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Positive and Negative Security: A Consequentialist Approach to EU Gas Supply

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Abbreviations

ACER	Agency for the Cooperation of Energy Regulators
CI	Critical Infrastructure
CMP	Congestion Management Procedure
CNG	Compressed Natural Gas
CSE	Central Stockholding Entity
DSO	Distribution System Operator
E&P	Exploration and Production
EP	Emergency Plan
EU	European Union
GDP	Gross Domestic Product
GIE	Gas Infrastructure Europe
GRI	Gas Regional Initiatives
GTL	Gas-To-Liquid
GWh/d	Gigawatt Hour per Day
IEA	International Energy Agency
IEM	Internal Energy Market
JPAP	Join Preventive Action Plan
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MS	Member State
MSD	Major Supply Disruptions
N-1	The N-1 Formula for Infrastructure Standard
NC BAL	Network Code on Gas Balancing of Transmission Networks
NC CAM	Network Code on Capacity Allocation Mechanisms in Gas Transmission Systems
NC	Network Code
NRA	National Regulatory Authorities
PAP	Preventive Action Plan
PSO	Public Service Obligation
R&D	Research and Development
RA	Risk Assessment
REMIT	Regulation on Wholesale Market Integrity and Transparency
S&T	Scientific and Technical
SGI	Service of General Interest
SMEs	Small and Medium-Sized Enterprises

SS	Supply Standard
SSO	Storage System Operator
TOP	Take-or-Pay
TPA	Third Party Access
TSO	Transmission System Operator
VTP	Virtual Trading Point

1 Introduction

By promoting peace, its values and the well-being of its peoples, the EU functions as an anchor of stability for the European continent.[1] It attempts to create an area of freedom, security and justice for its citizens.[2] A stable and abundant supply of energy, therein gas supply, is imperative to achieve these goals.[3] In 2015, the gross inland consumption of natural gas in the EU-28 was estimated at around 16 649 thousand terajoules (EUROSTAT 2017a).[4] The biggest gas consumers (presented in descending order) were Germany, the United Kingdom, Italy, France, the Netherlands, Spain, Belgium and Poland (EUROSTAT 2017a).[5] EU Member States had a relatively high import dependency in gas, which varied from around 70% (Hungary 67.9%, Poland 72.2% and Austria 72.5%) up to 100% (Estonia), with the majority of countries falling into the 90% range (Belgium, Bulgaria, Czech Republic, Germany, Ireland, Greece, Spain, France, Italy, Latvia, Lithuania, Luxemburg, Portugal, Slovenia, Slovakia, Finland and Sweden). Only Denmark and the Netherlands had a negative gas dependency, while Cyprus and Malta experienced no gas dependency at all, since their domestic gas consumption was equal to zero. Romania, Croatia and the United Kingdom were also in good situations, where gas dependency totaled 1.8%, 27.1% and 41.8% respectively (EUROSTAT 2017c).[6]

Natural gas has a wide range of applications in the EU.[7] It is used in the sectors of transformation (to produce electricity and heat), energy (as fuel in electricity plants, combined heat and power plants, heat plants, gas works, coal mines, oil refineries, blast furnaces, coke ovens, etc.), transport (e.g. compressed natural gas in road vehicles or natural gas in pipeline transport and the distribution of diverse commodities such as water), industry (iron and steel; chemical and petrochemical; non-ferrous metals; non-metallic minerals; transport equipment; machinery; mining and quarrying; food, beverages and tobacco; paper, pulp and printing; construction; wood and wood products; textile and leather), commercial and public services, residential consumption, agriculture and forestry and fishing (EUROSTAT, IEA, OECD, UNECE 2016).[8] As such, natural gas contributes to the production of numerous goods and to providing Europe with diverse services. In this regard, we can say that gas supply has a value that exceeds its price. This is a value of societal welfare and well-being that is a consequence of the effects that these produced goods and provided services have on the European population at large (Buchan and Keay 2015, 114).

Historically, the notion of gas security is affiliated with the concept of energy security that is a legacy of US President Ronald Reagan's term in office and his efforts to block development of the Yamal/Urengoi gas pipeline project in the mid-1980s (EIU 1983a: 1).[9] In 1982, Reagan put an embargo on the sale to the USSR of engineering parts produced under US licence by European companies that were necessary to build the Russian pipelines in Europe (EIU 1982a: 20). Americans regarded the massive expansion of Soviet-supplied gas pipelines as a threat and raised questions concerning freedom and independence of Western European countries in the face of the growing contractual dependency on gas supplies from Siberia (EIU 3 (1981): 3). For Europe, however, the situation appeared slightly different. Western European countries needed "all the gas they could get" (EIU 1982c: 1) since it reduced their dependence on OPEC (EIU 1982c: 5). They obtained it, at that time, from the USSR. As such, the Soviet gas helped to *secure* the European continent's gas supply (EIU 1982d:18). Both sides (Europe and Russia) had a common economic interest that could contribute to their respective growth and prosperity (EIU 1981a: 29). Reagan's embargo, which was enacted to obstruct Soviet-European cooperation (EIU 1982a: 20), was met with strong resistance from both European and Russian partners (EIU 1982b: 26). The USSR started producing their own 25 mw compressors to deliver the necessary parts to build the pipeline, while European companies producing US-licenced parts resisted by claiming that American law had no jurisdictional relevance in Europe (EIU 1982b: 27). As a result, the Yamal-Urengoi pipeline project attained symbolic importance: it became a matter of national pride of the USSR (EIU 1982a: 20), and it also became a matter of exercising economic freedom in Europe (EIU 1982b: 27).

Just as the questions of gas security and freedom were pressing and intertwined in the 1980s, they are equally so dominating the EU energy security scene in the first decades of the twenty-first century. To a certain extent, the current debates echo that which the Americans feared 30 years ago. The concerns generated by the Russian-Ukrainian gas disputes (2005–2006, 2008–2009, 2013–2014), the Eastern Ukraine crisis (2014), the persistent vertical integration of gas undertakings in the downstream gas chain in Europe and the prevalent take-or-pay (TOP) gas agreements are all a burning source of an unease for the European policy-makers who wish to proceed in the liberal fashion and organise the gas markets in Europe accordingly.[10]

The EU energy policy is not a single policy, but one that consists of different Regulations, Directives and Recommendations (Eberlein 2005).[11] Since the year 2009, the EU policy on gas has experienced "a regulatory boom" that was reflected in the amount Regulations and Directives adopted, which resulted in a rapid development of common policy instruments. In this context, the most important were Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks, Regulation (EC) No 713/2009 establishing an Agency for the Cooperation of Energy Regulators (ACER), Regulation (EC) No 994/2010 concerning measures to safeguard security of gas supply, Regulation (EC) No 1227/2011 on the energy market integrity and transparency (REMIT) as well as Directive 2009/119/EC imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products and Directive 2009/73/EC concerning common rules for the internal market in natural gas.[12] Recently, the importance of the gas policy in Europe has become even more pronounced as the EU advances the Energy Union governance process and moves forward with a more complex strategy for energy security.[13]

Natural gas is one of the most important resources in the EU economy and a significant factor in the European energy security. In 2015, it provided 21% of the EU-28's primary energy.[14] Over the period of the last 25 years, European countries' gas dependency grew from 45.5% to 69.1%, and the prognosis is that this trend will likely continue.[15] The emerging global gas market (Bielecki 2002; Weisser 2007) makes LNG trade and supply attractive to many countries, especially to those with sea access. Also, gas has been identified as the main alternative fuel with a potential for long-term oil substitution and decarbonisation, which strengthens its position on the energy market in Europe.[16] Finally, as recently as 2013 "an insufficient interconnection of wholesale gas markets led to a gross-welfare loss of approximately EUR 7 billion" (ACER/CEER 2013).[17] This is a loss that should and that can be avoided, and although it is a price being paid, it need not be.

It is therefore important to understand whether the EU gas policy's solutions suffice to secure the European continent's gas supply and, even more importantly, to comprehend what, where and how improvements can be made. By employing the analytical framework of negative and positive security, this chapter evaluates European gas policy in the context of its potential to maintain gas security in Europe. Gas security will be defined in terms of the delivery of a certain volume of gas that produces both economic value of societal well-being (produced goods and provided services) and a non-material value of freedom (which the delivery of these goods and services inspires) for EU citizens. Central to the proposed approach is an understanding of gas policy as having been created to provide a certain volume of gas and, by doing so, of maintaining and reinforcing the values of societal welfare and freedom. Negative gas security is the ability to *restore* required gas flows and, as such, to deliver *freedom from their loss*. Positive gas security entails innovatively managing these flows such that *freedom towards* acquiring the required volume of gas is strengthened. Negative gas security is negative only in the sense that it is the outcome of remedying a crisis situation where some threatening development is stopped and its negative consequences minimised so that the gas flow can be restored to pre-crisis levels. Positive security, which entails the creation of *added value*, allows for strengthening security itself. Positive security stimulates positive developments and maximises their good consequences: it signifies advancement and progress towards the required levels of gas supply. The negative and positive security can be regarded as fundamental building blocks of security strategy where security is perceived as a process of (re)producing certain values that are protected in the name of security.

By exploring the notion of the negative and positive security in EU gas policy, this chapter exposes a problem that the EU can have in delivering of gas security for its region. First, there would be a major difficulty in restoring lost welfare and confidence in freedom that would occur in the event of a major gas crisis and, as such, in delivering the negative gas security. The integration of national gas markets advances slowly and many projects are postponed. As a result, the levels of commercial and physical interconnectedness as well as procedural and technical interoperability in the EU gas system (which are required to activate the preventive and safeguard measures that inject the required gas flows in this system) are not met in several places.[18] Secondly, there is a problem in establishing freedom towards acquiring the needed gas flows and, as such, in delivering positive gas security. Here, the main line of criticism concerns the prevailing emphasis of the EU gas policy on a *technical* aspect of gas security (where gas security is perceived as resulting first and foremost from aggregated systemic technicalities in the EU gas system such as physical infrastructure, market rules, network codes, technical standards, etc.) while not adequately considering the role of the individual user of the gas system and that of the gas consumer in the creation of gas security in Europe. These issues (consumer's empowerment and end-user's energy efficiency and sustainable consumption patterns), if legally included in the EU gas policy and coupled with a functioning IEM for gas, can contribute to positive gas security in Europe. Here, added value enables energy consumers to exercise their liberty and tailor their energy security through their smart energy choices. This power affords them more welfare (since producing goods and services with energy-efficient solutions requires less energy) and freedom (since ability to act and enact gas security is brought closer to the consumer who becomes an active player instead of being a mere passive recipient of gas supply). Positive security is customised at the level of the individual in the local context, which stands in stark contrast to the solution proposed by the negative security model where gas security is perceived as a strategic choice of just a few high-level stakeholders at the national, regional and supranational levels. Both the negative and positive gas security models in the EU gas policy should be supported with the functioning and flexible IEM for gas that is critical to the European gas security. Effectively protecting Europe's gas flow today is not workable without a functional internal energy market for gas that can provide infrastructural, procedural and technical solutions to the activation of such flows. Also, the interconnected and functional gas network where tradable and transitable gas capacity is exchanged on commercial basis is a prerequisite to the accommodation of empowered energy consumers in the EU gas system and sustainable end-users.

2 The Negative and Positive Security

To explore the EU gas security, this chapter incorporates concepts of negative and positive security from Security Studies and augments them with a conceptual tool consisting of negative and positive security models originating from the field of Computer Science. As Salter and Mutlu (2013) note, "critical security scholars are wanderers, not to say pirates. We travel into far away disciplines and bring back concepts, ideas and tools that we believe that explain the social and the political in reflexive ways" (Salter and Mutlu 2013, 353). In this case, travel into far off disciplines enabled researcher to establish a link between Security Studies, Political Science, Computer Sciences and Philosophy of Science. This connection created a new analytical focus that has turned towards *the (re) productive functions* of security processes. These processes were further considered against the delivery of certain values and classified as belonging to either the negative security model (if they performed a reproductive function and restored the required values) or to the positive security model (if they executed a productive function and created added value).

The concepts of the negative and positive security are commonly reflected in the ideas of "freedom from" and "freedom to" (Isaiah Berlin) where, in negative terms, "security is about the absence of something threatening" (Williams 2013, 7) and, in positive terms, security involves "phenomena that are enabling and make things possible" (Williams 2013, 7). Debates on negative and positive security are abundant in the field of Security Studies (Williams 2013; Floyd 2007; Roe 2012; Hoogensen Gjørv 2012). However, they focus on the separation of these two security types rather than on unifying them in an approach that discerns the dialectical nature of security where both the negative and positive security can be simultaneously present in security strategy.

Computer Science-based negative and positive security models apply two distinct authorisation rules for input validation to protect the system from danger. The positive security model allows for what is "known and accepted as good" by defining a set of inclusions, while the negative security model disallows for what is "known as bad" by defining a set of exclusions (Murphy and Salchow 2007). Pragmatic transposition of these authorisation rules into the framework of negative and positive security from Security Studies allows for delineating two basic functions of security strategy: the positive "enable" ("the known as good") and the negative "disable" ("the known as bad"). As such, the negative gas security model can be regarded as working for *freedom from* the loss of certain values (by eliminating threats and minimising their bad consequences) and the positive gas security model as working for *freedom towards* the required values (by stimulating good developments and maximising their good consequences). Negative security grounded in the epistemology of fear (McSweeney 1999), can be further associated with restoring required values. Positive security, on the other hand, built on an epistemology of enablement (McSweeney 1999) and equipollent to a capacity to provide a new quality and a strength, can be associated with a function of production of an added value. Further, these two security types are linked to a consequentialism grounded in Mead's symbolic interactionism and pragmatism of Ch. S. Peirce.[19] In consequentialism a signification of a concept is calculated to produce some effect that takes the form of a habit or concrete behaviour that is spatiotemporally bound (Lewis and Smith 1980, 57).[20] As such, all conceivable consequences (Lewis and Smith 1980, 55) of the conceptualisation of security in the analysed policy can be identified while, at the same time, they can be divided into two distinct groups: reproduction-related (effects that allow for restoring the required values) or production-related (effects that allow for the delivery of an added value to the delivery of the values protected in the name of security).[21]

In summary, it can be posited that the negative and positive security models can be regarded as fundamental building blocks of security strategy where security is perceived as *a process of a (re)production of certain values that are protected in the name of security.* This (re)production of values is embedded in a *spatiotemporal synthesis* of the negative and positive

Table 11.1 Negative and positive security

Negative security	Positive security
Freedom from loss of value(s)	*Freedom towards* acquiring value(s)
Restored status quo	Created *added value*
Reproductive function	Productive function

security. The negative security introduces an equilibrated notion of security: it is reactive and restores the existing status quo. It develops strategic systemic capabilities that allow for fighting threatening developments. The negative security is inevitably regressive since it is unable to foresee and remedy all the possible threats (given the spatiotemporal and not absolute nature of security) that can put at risk the values that we wish to protect. The positive model introduces a notion of security that focuses not as much on equilibrium and restoration (as the precedent negative model does) as on a production of an added value and a creation of a new quality to the values protected in the name of security (Table 11.1).

The proposed approach to security is somewhat unorthodox in the domain of energy security studies. Although a plethora of studies on energy security exist, the proposed interpretations are often attributive in that they feature the desired ideal security types as, for example, accessibility or availability of energy supply (APERC 2007; Cherp and Jewell 2014; Chester 2010; Helm 2002; Kruyt et al. 2009; Sovacool 2011; Weisser 2007; Winzer 2012). As such, they sort the various energy security types according to their qualities rather than their functions. Only few authors refer to energy security as a set of processes as, for example, Hughes's 4Rs—review, reduce, replace and restrict for energy security (Hughes 2009)—or Landry's (2015): coordinate, interconnect, interoperate, protect and moderate (establishment of freedom of gas flow) for the EU gas security.

3 The EU Strategy for Gas Security

In the study of the EU policy on gas (Landry 2015), it had been concluded that the EU perceived its gas security as a being generated via a dynamic interplay of five grand gas security processes: (1) *coordination* that advanced the communitarian *energy acquis*, generated legal commitment to this acquis among Member States (MS) and extended this acquis beyond the EU borders to the closest neighbourhood and regions strategically important to the EU gas security; (2) *complex interconnectedness* of the intra-EU infrastructure and diversified external gas supply routes; (3) *complex interoperability*[22] that encompassed harmonisation of procedural and technical interoperability of the EU gas system through enhanced gas tradability (common gas trade rules) and transitability (common network codes) and an overall standardisation of gas standards (reference conditions and units, parameter ranges); (4) *protection of gas supply* through safeguard and preventive measures (market- or non-market-based depending on the crisis level); and (5) *moderation of gas demand* through reduction of gas consumption patterns with the help of rationalisation and modernisation measures (on both consumer's and producer's side) and through gas source replacement (e.g. alternative backup fuels) (see Fig. 11.1). These processes were further perceived as constituting the EU gas security strategy. This strategy was defined as generic for the Member States (MS) where MS were expected to work out their specific solutions within the framework of the Gas Regional Initiatives (GRI) process under the umbrella of the Agency for Cooperation of Energy Regulators (ACER). These solutions would be dependent on the MS gas supplies' vulnerabilities as defined by the real-

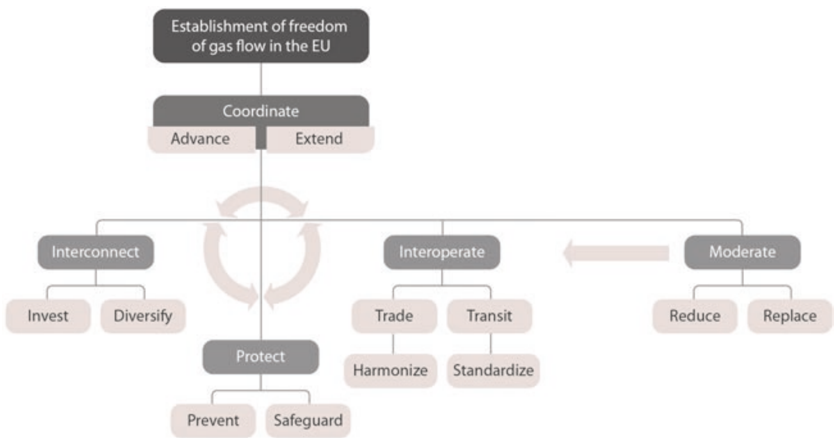

Fig. 11.1 The EU gas security strategy

ities of the Member States' energy markets: for example, the role gas plays in the energy mix, its gas market's size or its gas network configuration with regard to the existent level of interconnection, interoperability, storage and so on.

Yet, the mechanism of providing the strategic flows in the EU gas system is common for all MS. This mechanism is built upon a conception of a functional IEM for gas (with a complex interoperability at work and interconnectedness in place in this system) and a regional cohesion in a strategic decision-making. Even though some Member States will have their specific national/sub-regional solutions (e.g. particular interconnector, storage magazine, LNG terminal), they have rather limited options to invent a mechanism for the delivery of strategic gas flows other than the one discussed above.[23]

The establishment of a freedom of gas flow, represented by the accommodated and flexibly exchanged gas capacity in the EU gas system in a situation of gas crisis, was regarded as a symbolic representation of the entire strategy of the EU for gas security (Landry 2015). It had been further posited that at the heart of the EU strategy for gas security, there was the processual trio of *interconnectedness-interoperability-protection*. This trio, under the umbrella of a coordination process, worked to deliver the necessary infrastructural, procedural and functional conditions (integrated together in the Internal Energy Market for gas) to accommodation of the safeguard and preventive measures delivered by the protection process. The safeguard and preventive measures were explicitly designed to restore the lost gas flows in the situation of a gas crisis. The process of moderation was regarded as a supplementary to this trio as regards its technical feasibility and capacity of its reduction and replacement measures to cope with the gas crisis situations (see Fig. 11.1).[24]

4 Assets Ensuring Gas Security and the Value of Gas Security in Europe

Viewing security strategy (and its security processes) in terms of its impacts on assets that secure gas security and the way it may affect the values of security that these objects provide lies at the heart of the proposed approach. By analysing these assets and the values that they represent, we can infer whether the given security strategy focuses on restoring and/or producing a given value. We can conclude whether this strategy works towards delivering a negative and/or a positive security.

Material gas security assets (infrastructure, network and devices) and non-material items (norms, procedures, knowledge and technology) (Burgess 2007) together help to provide sufficient conditions to accommodation of a certain gas volume in the EU gas system.[25] This gas volume permits (either directly or indirectly) the generation of certain levels of the Gross Domestic Product (GDP). The GDP is delivered in form of produced goods and services that account for the well-being of the EU citizens, shape the human condition of welfare in Europe and grant freedom to the EU citizens in a more general sense.

The EU strategy employs many physical objects and non-material items (such as norms and procedures) (Burgess 2007, 479) in the pursuit of gas security. Gas security objects include the Trans-European transmission and distribution gas networks and the intra-EU gas infrastructure, such as entry points, exit points, bi-directional physical interconnectors and interconnection points, underground storage facilities, LNG storage facilities, liquefaction plants, import terminals, reception, offloading and regasification facilities, decompression terminals, export terminals, infrastructural solutions supporting virtual trading points (VTP) and gas hubs.[26] There are also specialised devices and equipment that increase energy efficiency of gas consuming households, industry services, agricultural buildings and heating plants.[27]

The non-material items employed by the EU energy policy in the pursuit of gas security are "procedures, the knowledge-based principles of operation as well as the knowledge itself" (Burgess 2007, 479). They represent "the socially and culturally determined values, which precede, presuppose, surround and help to operate the heavy physical installations" (Burgess 2007, 479). In the EU gas security strategy, these norms and procedures are represented by the safeguard and preventive measures (as specified in the Gas Regulation No 994/2010), the standards that support these measures (such as the N-1 formula for Infrastructure Standard, Supply Standard) and other crisis management rules and procedures outlined in Risk Assessments (RA), Emergency Plans (EP), Prevention

Action Plans (PAPs) and Joint Preventive Action Plans (JPAPs).[28] Also, there are stockholding obligations and stockholding mechanism imposed on Member States and certain methods to calculate the commercial, emergency and special stocks.[29] Further, gas market operations have their own rules such as gas trade rules and gas transit network codes that belong to this group as well. Gas trade rules and procedures are encompassed in the energy packages (Directive 2009/73/EC, Directive 2003/55/EC and Directive 98/30/EC) and include rules of Third Party Access (TPA), ownership unbundling, authorisation procedure, designation and certification of Transmission System Operators (TSOs), designation of Storage System Operators (SSOs) and LNG System Operators (LNGs), independence of these system operators or certification in relation to third countries as well as rules for public service obligations and consumer protection.[30] These gas trade rules are further supported by the rules for wholesale energy market integrity and transparency (as outlined in the Regulation on wholesale energy market integrity and transparency, REMIT).[31] The EU Network Codes (as required by Regulation No 715/2009) are established by Commission Regulation—Network Code on Capacity Allocation (CAM), Network Conde on Gas Balancing of Transmission Networks and Network Code on Interoperability and Data Exchange Rules—and established by Commission Decision procedures on Congestion Management (CMP).[32] These procedures should not be regarded as merely technical solutions for gas transit or gas trade challenges in Europe but also as necessary building blocks in an establishment of gas security. Even though some of them may not be applied explicitly in crisis situations (due to some exemptions), they nevertheless contribute significantly to enablement of the strategic gas flow exchanges. They do so by encouraging the harmonisation of technical and operational standards of operation of the EU gas system (e.g. common standards and parameters of pressure, temperature, the Wobbe index, etc.) (ECBR 2014) and by prompting the adjacent TSOs and NRAs, DSOs or SSOs to cooperate.[33]

Yet, at the non-material level of gas security process are the knowledge and technology (Burgess 2007) that deliver a variety of energy-efficiency tools (e.g. modernisation, rationalisation and modification tools) to both gas consumers and gas producers.[34] Knowledge and technology make it possible to outline criteria used to ensure the technical and environmental safety of the EU gas system and its performance and maintenance.[35] This includes, for example, minimum technical design, safety rules and operational requirements for connecting to the system of LNG facilities, storage facilities, other transmission or distribution systems and direct lines. Another example includes requirements for minimum energy performance for buildings or CO_2 performance standards for cars and vans. They all exemplify the role that science, technology and innovation together play in the process of the EU gas security.[36]

It can be further posited that at the socio-cultural level, the EU gas security strategy strives to reassure the EU citizens' confidence in freedom in a more general sense. By carrying out their respective subtasks, the socio-cultural norms and procedures reinforce the rules for transparency, non-discrimination of access, equality, elasticity and universality. They collectively contribute to establishment of freedom of movement of goods and services in the context of the EU gas market. For example, both the rule of Third Party Access (that attempts to deliver a common minimum set of third-party access services) and the rule of ownership unbundling (that contributes to the separation of networks from activities of production and supply) or the rule of TSOs' certification and designation (that attempts to establish independent TSOs and separate gas transmission from production and supply) support the concepts of a non-discriminatory operation of the EU gas network and functionality of the IEM for gas.[37] Similarly, the Public Service Obligations that work for "security of supply, regularity, quality and price of supplies" (EU, Directive 2009/73/EC) and "guarantee equality of access for natural gas undertakings of the Community to national consumers" (EU, Directive 2009/73/EC) or the safeguard and preventive measures that promote concepts of continuity and consumer protection are reinforcing some of the fundamental rights of the EU citizens, and, by doing so, they grant freedom to them in a more general sense.[38] Alike in the reinforcing fundamental rights are the rules for Critical Infrastructure that help to protect the EU citizens from suffering the consequences of disruptions in gas supply that could otherwise impair "their vital societal functions, health, safety, security, economic or social well-being" (EU, Directive 2008/114/EC) or the rules for Services of General Interest (SGI) that invoke the ideals of availability, quality, affordability of the supply services as well as the issues of end-users' protection.[39] Also, energy-efficiency solutions for gas consumers and gas producers, R&D policies, innovative exploration and production techniques (E&P) as well as scientific and technical (S&T) cooperation tools encourage freedom to acquire the necessary gas flows in the EU, and by doing so, they reassure the EU citizens' confidence in freedom that exceeds the mere context of gas security.

Consequently, gas security will be defined in terms of the delivery of a certain volume of gas that produces both economic value of welfare (understood in terms of an economic well-being of the EU citizens represented by the goods and services produced and delivered with help of the gas supply) and a non-material value of freedom (where freedom is understood in terms of the liberal freedoms that the European project of gas market integration fosters, conveys and reinforces, such as freedom of movement of goods and services, the notion of universality and continuity of services, transparency and the concept of non-discrimination, etc.).

5 The Negative Gas Security in the EU

All the processes associated with a function that "disallows for a loss of welfare and/or loss of confidence in freedom" and/or "reproduces welfare and/or restores confidence in freedom" are classified as working within the framework of the negative security. The negative gas security, by restoring the free circulation of gas flow, does not allow for the loss of production of certain goods and the loss of the delivery of certain services. As such, the negative security has a potential capacity to restore the existing welfare and confidence in freedom that the loss of these gas flows (either sudden in case of gas crisis or in the forecasted future) would cause otherwise.

If we look at Fig. 11.1 again, the negative security model penetrates all the recognised processes. The EU energy policy has largely focused on restoration of the required volume of gas: either in a short- to medium-term perspective (the protection and coordination processes) or in a long-term perspective (the processes of moderation, complex interconnectedness and complex interoperability).

In the EU strategy for gas security, *the processes of coordination*, *complex interconnectedness*, *complex interoperability*, *moderation* and *protection* are developed in response to some major threats identified for the EU gas security. The list of these threats presented here is non-exhaustive, but some of the major ones are present: dependency on an external gas supply (for the process of complex interconnectedness), dependency on the single largest gas supplier that dominates the downstream gas chain (for the complex interoperability process), energy nationalism (for the coordination process), scarcity of gas resources and climate change (for the moderation process) and dependency on a potentially unreliable transit zone (for the protection process) (for more detailed list, see Landry 2015). The processes deployed by the negative security model are developed to offset the negative consequences of these identified threats. Employed to restore the needed gas capacity in the EU gas system either in a short- to medium-term or long-term perspective, they stimulate the reproductive capacity of this system. The negative gas security model equips the policy-makers with a vocabulary consisting of Major Supply Disruptions (MSD) (outlined in Risk Assessments and defined in relation to minimum stockholding obligations), states of emergencies with different crisis levels (defined in Emergency Plans, EPs), and national and regional emergency levels (defined in Preventive Action Plans and Joint Preventive Action Plans) and adds Supply and Infrastructure Standards as tools to identify major threats and risks to the EU gas system. Further, the model recognises not only the notion of market manipulation but also attempts to manipulate the market, which is classified as an abusive practice on the wholesale gas market (as outlined by REMIT).[40] The list of these internal threats and risks is long, and it is outside of scope of this chapter to discuss them all. The purpose of mentioning them is just to show the mechanism of creation and development of this negative security model. Once the external threat and the threatening development that this threat causes internally in the system are identified, measures to diminish the negative consequences and offset the risk are established. For example, the protection process delivers short- to medium-term preventive and safeguard measures that inject the strategic flows at times and places where and when they are needed. The preventive measures that are market-based, and as such commercial and voluntary, can be applied on

(a) *supply-side*, for example, peak-shaving measures, commercial gas storage, LNG-terminal capacity, increased production and import flexibility, interconnection points, reverse flows and so on, or on (b) *demand-side*, for example, fuel switching, use of interruptible contracts, firm load shedding, increased efficiency and usage of renewable energy resources.[41] There are also safeguard measures that are non-market-based. They include all the above mentioned supply- and demand-side preventive measures (market-based) that here become compulsory, such as enforced peak-shaving measures, enforced withdraws from commercial storage, enforced use of stocks of alternative fuels, enforced increase of gas production levels, enforced storage withdrawal, enforced utilisation of interruptible contracts, enforced load shedding and so on, and other supplementary crisis measures defined by Member States in their Risk Assessment (stress tests) and by Member States together in their Gas Regional Groups within ACER (GRI ACER) and further included in the Emergency Plans (EP).[42] The protection process also introduces stockholding obligations imposed on Member States that are regarded as key elements of the EU gas security architecture in addition to these safeguard and preventive measures.[43]

The protection process that is at the heart of the negative gas security model in the EU strategy is built upon the dynamic interplay of the trio interconnectedness-interoperability-coordination. As such, these processes have been so far developed as underlying components of the negative gas security model rather than standalone solutions related to creation of an added value. The interconnectedness-interoperability-coordination trio is a core to the protection process since it works towards delivering the required basis for the activation of the preventive and safeguard measures. These are the *infrastructural solutions* (such as interconnected intra-EU gas infrastructure and diversified external gas supply routes), the *procedures and norms* for operating gas market (such as harmonised trade and transit rules as well as an overall standardisation of gas units and parameters) as well as the *strategic cohesion in decision-making* respectively made by and between key stakeholders in the region concerned (such as regional cooperation of adjacent TSOs, SSOs, DSOs, NRAs). However, the required levels of commercial physical interconnectedness and procedural and technical interoperability in the EU gas system are not met in several places (ACER 2015). The reasons for that are financial, organisational and political. As such, there would be a major difficulty in restoring lost welfare and confidence in freedom that would occur in the event of a major gas crisis. Completing the IEM is critical for the delivery of the negative gas security in Europe.

Having said this, even if the physical infrastructure, procedural solutions and regional cohesion are in place, we cannot forget about the major challenge in cyber security that arises (EECSP 2017). IEM's dynamism and functionality relies on the fluid and secure e-traffic of accurate and timely information that is debited from the data and the Virtual Trading Points (VTP). Rules for electronic processing of statistical data (such as, procedures for storing, receiving and exchanging of this data) as well as relevant IT resources (software and hardware) are needed. Questions of scope and scale of such a cybernetic information system are critical at this stage. The growing importance of an intelligent e-system management for e-business and e-gas commerce as well as e-management in a situation of gas crisis reveals another potential problem, which is that of communication. A variety of actors would have to simultaneously communicate with the system itself (TSOs, DSOs, SSOs, NRAs, gas undertakings, consumers) and with each other and, consequently, undergo a specialised training. The problem, technically speaking, is that these stakeholders often do not speak the same language (if the parameters, ranges, gas quality, etc. are not standardised), or they do not know how to communicate (if the network codes, procedures, etc. are not implemented), or they do not have yet the access to such a system (as the end-users, consumers). It seems that the European Commission is interested in playing the role of an intermediary for electronic gas security proceedings since it is, for example, willing to take over the responsibility "for developing, hosting, managing and maintaining the IT resources needed to receive, store and carry out any processing of the data provided in the statistical summaries" on levels of commercial and specific stocks.[44]

The previously mentioned lack of a cohesive decision-making by the adjacent NRAs, TSOs and so on constitutes a major weakness of the negative gas security in the EU gas policy. For example, rules governing penalties applicable to infringements of the national provisions adopted pursuant to the Directive 2009/119/EC, dispute resolution methods, and effective, proportionate and dissuasive penalties for market abuse require such cohesion. Similarly, the recommended releases of emergency stocks or special stocks, publishing of the updated information (statistical summaries) about levels of these stocks as well as the necessity to standardise methodology for calculating minimum stock levels all require minimum cohesion in decision-making.[45] The recent Proposal for a Regulation concerning measures to safeguard the security of gas supply attempts to remedy these problems by delegating supervisory and monitoring powers to the Commission on the one hand (by requiring a pre-review and approval of the generated Risk Assessment by the Commission) and to the Gas Coordination Group on the other hand (that has the task of assuring the cohesiveness of these different regional plans).[46] This proposal introduces a new mandatory solidarity principle and encourages the establishment of a joint purchasing mechanism for gas in the EU.[47] Similarly, the recent proposal for the Regulation establishing ACER (recast) is crucial to enhancement of a regional cooperation of regulators and grid operators.[48] Also, the Energy Union governance process, if equipped with a mechanism of a common gas purchases (Tusk 2014) and linked to the notion of central stockholding entity (CSE) at the supranational level (that can manage special or emergency stocks), can be regarded as a key element of the EU gas security architecture.[49]

Lastly, it should also be posited that the negative security model suffers from a vicious circle of the need to maintain the required security values: a continuous reproduction of welfare and restoration of the confidence in freedom (in short- and long-term perspective). The demand for gas progressively advances over time. First, gas is identified as the main alternative fuel with a potential for long-term oil substitution and decarbonisation.[50] It means that there will be more demand for the GDP that constitutes "the gas-welfare value" (production of goods and services permitted by the accommodated volume of gas). The second argument here is a more fundamental one, and it concerns the very ontology of the negative security that is built upon a belief that threats and risk can be identified and accordingly counteracted. In the case of the gas security, there is a complex net of uncertainties in which the delivery of gas supply is interwoven. These uncertainties are not only internal such as system-based (that can be potentially eliminated) but also external—actor-based (e.g. unstable transit zone or dependency on the external largest gas supplier that are difficult to manage or control by the EU). This signifies an increased demand for restoring the confidence in freedom for the EU gas consumers. There is however a way out of this dilemma and this is a solution proposed by the framework of the positive security model.

6 The Positive Gas Security in the EU

The positive security is the ability to create added value: a new quality to the existent values protected in the name of security. In the context of the EU gas security, creating added value is about managing the required volume of gas in such a way that it allows for the delivery of welfare (in the form of goods and services) and freedom which are better in qualitative terms. Positive gas security is an outcome of empowerment and enablement that collectively work towards strengthening the welfare-freedom axis.

What is "the known as good" that "allows for more welfare and more confidence in freedom" in the context of the EU gas security? Something that, at the same time, does not entrap the policy-makers in the vicious circle of merely maintaining welfare and freedom, but instead creates added value and that makes a difference both in quantitative and qualitative terms? What can decrease demand for welfare and decrease demand for confidence in freedom *without negatively impacting* welfare and freedom themselves? It is not such as Catch 22 as it may seem to be at first glance. Let's look at Fig. 11.1 again and think carefully about which processes have the potential to create such an added value in the EU.

The positive security model for gas in Europe can be achieved by an advancement of the moderation process and development of its reduction measures (that stimulate resource-efficient and sustainable gas consumption) and replacement measures (that allow for including gas supplied from sustainable sources: e.g. biomass) and further by associating this moderation process with the privileges (market access, real market choice, virtual market choice) that an individual empowered gas consumer could enjoy in the future IEM on the one hand and by a better regional coordination of the interaction of actors involved in the process of the EU gas security on the other hand.[51] This model is already being developed in the EU. There have been several signals from the energy policy field that testify to this, and the most recent ones are *Clean Energy Package*, *Energy Union Package*, *European Energy Security Strategy*, *A policy framework for climate and energy* in the period that spans from 2020 to 2030 and preceding this framework *Green Paper on future climate and energy policies.*[52]

The above mentioned documents reveal an emerging pattern of where the EU energy consumer is empowered in the EU energy security strategy and of where end-users of the gas system are sustainable and energy-efficient.[53] These two elements are quintessential to the positive gas security model. In this model, gas security includes not only natural gas but also biogases that are integrated into the natural gas network. Here, the end-user displays patterns of engagement, seeking information, exploring options, and contributing time and money towards the establishment of gas security. In the positive security model, the consumer displays the capacity to conduct fuel switch and tries to obtain easier switching conditions and, also, increases the usage of renewables through the deployment of alternative gas resources.[54] The consumer utilises modern technologies (e.g. smart metres) to better control costs and demands straightforward bills that reflect the actual gas usage. In the positive security model, the consumers possess the "power to manage the energy consumption actively" what gives them an opportunity to tailor their energy liberty.[55] This power translates into positive gas security value: better quality welfare can be created and, potentially, also decrease the need for the gas supply since consumers committed to sustainability and energy-efficiency measures will eventually need less energy-intensive goods and services. Similarly, the demand for restoring confidence in freedom may perhaps decrease since freedom to act and enact security is brought closer to the consumer. With an active gas e-consumer, gas security is customised at the level of the individual user in a local context. As such, gas security is not only a technical task of and an exclusive right reserved for just few stakeholders at the higher levels (national or supranational), but it is also perceived *as a smart choice of the empowered EU* *citizen*: an e-consumer who pursues "energy liberty" that a smart grid grants.

The notion of energy liberty can be best comprehended if understood in terms of "an integrated continent-wide energy system where energy flows freely across borders, based on competition and the best possible use of resources, and with effective regulation of energy markets at EU level where necessary" and where "citizens take ownership of the energy transition, benefit from new technologies to reduce their bills, participate actively in the market, and where vulnerable consumers are protected."[56] Also, the Energy Union is very important in the context of the positive gas security model since it attempts to promote an interaction between energy consumers and business, encourage more sustainable solutions in the context of gas markets and, as such, further the goal of energy liberty in Europe.[57] Its importance becomes even more pronounced in the light of the recent proposal on the Governance of the Energy Union. In this proposal, the EU adopted the rhetoric of "added value" through the introduction of a new element of the regulatory fitness (REFIT). REFIT's *added value* is defined in terms of *a new quality* of transparency (simplified and streamlined planning, reporting and monitoring), efficiency (coherent administrative procedures) and affordability (proportionality in the contribution to attainment of common objectives) that this regulatory fitness offers to the Energy Union governance process.[58]

If we now look at Fig. 11.1, the crucial difference that this positive solution creates is that it brings the moderation process closer to the centre of the EU strategy for the gas security. If the positive gas security model is successfully developed, the reduction and replacement measures (both belong to the moderation process) are no longer just complementary to establishing of gas security in the EU, but they have a potential to run at its core, in parallel to the protection process that they complement (the demand-side preventive and safeguard measures that built upon energy efficiency and increased usage of renewable energy resources). This model requires the passive gas market end-user to transition towards being an active gas e-consumer (industrial, commercial and residential) interacting in the IEM for gas through Virtual Trading Points (gas hubs).[59]

Again, there is an assumption here that the IEM for gas is flexible and dynamic so that the positive security value created by an empowered consumer and environmentally aware end-user can be fully realised. This is, of course, a major challenge to the development of the positive gas security in the EU today. Also, implementing the positive gas security model requires a paradigm shift in how the gas business functions on the one hand and the consumers' mindset on the other hand. The change in the organisation of gas business involves the creation of a completely new level of digital e-consumer and an introduction of new methods for pricing and contracting gas capacity. This shift may signify a change in the gas security governance towards a local level of decision-making that could complement the national and supranational levels. Also, empowered and active energy consumers may target the European Parliament (being a driving force to mobilise citizens to act as co-legislators on key initiatives) as a potential channel to enact the EU gas policy and protect their rights.[60] The development of this positive gas security model can also increase the importance of the gas storage magazines and local gas distribution networks (e.g. for Bio-LPG) that the end-users would have to actively interact with and, potentially, contribute to their development or maintenance (e.g. if they produce biofuels or co-finance development of infrastructure). It can also strengthen the role of the local or regional small and medium-sized enterprises (SMEs) that produce energy from renewable resources.[61]

A potential problem that arises here is the trust put in the consumer's choices: the assumption that the end-users will be committed to sustainability and energy efficiency and make their energy choices, accordingly. Educational efforts are necessary to shape the projected habits and achieve a broader understanding of the range of energy security problems. Similarly, financial solutions that support such a green transition in households and made available to the minds of those concerned are necessary so that the consumer's ability to switch fuel suppliers can be fully reshaped. Financial instruments would certainly create the necessary incentive and, also, send a positive signal to the business world and potential investors: make the market prospective and attractive. The empowerment of energy consumers is not only a matter of infrastructure and interoperability of the energy system but also a question whether (or not) health, wealth and sustainability are the end-users' overarching motive, and if they care about those values. In this regard, these educational and financial measures are necessary to grant a true "energy liberty" to the Europeans.

7 Conclusions

This analysis demonstrates that the EU gas policy in its current shape does not constitute a sufficient solution for the maintenance of gas security in Europe. However, there have been several advancements towards changing this situation that include the recent proposal on the governance of the Energy Union, proposal for a regulation concerning measures to safeguard the security of gas supply, proposal for a regulation establishing ACER (recast) and directive on deployment of alternative resources.[62] As such, the prospects for Europe can be regarded as rather optimistic a lot has been already done and there is more to come. The EU policy on gas is being dynamically developed and is evolving.

The main arguments presented by this chapter are as follows. The EU policy on gas puts an explicit emphasis on the *technical* dimension in the EU gas security while not sufficiently addressing (in the form of directive or regulation) the role of the individual user of the gas system and that of the gas consumer in the creation of a better gas security situation in Europe. Also, gas security is almost exclusively viewed as a matter of securing natural gas supplies, while its definition should also include biomass and other alternative gas supply sources that comply with and support the sustainable fuels strategy in Europe. In the current design of the EU gas policy, the protection of gas flows in the EU depends exclusively on the operationalisation of the Internal Energy Market for gas (necessary for stepping up the safeguard and preventive measures) as well as on a cohesive and timely decision-making between the key stakeholders (National Regulatory Authorities, Transmission System Operators, Distribution System Operators and Storage System Operators). Neither the IEM nor such a cohesion exists in the context of the gas market in Europe today. As a consequence, the required levels of commercial and physical interconnectedness as well as procedural and technical interoperability in the EU gas system necessary for activating the protection measures are not met. Hence, there would be a major problem in restoring the required volume of gas in the event of a gas crisis and, as such, in delivering the negative gas security.

As regards the positive gas security, the chapter concludes that this model requires further advancement and a stronger regulation that would underpin it in the EU energy policy. The recent developments in this policy, such as Energy Union Package, Clean Energy Package and European Energy Security Strategy collectively create a fertile ground for an enhancement of this model in Europe.[63] Here, the added value translates into a power of the energy consumers to tailor their energy liberty through their smart energy choices. This power grants freedom towards better quality welfare (since the production of goods and services supported by energy-efficient solutions is less energy-demanding) and freedom (since a possibility to act and enact gas security is pooled closer to the consumer who becomes an active player instead of only being a passive recipient of gas supply). In the positive gas security model, security is customised at the level of the individual end-user in a local context where commitment to sustainability remains persistent. This stands in stark contrast to the solution delivered by the negative security model where gas security is a matter of a strategic choice made by only few stakeholders placed at the national, regional and supranational levels. The final remark is that the Energy Union governance process and the functioning IEM for gas are crucial to maintenance of gas security in Europe since they constitute the necessary conditions for the future enhancement of both the negative and positive gas security models.

Notes

1. EU, "Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union," 2012/C 326/13 (Article 3). See also EU, "Report on the Implementation of the European Security Strategy—Providing Security in a Changing World," 2008 S407/08.
2. EU, "Charter of Fundamental Rights of the European Union," 2000/C 364/01.

3. EU, “Energy roadmap 2050,” COM (2011) 885 final.
4. EUROSTAT, “Supply, transformation and consumption of gas—annual data,” [nrg_103a] last update: 06-02-2017, and, EUROSTAT, “Imports-gas-annual data,” [nrg_124a] last update: 17-02-2017.
5. At the time of writing of this chapter there are 28 member countries in the EU. However, the United Kingdom formally notified to the European Council its intention to leave the EU on 29 March 2017 following the results of the UK referendum on 23 June 2016. See http://www.consilium.europa.eu/en/policies/eu-uk-after-referendum/
6. EUROSTAT, “Energy dependence,” Code: tsdcc310.
7. “Natural gas comprises gases, occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. It includes both “non-associated” gas originating from fields producing hydrocarbons only in gaseous form, and “associated” gas produced in association with crude oil as well as methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas).” EUROSTAT, IEA, OECD, UNECE. “Natural Gas Annual Questionnaire 2015 and Historical Revisions,” (2016):3.
8. For detailed information please consult EUROSTAT, IEA, OECD, UNECE, “Natural Gas Annual Questionnaire 2015 and Historical Revisions,” (2016).
9. As we can read in *Quarterly Energy Review for Western Europe* “at the summit meeting of the International Energy Agency (IEA) earlier this year, natural gas not only reached the agenda for the first time, it also dominated it, thanks mainly to the importance attached to the new concept of ‘gas security’ by the Reagan administration and the battle it waged with its European allies over the supply of Soviet gas to Europe” (EIU 1983a: 1).
10. See also Sadek Boussena and Catherine Locatelli, “Gas market developments and their effect on relations between Russia and the EU,” *OPEC Energy Review* 35 (1) (2011):31, for a detailed list of “Gazprom’s main joint ventures, acquisitions among its European Union (EU) partners and its main subsidiaries in the EU (end of 2009).”
11. Energy policy is dynamically expanding and its’ importance is growing. As Szulecki et al. (2016) note only until 2010 the EU energy policy produced 350 legal policy instruments. See also Cameron (2005), Eberlein (2005), Goldthau and Sitter (2015).
12. EU, “Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators,”, “Regulation (EC) No 715/2009 of the European

Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005,", "Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC,", "Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency,", "Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC,", "Council Directive 2009/119/EC of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products,".

13. EU, "Energy Union Package, A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy," COM (2015)80 final, "European Energy Security Strategy," COM (2014)0330.
14. EUROSTAT, "Final energy consumption by product," Code: ten00095.
15. EUROSTAT, "Energy dependence," Code: tsdcc310.
16. As we can read 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" hydrogen, biofuels, natural gas, and liquefied petroleum gas (LPG) were identified as the principal alternative fuels with a potential for long-term oil substitution, also in light of their possible simultaneous and combined use by means of, for instance, dual-fuel technology systems.
17. For detailed information please consult ACER/CEER "ACER/CEER Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013" that demonstrates the welfare losses from imperfectly integrated gas markets in Europe.
18. ACER, "European Gas Target Model review and update," 2015.
19. Both G.H. Mead's symbolic interactionism and Charles Peirce's approach on logical structures (theory of signs) are grounded in the tradition of philosophical realism. In this respect, the pragmatic thought of Mead and Peirce is substantially different from the nominalistic pragmatism of Dewey and James. Both Peirce and Mead recognised importance of universal laws in social inquiry and supported the inductive reasoning by applying the moderate conception of generality which allowed for application of "spatiotemporally bounded", thus, limited generals in a social research (Lewis and Smith 1980: 21–22).

20. Consequentialism was also applied to analysis of security by Rita Floyd (2007). See also Hoogensen Gjørv (2012).
21. It is out of scope of this chapter to discuss in-depth the philosophical foundations of the proposed approach. The research presented here was also inspired by Hegel and his dialectics as well as by the conception of *reproduction* present in historical materialism.
22. The process of *complex interoperability* in this study encompasses broader set of rules and procedures for access to transmission networks and rules for access to internal market in natural gas, as well as processes of harmonisation and standardisation of gas exchange across Member States, than the procedural interoperability specified in the Network Code on Interoperability and Data Exchange rules.
23. These generic processes (coordination, interconnectedness, interoperability, moderation and protection) seem to be important also to security of other network-based supplies (e.g. water or electricity).
24. See also David Buchan and Malcom Keay, "Needed: A Demand-Side Strategy," in *Europe's Long Energy Journey: Towards Energy Union?*, David Buchan and Malcom Keay (Oxford: Oxford University Press, 2015), 101–127 for a discussion concerning the energy-efficiency in the EU energy policy and the need for a stronger demand-side strategy in Europe.
25. This capacity is represented by the import, transmission and distribution capacity of the Trans-European gas networks; the transitable capacity that enters and exits these transmission networks; the bi-directional interconnection capacity of the interconnectors; the withdrawal capacity and injection capacity of the gas storage magazines of emergency stocks and specific stocks; the imported, offloaded, re-gasified LNG gas capacity; and the alternative gas capacity injected into the EU gas system in form of hydrogen , biofuels, and natural gas in the forms of Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), or Gas-To-Liquid (GTL), and Liquefied Petroleum Gas (LPG).
26. For detailed information consult a website of Gas Infrastructure Europe, GIE (https://www.gie.eu) and the website of the European Network of Transmission System Operators for Gas, ENTSOG (https://www.entsog.eu/).
27. In the "Directive 2009/142/EC of the European Parliament and of the Council of 30 November 2009 relating to appliances burning gaseous fuels" the EU introduced requirements regarding Community-level harmonisation of standards (technical specifications) for operation and installation of appliances burning gaseous fuels (such as appliances used

for cooking, heating, hot water production, refrigeration, lighting or washing) and fittings where energy conservation is considered essential. Also, there is a growing need for harmonisation of rules and standards (for example technical specifications for interoperability of recharging and refuelling points) in the sector of transport. This need becomes especially pronuanced in light of the recent development of the European strategy for alternative fuels that incorporates usage of LPG (Liquefied Petroleum Gas), LNG (Liquefied Natural Gas) and CNG (Compressed Natural Gas) for transportation purposes (for more information please consult EU, "Clean Power for Transport. A European alternative fuel strategy" COM (2013)17).

28. EU, Regulation (EU) No 994/2010.
29. EU, Directive 2009/119/EC.
30. The EU energy packages for gas market regulation: "Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC", "Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC" and "Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas,".
31. EU, Regulation (EU) No 1227/2011.
32. For detailed information concerning the EU Network Codes please consult EU, Regulation (EC) No 715/2009, "Commission Regulation (EU) No 984/2013 of 14 October 2013 establishing a Network Code on Capacity Allocation Mechanisms in Gas Transmission Systems and supplementing Regulation (EC) No 715/2009 of the European Parliament and of the Council,", "Commission Regulation (EU) No 312/2014 of 26 March 2014 establishing a Network Code on Gas Balancing of Transmission Networks,", "Commission Regulation (EU) 2015/703 of 30 April 2015 establishing a network code on interoperability and data exchange rules,", "Commission Decision (EU) 2015/715 of 30 April 2015 amending Annex I to Regulation (EC) No 715/2009 of the European Parliament and of the Council on conditions for access to the natural gas transmission networks,".
33. Transmission System Operators (TSOs), National Regulatory Authorities (NRAs), Distribution System Operators (DSOs) and Storage System Operators (SSOs).

34. More on the issue of energy efficiency and rationalisation and modernisation measures can be found in the following documents: EU, "Green Paper 'For a European Union Energy Policy," COM (1994)659, "Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC,", "Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy," COM (2014)0520 final, "Regulation (EU) No 333/2014 of the European Parliament and of the Council of 11 March 2014 amending Regulation (EC) No 443/2009 to define the modalities for reaching the 2020 target to reduce CO2 emissions from new passenger cars,", "Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO2 emissions from light-duty vehicles,".
35. For example, in COM (2013)17 it is posited that "lack of fuelling infrastructure and common technical specifications on refuelling equipment and safety regulations for bunkering hamper market uptake for LNG" in the European Union. Similarly, the lack of alternative fuel infrastructure and of common technical specifications for the vehicle-infrastructure interface are defined as obstacles to the market uptake of ultra-low emission vehicles in Regulation (EU) No 333/2014.
36. EU, Directive 2009/73/EC, "Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy-efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC," "Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings," COM (2014)0520 final.
37. EU, Directive 2009/73/EC.
38. EU, Directive 2009/73/EC, Regulation (EU) No 994/2010.
39. EU, "Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection,", Council Directive 2008/114/EC, "Green paper on services of general interest," COM (2003)0270, "Services of general interest in Europe," COM (2000)0580.
40. EU, Regulation (EU) No 1227/2011.
41. EU, Regulation (EU) No 994/2010.
42. EU, Regulation (EU) No 994/2010.

43. EU, Council Directive 2009/119/EC.
44. EU, Council Directive 2009/119/EC (Article 15).
45. EU, Council Directive 2009/119/EC.
46. EU, "Proposal for a Regulation of the European Parliament and of the Council concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010," COM (2016)52.
47. "As regards joint purchasing mechanisms, the Regulation makes it clear that Member States and natural gas companies are free to explore the potential benefits of purchasing natural gas collectively to address supply shortage situations. Such mechanisms should be in line with WTO and EU competition rules, in particular with Commission guidelines on horizontal cooperation agreements" in EU, COM (2016)52.
48. EU, "Proposal for a Regulation of the European Parliament and of the Council establishing a European Union Agency for the Cooperation of Energy Regulators (recast)," COM (2016)863.
49. EU, COM (2015)080 final. See also Ole Gunnar Austvik, "The Energy Union and security-of-gas supply." *Energy Policy* 96 (2016): 372–382.
50. EU, "Proposal for a Directive on the deployment of alternative fuels infrastructure," COM (2013)18, "Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure,".
51. Natural gas can be also supplied from methanisation of hydrogen generated from renewable electricity. EU, COM (2013)17.
52. EU, "Clean Energy For All Europeans," COM (2016)860, COM (2015)080 final, COM (2014)0330, "A policy framework for climate and energy in the period from 2020 to 2030," COM (2014)015, "Climate and energy policy," COM (2013)0169.
53. EU, COM (2016) 863.
54. EU, COM (2016)860, COM (2013)18, Directive 2014/94/EU.
55. EU, COM (2014)520.
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