

# REPORT

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## **Work package: WP08**

*Proposals for the reduction of barriers and the creation of legislative instruments and regulations to increase the biogas use for heating, cooling and power generation*

Start data of the action: 1<sup>st</sup> of December 2006

End data of the action: 31<sup>st</sup> of July 2009

### **Deliverable: D25**

**A list of proposals for the reduction of barriers to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level**

### **Deliverable: D26**

**A list of proposals for the creation of legislative instruments to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level**

### **Deliverable: D28**

**A list of recommendations for reduction of financial barriers. Proposals for effective public and/or combined public/ private financial support for measures directed to the increase of using RES for heating and cooling**

Month of completion: 32 (July 2009)

Responsible partners:

D25: DBI Gas- und Umwelttechnik GmbH

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D26: Energy Experts Int. BV (EEI)

D28: GRUPPO IMPRESA FINANCE s.r.l. (GIF)

Date: 31 July 2009

**REDUBAR**

**WP08 D25, D26 & D28**

## **Abstract**

This document combines the deliverables D25, D26 and D28. The tasks that are written in the Annex II, has subsequently lead to a working method which is described in chapter 1. The chosen working method had to guarantee that consultations with diverse stakeholders of the different partner countries were streamlined.

Biomethane matrices were used to identify all obstacles and barriers for all points off the defined supply chain. The chosen working method lead to some additional deliverables, not mentioned in the Annex I, REDUBAR EIE/06/221/SI2.442663.

The chosen working method is general for generating a list of proposals for the reduction of barriers (D25), a list of proposals for the creation of legislative instruments (D26) both to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level and a list of recommendations for reduction of financial barriers. Proposals for effective public and/or combined public/ private financial support for measures directed to the increase of using RES for heating and cooling (D28). To complete this deliverable consultations with diverse stakeholders were made. We would like to thank the following stakeholders for their additions<sup>1</sup>:

- Mr. R. Erler – Projectleader DBI Gastechnologisches Institut gGmbH - Germany
- Mr. J. Ziegenbalg - gas supplier – Germany
- Mr. Dipl.-Ing. Werner Plettenberg - CTO Chief technical officer - GreenGas Produktionsanlage Rathenow GmbH & Co. KG – Germany
- Mrs. Dr. Claudia Brückner – Referentin - Landesamt für Umwelt, Landwirtschaft und Geologie – Germany
- Mr. Gecse, János (last name, first name) - biogas plant manager (CHP unit, no injection) - Pálhalmai Agrospeciál Kft - Hungary
- Mr. Dr. ing. Giorgio Tomaselli, Engineer; plants engineering – Italy.
- Mr. Arūnas Dovydaitis - Head of the technical standards division - Joint stock company LIETUVOS DUJOS – Lithuania
- Mrs. ir. Rosemarie van Eekelen- Consultant - Gas Distribution Systems - Kiwa Gas Technology – The Netherlands
- Mrs. Eliza Dyakowska - Head of the New Technology Department - The Gas Transmission Operator GAZ-SYSTEM S.A – Poland
- Mr. Robert Kłos-Kufel - Research & Development Specialist - Carpathian Distribution System Operator – Poland
- All specialists of the partners in the REDUBAR project.

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<sup>1</sup> Disclaimer: We apologize for those who were consulted but aren't mentioned in the list. We want to let you know that we did appreciate all additions and want to thank you for your additions.

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# 1. The working method

## 1.1 Introduction

First task in this working package is to set up an examination of all identified barriers for all points of the supply chain defined in WP7. Drawing up of practice relevant proposals for reduction/removing the barriers. The practice relevance will be guaranteed by intensive consultations with diverse target group actors. The highest priority has the biogas injection into the pipeline grid: if this bottleneck is not removed, other measures are useless. (Step 1).

For fulfilling this task a model is used, the biomethane-matrix. The biomethane matrix has been developed by the companies Kiwa Gas Technology, Gasunie Engineering and Technology, KEMA and NUON Tecno in the year 2007. This methodology is described in the report "State of the art of hydrogen- and biogas injection"<sup>2</sup>).

The biomethane-matrix has been adapted to the defined supply chain of WP7. The existing regulations and barriers were fixed in WP3 and WP4 and the main bottleneck for increasing the use of biogas, the biogas injection into the natural gas pipeline grid, was analyzed in WP5 and WP6. The biomethane-matrix has been set up for each country of the partners.

To guarantee the practice relevance diverse target group actors has been intensively consulted by interviews based on a questionnaire.

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<sup>2</sup> E.A. Polman, R.N. van Eekelen (Kiwa Gas Technology) E.Huijzer, S. Jager , L. Goorix, M. Theelen (NUON Tecno), O. Florisson, G.C. Tiekstra (Gasunie Engineering and Technology), J. van Wingerden, R. van Ommen, T.van Wingerden (KEMA), State of the art of hydrogen- and biogas injection , November 2007

## 1.2 An examination of all identified barriers for all points of the supply chain

For a common understanding and use of the biomethane-matrix, some parts need to be explained. First of all there's the defined supply chain used in the REDUBAR-project. Secondly all identified barriers will be discussed.

### 1.2.1 The defined supply chain

In the following table each part of the defined supply chain is explained in a few sentences.




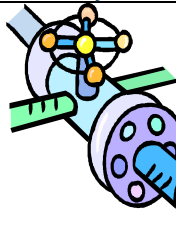
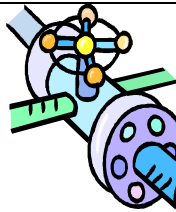

<b>Production</b>		<ul style="list-style-type: none"> <li>• Production of biogas with industrial waste as a source.</li> <li>• Production of biogas with household waste as a source.</li> <li>• Production of biogas with agricultural waste as a source and also co-fermentation with corn or other sources.</li> <li>• Production of biogas with renewable sources (RES). Not only fermentation but also gasification (SNG-production).</li> </ul>
<b>Upgrading</b>		<p>Chemical and physical upgrading by membrane-techniques, PSA or other techniques, odourisation combined with other physical conditions of the natural gas like temperature and pressure.</p>
<b>Injection</b>		<p>Injection into the gas-grid combined with measuring the biomethane and storage before injection.</p>
<b>Transportation</b>		<p>The transportation of biogas in the national gas-grid. (Between entry-exit points <math>\pm</math> 60-70 baro).</p>
<b>Distribution</b>		<p>The distribution of biogas in regional and local gas grids. (Between gas-receiving -station up till the gas meter of end-user <math>\pm</math> 8-4-1 bar and 30/100 mbar).</p>
<b>End-user</b>		<p>The net of the end user and his machines (like CHP, boiler etc.)</p>

Table 1:  
 The defined biomethane supply chain.

## 1.2.2 All identified obstacles and barriers<sup>3</sup>

In the following table all identified obstacles and barriers are (re)introduced in a few sentences.

Note that the table isn't a fixed table; some deliverables are so called 'working papers'.

Economics	Investments	These are the costs for purchasing a fermentation device, an injection system, an upgrading system or the costs for aggravation the transportation and distribution nets.
	Operational costs	These are the costs for operating a production plant and/or upgrading and injection device and/ or the transportation and distribution nets till the net of the end-user. Due to the fact that the value of the raw material (like corn) depends on market prices the operational costs may also be highly dependable especially by co-fermentation.
	Maintenance costs	These are the costs for maintenance. If maintenance costs are incidentally high a production plant may have to shut down. This represents an obstacle.
	subsidy	The (none) existence of subsidies for production- or upgrading devices may or may not appear as an obstacle.
	tariff	The tariff is a fixed price between production plants and transportation/ distribution nets and transportation/ distribution nets an end-user.
Administrative	image damage (grid-owner)	Explosions or other not wanted events at production plants may lead to image damage of grid-owners.
	experience	How the public experience the production sites (think of sight pollution) or biogas/ biomethane as a fuel.
	environmental value	The public and NGO's (Non Governmental Organizations) may discuss the environmental value, especially if biomass has to be transported long distances.
	Promotion and Information	Good promotion and information have to influence the publics opinion towards biogas/ biomethane.
	Administrative obstacles	Administrative obstacles are discussed in Deliverable 5 (D5) and written down in chapter 3.3.3 of this deliverable.
	Definition of biogas	The specs of biogas/ biomethane need to be clear (and well chosen) to avoid problems along the supply chain.
Environment	emissions	Emissions are regulated in the EU. The emissions of production sights need to be clarified. Momentarily there isn't enough experience on this matter.

<sup>3</sup> In deliverable 6 (D6) in chapter 3.1 we've introduced definitions for obstacles and barriers, instead of only discussing "barriers". The main difference between them in short: An obstacle is a difficult problem that may **slow down** the process and a barrier may even result in a **total hold** of the process (a so called "showstopper").

	CO2-savings	The CO2 savings are clear but may have to be clarified for every production sight.
Legal instructions	Quality requirements norms and directives	The quality requirements, norms and directives of biomethane have to be clear (and written down as a legal instruction).
	Test-gasses (and other test requirements like test-frequency)	The possibility of hydrogen in biomethane may result in the need of special test-gasses and new test frequencies.
	Allocation (continuity of supply and quality who decides quantities)	This obstacle appears in the transportation and distribution of biomethane (especially if large amounts have to be transported/ distributed).
	regulation (tariffs for transport, maintenance)	Tariffs need to be regulated. There are many uncertainties especially for the grid owners if the transportation/ distribution of biomethane are obligatorily.
	certification	A certification for the production process (that results in a certain gas-quality) isn't fixed (yet)
	EU directive (based on participation of stakeholders)	Article 6 of the directive 2003/55/EC of 26 June 2003 hasn't been implemented definitively (it's on-going and based on the participation of stake-holders).

Table 2:  
 Different obstacles and barriers that may appear along the pre-defined supply chain.

### 1.3 The Biomethane Matrices<sup>4</sup>

For every partner country a biomethane-matrix has been developed. In the biomethane-matrix all identified barriers and obstacles are fixed onto the defined supply chain.

The biomethane-matrices are used as a starting point for setting up an interview-form for consulting diverse target group actors.

<sup>4</sup> The biomethane matrix has been developed by the companies Kiwa Gas Technology, Gasunie Engineering and Technology, KEMA and NUON Tecno in the year 2007. This methodology is described in the report "State of the art of hydrogen- and biogas injection. E.A. Polman, R.N. van Eekelen (Kiwa Gas Technology) E.Huijzer, S. Jager , L. Goorix, M. Theelen (NUON Tecno), O. Florisson, G.C. Tiekstra (Gasunie Engineering and Technology), J. van Wingerden, R. van Ommen, T.van Wingerden (KEMA), State of the art of hydrogen- and biogas injection , November 2007

There are 5 different answers that can be given on each point of the supply chain:

- 1 Not relevant: the possible obstacle or barrier doesn't appear at this point of the supply chain.
- 2 Implementation straight forward: on this point of the supply chain a possible obstacle or barrier has already been or is easy to overcome.
- 3 Need further investigation: on this point of the supply chain further investigation is needed if a *possible* obstacle or barrier appears.
- 4 Resolvable issue (obstacle): on this point of the supply chain the possible obstacle or barrier appears as an obstacle.
- 5 Showstopper (barrier): on this point of the supply chain the possible obstacle or barrier appears as a barrier.

The following colors and/or numbers are used in the biomethane matrices:

not relevant	1
Implementation straight forward	2
need further investigation	3
resolvable issue (Obstacle)	4
showstopper (Barrier)	5

In the next paragraphs the different biomethane-matrices of each partner country will be discussed. Partner countries have consulted diverse target groups for adjusting and fixing the biomethane matrices.

### 1.3.1 Biomethane-matrix Czech Republic

In table 3 the Czech Biomethane-matrix is presented. This matrix has been fixed by the Institute of Chemical Technology in Prague (ICT). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further in chapters 2 (D25), 3 (D26) and 4 (D28).

			Production of biogas	Production Households waste	Production Agr. Waste	Production RES	Upgrading to natural gas quality	Injection	Transportation national	Distribution regional and local	End User CHP/ CHPC cooking fuel cell
not relevant	=	1									
implementation straight forward	=	2									
need further investigation	=	3									
resolveable issue (Obstacle)	=	4									
showstopper (Barriere)	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintainance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
		image damage (grid-owner)									
<b>Administrative</b>	D25	(D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
		Promotion and Information									
	D25	(D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>		Quality requirements norms and									
	D26	directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
		Test-gasses (D05) (and other									
	D26	test requirements like test-									
		frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
		Allocation (D05) (continuity of									
	D26	supply and quality who decides	p1	p2	p3	p4	p5	p6	p7	p8	p9
		quantities)									
		regulation (tariffs for transport,									
	D26	maintainance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
		certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
		EU directive (D05) (based on									
	D26	participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 3:  
 Biomethane Matrix Czech Republic

#### Discussion:

- There are 2 barriers. Both barriers are concerned with the production of biogas with industrial waste as a source. Because of the fact that there are other production methods, these barriers will not act as a showstopper in the process.
- Most obstacles are categorized as Economical obstacles and appear along the whole supply chain.

### 1.3.2 Biomethane-matrix Germany

In table 4 the German Biomethane-matrix is presented. This matrix has been fixed by DBI Gas and Environmental Technology (DBI) and the Society for the Promotion of Renewable Energies (FEE). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further in chapters 2 (D25), 3 (D26) and 4 (D28).

			Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas								
			Industr. Waste	Households waste	Agr. Waste	RES		to natural gas quality	(inter) national	regional and local	CHP/ CHPC cooking fuel cell
not relevant	=	1									
implementation straight forward	=	2									
need further investigation	=	3									
resolveable issue (Obstacle)	=	4									
showstopper (Barriere)	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintenance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
<b>Administrative</b>	D25	image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gasses (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintenance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 4:  
 Biomethane Matrix Germany

#### Discussion:

- There's one barrier mentioned in the German biomethane-matrix. In the remarks they write: "Regulations on cross-boundary delivery of biomethane within the EU or between Member States is missing". This barrier appears at the cross-boundary delivery of biomethane and doesn't affect the national transportation or distribution (depending on the injection point) of biomethane. Therefore this barrier may not be an immediate showstopper but it may affect the process on the long term.
- Most obstacles are categorized as "legal instructions".
- Most financial obstacles do not appear on the supply chain.

### 1.3.2.1 Revised Biomethane Matrix of Germany

The Biomethane matrix of Germany was revised by Dipl.-Ing. Werner Plettenberg. Mr. Plettenberg is a very experienced biogas and biofuel engineer and now manager of one of the most modern biomethane plants in Germany (uniting, 1st on-site CHP to produce just the heat needed for the digestion and upgrading processes, 2nd injection into the grid and 3rd use of biomethane as automotive fuel at the filling stations of GASAG, that is the gas company of Berlin where most of the taxis run on natural gas). Mr. Plettenberg recommended to integrate some extra barriers into the biomethane matrix, that's why this revised biomethane matrix is presented in this deliverable. Because of the size of the matrix its presented in table 4a on the next page. On this page we will discuss this revised biomethane matrix.

#### Discussion:

- Some additional obstacles/ barriers were integrated in the matrix namely:
  - Lack of priority
  - Missing biomethane strategy
  - Locally growing scarcity of substrates from industrial crops / arable land
  - Chances for higher prices of competing crops lead to reluctance for concluding long-term contracts and deficits in substrates
  - Reluctance of banks for crediting
  - Monopolistic or dominance ownership
  - No profitability
- The 'lack of priority' is already solved in Germany but important on EU-scale
- Missing a biomethane strategy is partly solved in Germany and still important also on a EU-scale.
- The last presented obstacle "No profitability" may result in a barrier and showstopper
- The additions of Mr. Plettenberg were merely handled in former Deliverables and in some cases they were hidden in the 'remarks'. For instance "lack of priority" was 'hidden' under regulation, the Dutch among others wrote in the remarks: If transportation (like electricity) of biomethane is obligatorily (there's a priority), the grid owners need to make expensive additions. There are the following uncertainties:
  - 1. How the extra costs (investments and operational costs) are fixed in the tariffs for transportation.
  - 2. What is the position of the grid owner in making negotiations?
  - 3. If community costs are well taken into account.

**Scale of Evaluation:**

not relevant	=	1
implementation straight forward	=	2
needs further investigation / activities	=	3
resolvable issue (Obstacle)	=	4
showstopper (Barriere)	=	5
not contested to by interviewed	=	6

Area of influence in the added-value chain	D	Activity of influence in the added-value chain	Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas from household waste	of biogas from agrarian waste	of biogas from industrial crops (RES)	of biogas to bio-methane in local natural gas quality	of bio-methane into the natural gas grid	(inter) national	regional and local	CHP / CHPC, cooking, transport fuel, industrial burners	
			Substrates for biogas production phase				Upgrading phase	Injection phase	Transport and distribution phase		Applications
<b>General</b>	D29	Lack of priority (D6)	t1 (1)	t2 (1)	t3 (1)	t4 (1)	t5 (1)	t6 (1)	t7 (1)	t8 (1)	t9 (1)
	D29	Missing biomethane strategy (D6)	u1 (2)	u2 (2)	u3 (2)	u4 (2)	u5 (2)	u6 (2)	u7 (2)	u8 (2)	u9 (2)
	D29	Locally growing scarcity of substrates from industrial crops / arable land (D06)	v1	v2	v3	v4	v5	v6	v7	v8	v9
	D29	Chances for higher prices of competing crops lead to reluctance for concluding long-term contracts and deficits in substrates (D06)	w1	w2	w3	w4	w5	w6	w7	w8	w9
<b>Economics</b>	D28	Investment costs (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintenance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	Missing subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	Missing tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
	D29	Reluctance of banks for crediting (D06)	x1	x2	x3	x4	x5	x6	x7	x8	x9
	D29	Monopolistic or dominance ownership (D?)	y1	y2	y3	y4	y5	y6	y7	y8	y9
	D29	No profitability (D06)	z1	z2	z3	z4	z5	z6	z7	z8	z9
<b>Administrative</b>	D25	image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gases (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintenance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

**Remarks**

- 1) Resolved in Germany, but importance scale 4 to 5 for EU
- 2) Partially solved in Germany, but importance scale 4 to 5 for EU

**Table 4a:**  
**Revised Biomethane matrix of Germany**

### 1.3.3 Biomethane-matrix Greece

In table 5 the Greece Biomethane-matrix is presented. This matrix has been fixed by the Centre for Renewable Energy Sources (CRES). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further in chapters 2 (D25), 3 (D26) and 4 (D28).

			Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas				to natural gas quality		national	regional and local	CHP/ CHPC cooking fuel cell
not relevant	=	1	Industr. Waste	Housholds waste	Agr. Waste	RES					
implementation straight forward	=	2									
need further investigation	=	3									
resolveable issue (Obstacle)	=	4									
showstopper (Barriere)	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintainance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
<b>Administrative</b>	D25	image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gasses (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintainance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 5:  
 Biomethane Matrix Greece

#### Discussion:

- There're no barriers identified (yet).
- There're very many presented obstacles/ barriers that need further investigation; if, where and how they appear on the defined supply chain.
- Most identified obstacles are categorized as "administrative".

### 1.3.4 Biomethane-matrix Hungary

In table 6 the Hungarian Biomethane-matrix is presented. This matrix has been fixed by the University of Miskolc (UNI MISKOLC) and the HUNGARIAN SCIENTIFIC SOCIETY OF ENERGY ECONOMICS (ETE). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further chapters 2 (D25), 3 (D26) and 4 (D28).

			Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas								
			Industr. Waste	Housholds waste	Agr. Waste	RES		to natural gas quality	national	regional and local	CHP/ CHPC cooking fuel cell
not relevant	=	1									
implementation straight forward	=	2									
need further investigation	=	3									
resolveable issue (Obstacle)	=	4									
showstopper (Barriere)	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintainance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
		image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
<b>Administrative</b>	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gasses (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintainance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 6:  
 Biomethane Matrix Hungary

#### Discussion:

- There're no barriers identified (yet).
- There're many presented obstacles/ barriers that need further investigation; if, where and how they appear on the defined supply chain.
- Most identified obstacles are categorized as "administrative" and "economics".

### 1.3.5 Biomethane-matrix Italy

In table 7 the Italian Biomethane-matrix is presented. This matrix has been fixed by the GRUPPO IMPRESA FINANCE s.r.l. (GIF). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further chapters 2 (D25), 3 (D26) and 4 (D28).

			Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas								
			Indust. Waste	Housholds waste	Agr. Waste	RES	to natural gas quality		national	regional and local	CHP/ CHPC cooking fuel cell
not relevant	=	1									
implementation straight forward	=	2									
need further investigation	=	3									
resolveable issue (Obstacle)	=	4									
showstopper (Barriere)	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintainance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
		image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
<b>Administrative</b>	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gasses (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintainance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 7:  
 Biomethane Matrix Italy

#### Discussion:

- There're several barriers identified along the supply chain, mainly focusing on the investments (costs) and the experience of the public. In the remarks it is noticed that subsidies need to overcome high investment costs so that this item may not appear as a possible showstopper. Furthermore in the remarks it is written that the public opinion towards biogas has to be changed and that this (the public opinion) may possible appear as a showstopper.
- Most identified obstacles are categorized as "economics".

### 1.3.6 Biomethane-matrix Lithuania

In table 8 the Lithuanian Biomethane-matrix is presented. This matrix has been fixed by the Lithuanian Energy Institute (LEI). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further chapters 2 (D25), 3 (D26) and 4 (D28).

		Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User	
		of biogas				to natural gas		national	regional and	CHP/ CHPC	
		Industr.	Households	Agr. Waste	RES	quality			local	cooking fuel	
		Waste	waste							cell	
<b>not relevant</b>	=	1									
<b>implementation straight forward</b>	=	2									
<b>need further investigation</b>	=	3									
<b>resolveable issue (Obstacle)</b>	=	4									
<b>showstopper (Barriere)</b>	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintenance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
<b>Administrative</b>	D25	image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gasses (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintenance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 8:  
 Biomethane Matrix Lithuania

Discussion:

- There're no barriers identified (yet).
- There're many presented obstacles/ barriers that need further investigation; if, where and how they appear on the defined supply chain.
- Most identified obstacles are categorized as "administrative" and "economics".

### 1.3.7 Biomethane-matrix the Netherlands

In table 9 the Dutch Biomethane-matrix is presented. This matrix has been developed by the companies Kiwa Gas Technology, Gasunie Engineering and Technology, KEMA and NUON Tecno in the year 2007, and has been adjusted by Energy Experts Int. (EEI) based on the findings of the REDUBAR project. A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further chapters 2 (D25), 3 (D26) and 4 (D28).

			Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas				to natural gas quality		national	regional and local	CHP/ CHPC cooking fuel cell
not relevant	=	1	Industr. Waste	Households waste	Agr. Waste	RES					
implementation straight forward	=	2									
need further investigation	=	3									
resolveable issue (Obstacle)	=	4									
showstopper (Barriere)	=	5									
<b>Economics</b>	D28	Investments (D10)	a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28	Operational costs (D10)	b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28	Maintainance costs (D10)	c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28	subsidy (D10)	d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28	tariff (D05)	e1	e2	e3	e4	e5	e6	e7	e8	e9
<b>Administrative</b>	D25	image damage (grid-owner) (D10)	f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25	experience (D10)	g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25	environmental value (D10)	h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25	Promotion and Information (D05/D10)	i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25	Administrative obstacles (D05)	j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25	Definition of biogas (D10)	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25	emissions (D10)	l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25	CO2-savings (D10)	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26	Quality requirements norms and directives (D05)	n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26	Test-gasses (D05) (and other test requirements like test-frequency)	o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26	Allocation (D05) (continuity of supply and quality who decides quantities)	p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26	regulation (tariffs for transport, maintainance) (D05, costs)	q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26	certification	r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26	EU directive (D05) (based on participation of stakeholders)	s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 9:  
 Biomethane Matrix of the Netherlands

#### Discussion:

- There're no barriers identified, but in the remarks is written that public opinion (their experience) may appear as a possible showstopper.
- There're many presented obstacles/ barriers that need further investigation; if, where and how they appear on the defined supply chain. In the remarks it is very well clarified what needs to be investigated and even the fact that investigations are already in progress (note remark k7: "The specs for biomethane aren't clarified for the transportation net. A pilot study where biomethane is injected in the transportation net and the effects on the pipes and measuring equipment are measured is running in 2009 (by GASUNIE, [www.gasunie.nl](http://www.gasunie.nl))".
- Most identified obstacles are categorized as "administrative" and "economics".

### 1.3.8 Biomethane-matrix Poland

In table 10 the Polish Biomethane-matrix is presented. This matrix has been fixed by the Oil and Gas Institute Krakow (INIG). A few easily noticed observations are discussed under the matrix. The matrix and its results will be discussed further chapters 2 (D25), 3 (D26) and 4 (D28).

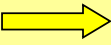
Biomethane supply chain 			Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
			of biogas				to natural gas quality		national	regional and local	CHP/ CHPC cooking fuel cell
			Industr. Waste	Housholds waste	Agr. Waste	RES					
	not relevant	=									
	implementation straight forward	=									
	need further investigation	=									
	resolveable issue (Obstacle)	=									
	showstopper (Barriere)	=									
<b>Economics</b>	D28 Investments (D10)		a1	a2	a3	a4	a5	a6	a7	a8	a9
	D28 Operational costs (D10)		b1	b2	b3	b4	b5	b6	b7	b8	b9
	D28 Maintainance costs (D10)		c1	c2	c3	c4	c5	c6	c7	c8	c9
	D28 subsidy (D10)		d1	d2	d3	d4	d5	d6	d7	d8	d9
	D28 tariff (D05)		e1	e2	e3	e4	e5	e6	e7	e8	e9
<b>Administrative</b>	D25 image damage (grid-owner) (D10)		f1	f2	f3	f4	f5	f6	f7	f8	f9
	D25 experience (D10)		g1	g2	g3	g4	g5	g6	g7	g8	g9
	D25 environmental value (D10)		h1	h2	h3	h4	h5	h6	h7	h8	h9
	D25 Promotion and Information (D05/D10)		i1	i2	i3	i4	i5	i6	i7	i8	i9
	D25 Administrative obstacles (D05)		j1	j2	j3	j4	j5	j6	j7	j8	j9
	D25 Definition of biogas (D10)		k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	D25 emissions (D10)		l1	l2	l3	l4	l5	l6	l7	l8	l9
	D25 CO2-savings (D10)		m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	D26 Quality requirements norms and directives (D05)		n1	n2	n3	n4	n5	n6	n7	n8	n9
	D26 Test-gasses (D05) (and other test requirements like test-frequency)		o1	o2	o3	o4	o5	o6	o7	o8	o9
	D26 Allocation (D05) (continuity of supply and quality who decides quantities)		p1	p2	p3	p4	p5	p6	p7	p8	p9
	D26 regulation (tariffs for transport, maintainance) (D05, costs)		q1	q2	q3	q4	q5	q6	q7	q8	q9
	D26 certification		r1	r2	r3	r4	r5	r6	r7	r8	r9
	D26 EU directive (D05) (based on participation of stakeholders)		s1	s2	s3	s4	s5	s6	s7	s8	s9

Table 10:  
 Biomethane Matrix of Poland

#### Discussion:

- There're no barriers identified (yet).
- Most identified obstacles are categorized as "administrative" and "legal instructions".
- There're many presented obstacles/ barriers that need further investigation; if, where and how they appear on the defined supply chain.

### 1.4 The General Questionnaire

The biomethane matrices were used for consulting diverse target group actors. A copy of this questionnaire has been concluded as annex 1.

## 2. A list of proposals

for the reduction of barriers to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level (D25)

### 2.1 Disclaimer

All the measures of interference should be elaborated with care, utilizing prior studies and taking into account prevailing regional conditions to give freedom of choice for the selection of the most favorable application. Applications could include injection and distant use in highly efficient conversion to power, heat and cold polygeneration using either local biogas or Biomethane micro gas grids, direct supply to industrial consumers or as automotive fuel.

The mechanism for breaking the barrier is to amend basic legislation on climate protection, security of energy supply, agricultural restructuring, regional development, renewable energy sources (RES), and bio fuels both for the EU and with obligations for the Member States (MS).

The mechanisms for breaking the barrier are fixed medium and long term strategic targets for 2015, 2020, 2030, 2040 and 2050 as well as long term development plans for RES for all regions.

### 2.2 The elaborated list of proposals

In table 11 the elaborated list of proposals for the reduction of barriers to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level, is presented. The proposals are categorized in 5 categories: **Educational**, **Financial**, **Legislative**, **Mental** and **Technical/ Technological**.

type of B/O	Mechanism of breaking the barriers (B)/ obstacles (O)
<i>Educational</i>	
E	To win in times of globalization do the best to promote regional economic development, accumulate indigenous know-how and put it into global relations, according to the slogans "From research to industry and market", "Capacity is the cheapest investment" start a EU-wide information and dissemination campaign to spread the knowledge and export technology gained in scientific institutions and by the practical experiences of bio-methane injection and best practice use of bio-methane as automotive fuel in the most advanced countries Austria, Sweden, The Netherlands and in the last three years soaring Germany to all Member states.

E	Adopt biomethanation as a focus to the EU funded programs as Intelligent Energy Europe, Life, Leader etc. putting special emphasis to modern media to reach the youth, professional associations to reach target groups like farmers or drivers, to governmental, municipal and communal bodies to reach the authorities
E	Developing the market for RES technologies and equipment Initiating activities to enable the transfer and production in EU countries of the best RES technologies.
E	Implement and co-finance the necessary educational restructuring, capacitating programs about RES resources and technologies in all levels not only of education, but of policy making and professional life in industry and agriculture
E	Founding a non-governmental European network for biomethane like the German BioMethane Board established as an additional initiative based on the needs analyzed within the REDUBAR-project with four main targets: <ul style="list-style-type: none"> <li>- lobbying in favor of the technology and best conditions</li> <li>- join all stakeholders</li> <li>- further new technological solutions</li> <li>- disseminate knowledge</li> </ul>
E	Supporting intra-European technology transfer from the in biomethane application higher developed Member States, as Austria, Germany, the Netherlands, Sweden to countries with nil applications and limited technical experience in this field so far primordially in national languages
E	Stimulating a demonstration program by the European Commission for constructing in every member state several biogas, upgrading and injection plants of different types at least one plant each for organic residues and one for energetic crops
E	Accompanying pioneer plants by research projects
E	Searching of promising sites for establishing biomethane injecting plants (establish a plant register as comprehensive as possible) on the base of rather uniform assessment criteria
E	Check the possibility to establish an exchange program for related stakeholders taking the programs for exchange of young scientists as an effective example
E	Increasing funds for scientific- research studies in RES.
E	Creating new research and development (R&D) programs. - Increasing funds for scientific research studies in RES (incl. biogas)
E	Creating educational system about needs and methods in using RES energy. <ul style="list-style-type: none"> <li>- Introducing RES trainings into higher education and further education</li> <li>- Implementing educational programs about RES resources and technologies in all levels of education</li> </ul>
E	Establish a program to "Train the Trainers" at all levels of stakeholders. This seems to be important not only for biomethanation but for almost all RUE and RES
E	Provide support for translating manuals and reports on biogas use, best practices into ALL languages of the member states.
E	Qualification of the personal of biogas plants for more efficiency
E	Intensively lift the RES technologies into technical education and into specific further education (for experts in gas industry and energetic).
E	promotions, organization of professional further education
E	Expanding available arable land by putting set-aside land into production, regional planning, collecting and using biowaste.
E	Designing and offering capacity building courses for investors, bankers and farmers

E	It needs to be studied properly especially if large quantity of bio-methane is going to get transported or distributed. - Prolongation of study BONGO and/or REDUBAR in specific areas.
E	Carry out researches and create adequate norms
<i>Financial</i>	
F	Establish a “New Deal for Climate Protection and of Energy Supply Change” in favor of efficiency and RES
F	Create a special fund and a specialized financial institution to boost RUE and RES, including bio-methane, either as a separate body or within the EIB but with special rights
F	Check all established financial measures and institutions within the EU and obligate them to contribute to the anti-crisis, pro climate protection and energy change deal, including EFRE, GAP, LEADER, INTERREG at one hand and European banks, like ECB and EIB at the other
F	Set up innovative systems of RES investment financing including investors, financial institutions and EU support mechanism for innovative technologies
F	Establish a European investment fund for the purposes with favorable conditions for drawing rights
F	Build-up a guarantee fund to support liabilities of investors and small and medium-sized companies
F	Push a European Union-wide tariff for every cubic meter bio-methane produced either for injection or use as automotive fuel or for direct industrial consumption and take the very successful German budget-neutral feed-in tariffs for electricity from RES as a model
F	Provide favorable low-interests credits with from European banks and grants from European funds either directly to applying enterprises or investors or via business banks or groups of them but to the latter only under the condition that they pass all preferences immediately and directly to the applicants
F	Impede completely for all member states the practice of exemption from carbon dioxide taxes by 2012 at the latest
F	Allow tax exemptions for natural gas usage in member state only under the condition that they are provided without any discrimination to bio-methane likewise
F	Prepare a code of conduct, including sanctions against business banks which do not provide credits under defined reasonable conditions to enterprises and for projects in line with the above mentioned strategic aims of the EU Improving „green certificates” and energy costs system
F	With regard to bio-methane, give it the task to concentrate on financially weak member state, first of all East-European countries, and less developed regions with large potential for production of biomass
F	Do not allow the discrimination of biowaste within the member states
F	Creating and building funds in order to support RES investment programs. Promoting RES investments financial support mechanisms. Setting up financial institutions specializing in RES investment financing and improving their performance
F	Improving „green certificates” and energy costs system or setting up the biodiesel system for bio-methane (mix it). Preparation and setting up innovative systems of RES investment financing including investors, financial institutions and EU support mechanism for innovative technologies.
F	Decrease or repeal the VAT of energy comes from RES (incl. biogas)

F	Reviewing the Energy Law so as to set a price for heat, as there is already for electricity produced by biomass. - Preparing and setting up financial incentive mechanisms for those using biomass for heat
F	Set up an investigation plan (perhaps European wide for each country) and making decisions for the whole EU.
F	Market stimulation in the case of agricultural and industrial wastes for example with a decree about the acceptance prices of the agricultural and industrial waste types or with tax allowances.
F	Make available subsidies for increase biogas project –production and establish on the market
F	Creating favorable financial conditions for the farmers, involving them into the operating enterprises and let them take part at the ownership of the upgrading or injection plants.
F	Checking to establish Biomethane trading platforms either as a kind of virtual or real exchange place that might contribute rapidly to create economic criteria
F	In order to make the market price of renewable energy (and thus biogas) competitive, financial subsidies of various types and extent are needed in the complete vertical set-up of energetic from production to utilization.
F	Introduce the principles “polluter pays” and “perpetrator of the financial and economical crisis pays” within the EU and the member states
<i>Legislative</i>	
L	Expanding the norms of natural gas supply to the bio-methane injection of defined parameters
L	Legislate Renewable Energy Law Act or create an article regarding biogas in Energy Law Act, Introducing changes in Energy Law Act by specialists
L	Specification of the quality requirements of the different types of biogases for different applications (CHP, injection, vehicle fuel) in the form of national standards.
L	Put into force a comprehensive Guideline / Act for Biomethane Injection, at the best, regulating all important issues, but at least, giving priority to injection.
L	Introduce biomethanation (both digestion and BioSNG paths and utilization) in all related strategic documents (Programs, Guidelines, White and Green Papers etc.) <ul style="list-style-type: none"> <li>- Prioritize bio-methane injection and use of automotive fuel equally at the levels of the EU and the member states</li> <li>- Create conditions for real unbundling and prevent faking. In case of resistance allow expropriation for the sake of preservation of fundamentals of living and the interests of the community</li> <li>- Give permission to the member states for free supporting measures to allow profit-making by use biomethane technology</li> <li>- Establish conditions for cross-border delivery</li> <li>- Start a G-20 initiative</li> </ul>
L	Introduce balanced aims for bio-methane into the binding objectives set by the Council for RES and biofuels: <ul style="list-style-type: none"> <li>- Elaborate criteria for the priority of use of arable land, forestry and biomass</li> <li>- Call for fundamental research on potentials, technologies and accompanying investigative actions in the 7th framework program and in the preparation to the 8th FP</li> <li>- Set minimal targets in amount and time to be reached by every MS</li> <li>- Establish a control mechanism</li> </ul>

L	Creating long term development plans for RES for all regions. Model of long term agreements considering the different condition of raw gas production and the injecting process. Accepting priorities of regional RES development adequate to regional energy sources
L	Establish (addition) the relevant laws for stimulating the bio-methane producing and utilization
L	Establishing regional energy agencies and cooperation between them. Setting up regional energy agencies network program.
L	Organizing the stakeholders in a technological platform but keep care to integrate innovative small and medium sized enterprises
L	For determination of the specific values of biogas parameters establish a system for measuring biogas parameters and legislatively define the biogas parameters needed for injection. Use of existing experience and opportunities to supply biogas to the distribution network. (like Austria, Sweden or Germany)
L	Review of regional development strategies regarding RES Review of regional working plans regarding RES funds
L	Prepare simple administrative structures for the approval process of biogas plants (fix tasks and responsibilities)
L	Research and development, monitoring of the biogas injection plants to collect practical experience and later than for modification of standards for gas quality in the public natural gas grid
<b>Mental</b>	
M	Lobby activities including popularizing publications and reference visits for the members of target groups
M	Promoting RES energy usage as ecological element of business practices and life style.
M	Good communication and promotion to the public. - Setting up a good definition about renewable energy (no food for fuel).
M	Setting up regional energy agencies network to promote and wide spreading usage of RES
M	Setting up financial incentives for developers to promote and wide spreading usage of RES
M	Creating RES projects for specific public infrastructure like: schools, hospitals, civil service building
M	Work out a 'green gas' certification system
M	Define clear sponsorship mechanism. Preparation of rules and regulations for injection into natural gas grid (technical and non-technical)
M	Working out a quality and technical regulation / standard for biogas injection
M	Elaborating of a special manuals for bankers, investors and farmers in their national languages
M	Drafting model contracts
M	Providing checklists for example for developing and controlling projects in national languages

<i>Technical / Technological</i>	
T	Optimizing the plant size to the territorial conditions – optimizing the collecting and transportation systems for raw materials
T	Working out a wide-ranging accepted injection model on the basis of operating West-European experiences.
T	Make enough buffer capacity in the natural gas grid available.
T	Collect experiences from injection projects (country and EU – level -> revision of the actual regulations)
T	Create a basic uniform norm and introduce it all over the EU for bio-methane injection and use as automotive fuel
T	Creating a handbooks and RES equipment technical standards for using different RES technologies like in Germany: <ul style="list-style-type: none"> <li>- “Biogas – an introduction” by FNR</li> <li>- DVGW-standard VP 265</li> </ul>
T	Define the chemical composition of biogas and its combustion performance properties compared to natural gas.
T	Minimize methane leakages (f.i. covering stores, introduce emission limits for the upgrading plant) along the technological chain until injection by technical means partially to be demanded or ordered by authorities

### 3 A list of proposals

for the creation of legislative instruments to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level (D26)

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#### 3.2 The elaborated list of proposals

In table 12 the elaborated list of proposals for the creation of legislative instruments to increase the use of biogas for heating, cooling and power generation on different regional levels, the national level of the partner countries and the EU-25 level, is presented. The level where the barriers and obstacles are representing its selves is fixed in the third column of the table. The following abbreviations are used: G = Germany; I = Italy; P = Poland; N = the Netherlands; H = Hungary; L = Lithuania; C = the Czech Republic; Gr = Greece and EU = EU-25 level.

<b>Legislative B/O</b>	<b>Proposal for the creation of legislative instruments</b>	<b>Level</b>
Lack of a special strategy for biomethane production to substitute fossil fuels within the EU	1) Prioritize bio-methane injection and use of automotive fuel equally at the levels of the EU and the MS 2) Create conditions for real unbundling and prevent faking. In case of resistance allow expropriation for the sake of preservation of fundamentals of living and the interests of the community 3) Give permission to the MS for free supporting measures to allow profit-making by use biomethane technology 4) Establish conditions for cross-border delivery 5) Start a G-20 initiative	EU

Lack of fixed strategic targets	<p>1) Elaborate criteria for the priority of use of arable land, forestry and biomass</p> <p>2) Call for fundamental research on potentials, technologies and accompanying investigative actions in the 7th framework program and in the preparation to the 8th FP</p> <p>3) Set minimal targets in amount and time to be reached by every MS</p> <p>4) Establish a control mechanism</p>	EU
Lack of uniform, easily to handle contractual instruments equally recognized in all MS and applicable between all contracting parties covering all requirements referring to the biogas and bio-methane production and its utilization	Establish (addition) the relevant laws for stimulating the bio-methane producing and utilization	EU
Lack of Renewable Energy Law Act	Introducing changes in Energy Law Act by specialists	P
Lack of development plans for biogas in regions in the countries	Review of regional working plans regarding RES funds	P
Lack of national organizational structure implementing country's policy regarding RES including biogas	Appointing civil servants to coordinate regional RES development	P
No incentive measures for developing biogas industry (CHP, polygeneration, injection)	Make a long term energy strategy	H
Article 6 of the directive 2003/55/EC of 26th of June 2003 hasn't been implemented definitively.	Don't set up directives for implementations that rely on the participation of main stakeholders, but set up a MS protocol (like KYOTO).	EU
The absence of standards determining the quality of biogas needed for injection.	Determination of the specific values of biogas parameters	C

## 4. A list of recommendations

for reduction of financial barriers. Proposals for effective public and/or combined public/ private financial support for measures directed to the increase of using RES for heating and cooling (D28)

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### 4.2 *The elaborated list of recommendations*

#### **Methodology comment:**

These recommendations have been developed according to the previous deliverables. These recommendations aim at improving biogas market conditions.

- A common overall strategy should be launched and implemented at European level; the biogas market suffers from a lack of uniform situation regarding biogas and biogas injection in the natural gas grids. As we can see from the results of the questionnaire concerning the "General development level of the biogas market:".
- A solid legislative and regulatory framework is the necessary precondition for the development of biogas market as basic to guarantee access to the market for potential producers, as well as consumers and end users.
- A solid regulatory framework needs smooth and flexible administrative structures.
- Cooperation among the actors is also highly recommended; the territorial approach is therefore essential, the territorial chain identifies the following subjects: farmers, farmers associations, local and regional authorities, agro-food industries, plants producers, enterprises, associations, chambers of agricultures, as well as of commerce, last but not least research institutes and universities.

- To reach a better acceptance of biogas. A better acceptance of biogas leads to a increasing of the market capacity to welcome new actors.
- Implementation of “ad hoc” tools for the promotion of electricity through feed-in-tariffs or through green certificates especially dedicated to biogas should be considered, especially for those countries where biogas plants are numerous and well accepted.
- Necessity to increase the critical mass regarding biogas technologies, technological innovation is the key word for market improvement.
- Another recognized barrier is the difficult to access to financial sources; we can identify a two fold problem; there is a initial difficulty to find information on possible funding, application procedures; secondly there is an objective lack of supporting schemes and incentives for biogas sector; funding schemes are rarely implemented in the biogas sector. Italy can offer an example, funding for biogas plants are foreseen but just small scale plants and just for the agricultural sector. (source: Dduo 16.07.08 n.7840 in BURL del 31 luglio 2008 n.31

[http://www.agricoltura.regione.lombardia.it/sito/tmpl\\_action.asp?DocumentId=3802&SezioneId=2305020714&action=Documento](http://www.agricoltura.regione.lombardia.it/sito/tmpl_action.asp?DocumentId=3802&SezioneId=2305020714&action=Documento)).

According from results identified by D.22 (“An overview of existing supply-chains and market structures arranged by their potential for increasing the biogas use for heating and cooling”), the increase of biogas market depends also by developing support measures for the whole chain, to create investment security and making profit:

- obligation to the grid operators to accept every kWh electricity and m<sup>3</sup> biomethane offered by the operators of biogas and biomethane plants.
- obligation to the grid operators to pay fixed prices for long periods that allow to amortization of investments and a small profit.
- introducing a bonus for the use of wanted biomass, CHP, new technologies
- allowing the grid operators to distribute the higher costs to all consumers likewise (application of the polluter pays principle).
- decreasing remuneration for new investments from year to year (to accelerate application and faster decreasing plant prices and avoid windfall profits for the manufactures).

**For the whole chain the D22 identifies the following measures:**

- Implement certification of origin to exclude betrayal
- Look for integration of all stakeholders of the added-value chain (farmers, engineering or manufacturing company, grid operator, investors)
- Optimise the whole chain

- Guarantee operational stability of the whole chain
- Tax incentives should favour projects with technological innovation and low environmental impact; today, there are no such criteria for giving tax incentives
- The requirements and procedures for environmental impact assessment should be harmonised across the regions
- Premiums under the special system should be reallocated to favour less developed technologies
- Incentives should be developed to support investment in the development of new technologies
- Developers of projects for renewable energy sources should get discounts for their payments to mutual guarantee societies.

A copy of the questionnaire has been included as annex 2.

## **FINAL LIST OF RECOMMENDATIONS**

A common overall strategy should be launched and implemented at European level; the biogas market suffers from a lack of uniform situation regarding biogas injection in the natural gas grids. As we can see from the results of the questionnaire concerning the “General development level of the biogas market:”.

A solid legislative and regulatory framework is necessary precondition for the development of biogas market as basic to guarantee access to the market for potential producers, as well as consumers and end users.

A solid regulatory framework need smooth and flexible administrative structures.

Cooperation among the actors is also highly recommended; the territorial approach is therefore essential, the territorial chain identifies the following subjects: farmers, farmers associations, local and regional authorities, agro-food industries, plants producers, enterprises, associations, chambers of agricultures, as well as of commerce, last but not least research institutes and universities.

This is also the first step to reach a better acceptance of biogas.

Therefore, another recommendation is that biogas should be better known and accepted by the public opinion;

Implementation of “ad hoc” tools for the promotion of electricity through feed-in-tariffs or through green certificates especially dedicated to biogas should be considered, especially for those countries where biogas plants are very common.

Necessity to increase the critical mass regarding biogas technologies.

## ANNEX 1 General Questionnaire

### GENERAL QUESTIONNAIRE

To generate proposals for the reduction of barriers and the creation of legislative instruments and regulations to increase the biogas use for heating, cooling and power generation

## ABSTRACT

This questionnaire is used together with the BIOMETHANE matrix and should generate proposals for the reduction of barriers and the creation of legislative instruments and regulations to increase the biogas use (or once upgraded BIOMETHANE use) for heating, cooling and power generation.

The questionnaire is used for interviewing main stake-holders in the supply chain of producing biogas, upgrading biogas to biomethane, injecting biomethane into the natural gas-grid and transporting or distributing the biomethane/ natural gas mixture to end-users.

The biomethane matrix has been developed by the companies Kiwa Gas Technology, Gasunie Engineering and Technology, KEMA and NUON Tecno in the year 2007. This methodology is described in the report "State of the art of hydrogen- and biogas injection"<sup>5)</sup>.

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<sup>5</sup> E.A. Polman, R.N. van Eekelen (Kiwa Gas Technology) E.Huijzer, S. Jager , L. Goorix, M. Theelen (NUON Tecno), O. Florisson, G.C. Tiekstra (Gasunie Engineering and Technology), J. van Wingerden, R. van Ommen, T.van Wingerden (KEMA), State of the art of hydrogen- and biogas injection , November 2007

Name:

Address:

Function:

Firm- name:

Knowledge of the Supply Chain (more answers are possible):

- Production of biogas with industrial waste as a source.
- Production of biogas with household waste as a source.
- production of biogas with agricultural waste as a source and also co-fermentation with corn or other sources.
- Production of biogas with renewable sources (RES). Not only fermentation but also gasification (SNG-production).
- Upgrading (biogas to biomethane).
- Injection (biomethane into the natural gasgrid).
- Transportation of gas.
- Distribution of gas.
- Knowledge of the total supply chain.

**Task 1:** Please study and/or discuss the BIOMETHANE matrix.

**Question 1:** Is the presented BIOMETHANE matrix understandable?

- Yes
- No

**Question 2:** Are there any presented obstacles or barriers that you want to discuss further?

- Yes → please fill in the discussion box
- No

**Discussion box question 2:**

**Question 3:** Are there any obstacles or barriers missing in your opinion?

- Yes → please fill in the motivation box (make copy's if more obstacles or barriers are missing)
- No

**Motivation box question 3:**

**Description obstacle or barrier:**

**Influence obstacle or barrier:**

**How to solve the obstacle or barrier:**

**Time needed to solve the obstacle or barrier:**

- less than 1 year
- 1-2 years
- 2-5 years
- More than 5 years
- No idea

**Funds needed to solve the obstacle or barrier:**

- 0 - 10.000 Euro
- 10.000 - 50.000 Euro
- 50.000 - 100.000 Euro
- 100.000 - 500.000 Euro
- 500.000 - 1.000.000 Euro
- More than 1.000.000 Euro
- No idea

**Task 2:** Please study and discuss the presented Obstacles and Barriers in the BIOMETHANE matrix. Notice that the individual cells in the matrix are numbered a1 till s9.

**Question 4:** On which of the presented obstacles (numbers a1 till s9) do you have ideas to overcome them? (please mark in figure with a cross)

Matrix BIOMETHANE		Production	Production	Production	Production	Upgrading	Injection	Transportation	Distribution	End User
		Industr. Waste	Housholds waste	Agr. Waste	RES	to natural gas quality		high pressure	local	CHP/ CHPC cooking fuel cell
<b>Economics</b>	<b>Investments (D10)</b>	a1	a2	a3	a4	a5	a6	a7	a8	a9
	<b>Operational costs (D10)</b>	b1	b2	b3	b4	b5	b6	b7	b8	b9
	<b>Maintainance costs (D10)</b>	c1	c2	c3	c4	c5	c6	c7	c8	c9
	<b>subsidy (D10)</b>	d1	d2	d3	d4	d5	d6	d7	d8	d9
	<b>tariff (D05)</b>	e1	e2	e3	e4	e5	e6	e7	e8	e9
<b>Administrative</b>	<b>image damage (netmanager) (D10)</b>	f1	f2	f3	f4	f5	f6	f7	f8	f9
	<b>experience (D10)</b>	g1	g2	g3	g4	g5	g6	g7	g8	g9
	<b>environmental value (D10)</b>	h1	h2	h3	h4	h5	h6	h7	h8	h9
	<b>Promotion and Information (D05/D10)</b>	i1	i2	i3	i4	i5	i6	i7	i8	i9
	<b>Administrative obstacles (D05)</b>	j1	j2	j3	j4	j5	j6	j7	j8	j9
	<b>Definition of biogas (D10)</b>	k1	k2	k3	k4	k5	k6	k7	k8	k9
<b>Environment</b>	<b>emissions (D10)</b>	l1	l2	l3	l4	l5	l6	l7	l8	l9
	<b>CO2 (D10)</b>	m1	m2	m3	m4	m5	m6	m7	m8	m9
<b>Legal instructions</b>	<b>Quality requirements norms and directives (D05)</b>	n1	n2	n3	n4	n5	n6	n7	n8	n9
	<b>Test-gasses (D05) (and other test requirements like test-frequency)</b>	o1	o2	o3	o4	o5	o6	o7	o8	o9
	<b>Allocation (D05) (continuity of supply and quality who decides quantities)</b>	p1	p2	p3	p4	p5	p6	p7	p8	p9
	<b>regulation (tariffs for transport, maintainance) (D05, costs)</b>	q1	q2	q3	q4	q5	q6	q7	q8	q9
	<b>certification</b>	r1	r2	r3	r4	r5	r6	r7	r8	r9
	<b>EU directive (D05) (based on participation of stakeholders)</b>	s1	s2	s3	s4	s5	s6	s7	s8	s9

**Task 3:** Of each marked obstacle/barrier please answer the following questions, beginning with naming the obstacle.

**Question 5:** What is your idea to overcome this obstacle/barrier?

**Question 6:** Why should this obstacle/barrier be solved in your described manner?

**Question 7:** Who should solve the obstacle/ barrier?

**Question 8:** When should this obstacle/barrier be solved?

**Question 9:** Time needed to solve the obstacle or barrier:

- less than 1 year**
- 1-2 years**
- 2-5 years**
- More than 5 years**
- No idea**

**Question 10:** Funds needed to solve the obstacle or barrier:

- 0 - 10.000 Euro
- 10.000 - 50.000 Euro
- 50.000 - 100.000 Euro
- 100.000 - 500.000 Euro
- 500.000 - 1.000.000 Euro
- More than 1.000.000 Euro
- No idea

**Task 4:** Please add an priority to the presented obstacles and barriers (from 1 to 10) Which obstacle or barrier needs to be fixed first?

**Task 5:** Notice the white spots in the BIOMETHANE matrix.

**Question 11:** What (in the opinion of the interviewed) needs to be investigated first

# Annex 2 Questionnaire

**Analysed country:**

**1. General development level of the biogas market:**

- A) No biogas market yet (no interest for biogas use)
- B) Very low – very initial phase (only a few sporadic plants, no general awareness)
- C) Low but promising (only some plants exist, but awareness of target actors and potential is relevant)
- D) Young but growing market
- E) Developed but there are still some missing links (regulations, incentives, cooperation of actors, etc)
- F) Well developed and further growing (actors are organised, regulations and incentives already exist)
- G) other, particular situation:  
.....

**2. Development level of regulatory framework**

A) missing or unsatisfactory       B) fair       C) good       D) very good

**3. Supporting and incentive measures for biogas use**

A) missing or unsatisfactory       B) fair       C) good       D) very good

If such measures exist (B-C-D) what type are they?  
.....  
.....  
.....  
.....

**4. Business and economic cooperation among actors is**

A) missing or unsatisfactory       B) fair       C) good       D) very good

If such cooperation among some actors at any level *exists* (B-C-D)

- who are the cooperating actors?  
.....  
.....
- how do they cooperate?  
.....  
.....  
.....

If cooperation among partners is *fair* or *good* (B-C)

- which are the missing links, weaknesses or obstacles which should be *eliminated* in order to develop the actual cooperation to a very good level?  
.....  
.....  
.....
- which kind of actors do not cooperate enough/at all?  
.....
- what kind of actions/measures would be *needed* to achieve a *very good* cooperation among all actors?  
.....  
.....  
.....

