	0			kW				
Notification Time	00			15	:	00		
Load Type	Other							
Tariffs	+ Add Ta	ariff						
		#	Sel	ected Tariff	т	ariff Appli	cation	
	×	1	Tariff	1	¢ All		\$	
Events	+ Add Ev	vent						
		# P	eriod	Max. Even	ts Dur	ation of Ea	ch Event	
				1	00	1 05	; or	

Figure 5 – DR Aggregator's registration interface page

The tariffs for consumption and production used by the models can be based, or be equal, to real tariffs from several countries. Figure 6 shows the form to be filled by a retailer to

create and personalize its tariffs for consumption. The tariffs prices can be filled with actual tariffs values or real-time pricing. This allows better analysis of the impact of the real pricing methods or experiment with new ones. Tariffs personalization makes the system more flexible.

Consumption Tariffs List	Consumption Tariff De	etails				
+ Add	Name	Tariff 6				
Limport From DB	Description	Austria Strom Aqua Garant12				
Name	Consumer Type	Comm	nercial			\$
Tariff 1	Currency	EUR				\$
Tariff 2						
Tariff 3	Price Details					
Tariff 4	Tariff Type	Tariff Type Dynamic				¢
Tariff 5	Number of Periods	Number of Periods 96 (Each 15 minutes)				\$
Tariff 6	Prices		🕞 Import From E	ixcel	🗙 Reset Tariff	
		46	11:15:00	11:29:59	0.045	
		47	11:30:00	11:44:59	0.045	
		48	11:45:00	11:59:59	0.045	
		49	12:00:00	12:14:59	0.045	
		50	12:15:00	12:29:59	0.045	

Figure 6 – Retailer Consumption Tariff's registration interface page

Figure 7 shows another registration interface, which is directed to consumers' registration of their flexibility for energy reduction/increase at each moment, which can correspond to different time intervals (e.g.: each 15 minutes).

Consumer	Consumer 1						
DR Program	Program 1						
Elasticity		😂 Import From Excel		× Reset			
	14	03:15:00	03:29:59	0,53			
	15	03:30:00	03:44:59	0,53			
	16	03:45:00	03:59:59	0,53			
	17	04:00:00	04:14:59	0,53			
	18	04:15:00	04:29:59	0,53			
	19	04:30:00	04:44:59	0,53			
Max Price Variation		🗁 Import From Excel		× Reset			
	72	17:45:00	17:59:59	15,92420243			

Figure 7 – Consumer's registration of flexibility for elasticity and price reduction and increase interface page

It can be seen in Figure 7 that consumers can define their consumption elasticity for each hour of the considered day, which is a value that represents the expected variation of the

consumption according to the energy price. This means that when the price increases, the consumption is expected to decrease, and when the price decreases, the consumption is expected to increase. The maximum consumption increase and decrease can be specified by the consumer, as well as the corresponding prices. This type of information can be used by aggregators and DR managers to execute algorithms that manage the DR at each specific moment, considering variations in the energy price.

The obtained results not only can demonstrate the general impact of DR on the whole network but also the influence of a single entity in the model. Moreover, it can be also observed the impact of the DR in the consumption profile of each entity.

The D2RD framework thus enables consumers to register their flexibility, their expected consumption, and their envisaged costs for using such flexibility. This is important information that can be managed by different entities, considering each consumer in particular, or as a group by aggregating the information from different consumers.