

UNIVERZITA KARLOVA V PRAZE

FAKULTA SOCIÁLNÍCH VĚD

Institut politologických studií

Ondřej Burda

**The Impact of US Shale Gas Extraction
on Local Dynamics between
Environmental- and Economic-
Security Frames**

Diplomová práce

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Autor práce: **Ondřej Burda**

Vedoucí práce: **doc. PhDr. RNDr. Nikola Hynek, M.A., PgDip Res, PhD**

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Abstrakt

Tato práce se věnuje lidské bezpečnosti, konkrétně pak situaci, kdy se dva různé sektory této bezpečnosti – ekonomický a environmentální - střetnou. Využívá v současnosti populární téma těžby břidlicového plynu v USA k tomu, aby určila, co se při takovém střetu stane a jaký sektor případně získá navrch. V první části práce vymezuje výzkumné otázky, definuje předběžnou tezi a diskutuje používané zdroje. Ve druhé části je nastíněno celé teoretické pozadí práce. Speciální pozornost je věnována konceptu lidské bezpečnosti a Kodaňské škole, tedy prvkům, které tradiční vnímání bezpečnosti rozšířily. Zároveň se ale část věnuje i nastínění jednotlivých bezpečnostních sektorů a definici jejich teoretického rámce v souvislosti s americkou těžbou břidlicového plynu. Třetí část práce je těžištěm samostatného výzkumu, jsou zde diskutovány jednotlivé mini případové studie v rámci Spojených států a jejich jak ekonomické tak i environmentální proměnné. Cílem je zjistit, k čemu při střetnutí obou sektorů v jednotlivých případech došlo. Čtvrtá část práce si klade za cíl nastínit možné faktory, které nebyly ve třetí části zmíněny, které ovšem i tak mohly hrát roli v utváření daných výsledků. V páté části pak dochází k předběžné analýze výzkumných otázek, které jsou nakonec zodpovězeny v závěrečné části práce. Ta zároveň předkládá i doporučení pro vládní a soukromý sektor ohledně toho, jak se v oblasti konfliktních priorit mezi ekonomickou a environmentální bezpečností mají chovat.

Abstract

This work focuses on situations where two different sectors of human security - economic and environmental - clash. It uses the currently popular topic of shale gas in the United States in order to determine what happens when such conflict occurs. It also tries to find out which sector potentially dominates in this conflict. The first part of the

work defines the research questions, states my preliminary working thesis and discusses sources used. The theoretical background of the whole work is then outlined in the second part. Special attention is given to the concept of human security and the Copenhagen school, i.e. to elements that widened the traditional perception of security. The second part, however, is also engaged in the definition of the theoretical framework of given security sectors in the context of US shale gas. The third part is the core of the work's research. Here, various mini case studies within the United States and their economic and environmental variables are discussed. The aim is to find out what happened in specific cases when the clash of the two sectors occurred. The fourth part aims to outline the possible factors not mentioned in the third part, which, however, could still play a role in the shaping of the results. In the fifth section, there is a preliminary analysis of research questions that are ultimately answered in the final part. At the same time, the final part also presents some recommendations for both the government and private sectors in order to provide them with guidance on how to behave among conflicting economic and environmental priorities.

Klíčová slova

lidská bezpečnost, ekonomická bezpečnost, enviromentální bezpečnost, břidlicový plyn, Spojené státy americké, konflikt

Keywords

human security, economic security, environmental security, shale gas, United States, conflict

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Prohlášení

1. Prohlašuji, že jsem předkládanou práci zpracoval/a samostatně a použil/a jen uvedené prameny a literaturu.
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3. Souhlasím s tím, aby práce byla zpřístupněna pro studijní a výzkumné účely.

V Praze dne 5. ledna 2015

Ondřej Burda

Poděkování

Na tomto místě bych rád poděkoval své snoubence a své mámě, dvěma ženám, které mě neustále motivovaly k tomu, abych tuto práci dokončil.

Institut politologických studií

Teze diplomové práce

Ve své práci bych se rád věnoval tématu těžby břidlicového plynu v USA, což je téma, které je v současné době více než populární, a to jak díky své novosti tak také především díky svému významu. Využívání nalezišť břidlicového plynu ve Spojených státech amerických zcela změnilo energetické postavení země a USA, které byly dříve značně závislé na dovozu ropy a plynu z ciziny, spějí nyní k tomu, že se stanou čistým exportérem obou komodit. Tato energetická samostatnost je ovšem – jak mnozí komentátoři poukazují – vykoupena těžkými zásahy do životního prostředí. Mezi nejčastěji zmiňované problémy přitom patří znečišťování úložišť podzemní pitné vody, půdní eroze či zvýšené emise skleníkových plynů.

Jelikož téma samotné těžby je značně rozsáhlé, je nutné ho jistým způsobem zúžit. K tomu bych rád využil koncept lidské bezpečnosti, konkrétně pak teoreticky zajímavou část, která se věnuje konfliktnímu vztahu mezi jednotlivými dílčími složkami této bezpečnosti. Jak téma práce napovídá, konkrétně jsem si vybral vztah mezi ekonomickou a environmentální bezpečností a také to, jak byl tento vztah v kontextu Spojených států ovlivněn díky novému využívání ložisek. Při zkoumání tohoto vztahu mám v plánu postupovat cestou jedinečné případové studie, neboť věřím, že zkoumaný jev je natolik specifický, že se na něj dosud existující teorie nedají uplatnit. Existuje sice literatura, která se věnuje vztahu ekonomické a environmentální bezpečnosti v kontextu rozvojových zemí (viz např. Homer-Dixon), teoretické zkoumání tohoto vztahu pro rozvinuté země je ale nedostačující a většinou se pohybuje v implicitní rovině, kdy je vztah patrný, ne ovšem jasně deklarovaný a zkoumaný.

I když by práce měla být - jak už bylo nastíněno - v podstatě jednopřípadovou studií se zaměřením na problematiku Spojených států, v jejím rámci bych rád diskutoval i jednotlivé regionální „případy“, které jsou nevyhnutelně způsobeny mnohačetným výskytem nalezišť. Těmito regionálními případy jsou kupříkladu naleziště v Severní Dakotě, Pensylvánii nebo stále ještě plně nerozvinutá naleziště v jižní Kalifornii. V jejich rámci bych rád zkoumal konkrétní změnu vztahu pomocí tématické analýzy dokumentů. Zaměřím se přitom na dokumenty a vyjádření jednotlivých klíčových aktérů debaty, mezi které řadím (ne nutně v tomto pořadí) vládu, energetické společnosti, neziskové organizace a představitele místních komunit. Jako klíčová slova

se dají například použít termíny životní prostředí, vodní zdroje, pracovní místa nebo příjem. Jelikož se ale jedná o kvalitativní analýzu těchto termínů, mám v plánu je zkoumat v souvislosti s atributy, které mohou přenášet ať už pozitivní (např. vzrůstající, zlepšující se), tak i negativní (např. klesající, zhoršující se) vlastnosti. Jako předběžnou hypotézu používám tvrzení, že v okamžiku, kdy těžba přináší ekonomický zisk místní komunitě, ustupují environmentální rizika do pozadí.

Vzhledem k tomu, že svůj výzkumný předmět hodlám zkoumat pomocí kvalitativních metod, představuje operacionalizace dat jistou komplikaci. Kromě již zmíněného zkoumání relativní četnosti jednotlivých termínů bych ale také rád využil data z amerických ekonomických statistik. Zde je významným zdrojem Úřad pro ekonomické analýzy, který pracuje pro americké Ministerstvo obchodu, nebo také Úřad pro pracovní statistiky, který je veden pod Ministerstvem práce. Zajímavé statistiky navíc poskytuje stránka usa.gov, která byla americkou vládou zřízena právě pro snadný přístup k informacím. Kromě již zmíněných ekonomických a sociálních statistik zde jde nalézt i data, která se týkají životního prostředí, zemědělství a energetického sektoru. Tato data se navíc dají najít i na stránkách Environment Protection Agency, hlavního amerického úřadu na ochranu životního prostředí.

Co se literatury týče, bude se má práce, jak již bylo naznačeno, opírat o oficiální tisková prohlášení hlavních klíčových aktérů. Pro změnu vztahu se přitom plánuji volně zaměřit na období posledních deseti let, které se mj. vyznačovalo vzrůstajícími cenami energie, nárůstem důležitosti environmentálních témat a technologickým pokrokem v oblasti těžby. Zvýšený důraz bude navíc kladen na období finanční krize, která ve Spojených státech výrazným způsobem zasáhla celou řadu domácností. Kromě této primární literatury ale očekávám, že se ve zvýšené míře budu opírat o novinové zdroje. To je dáno především nedostatkem teoretické literatury, která by se vztahem mezi ekonomickou a environmentální bezpečností v tomto kontextu zabývala. K ohodnocení dřívější úrovně vztahu bych rád využil stejné zdroje, zároveň se ale zaměřím na teoretickou literaturu, která se danou problematikou zabývala z pohledu národní bezpečnosti. Jako příklad zde lze uvést knihu Michaela Rennera s názvem *National security, the economic and environmental dimensions*.

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1. Introduction to topic

The concept of energy security is nothing new in the arena of international relations. Although in the past energy used to be only one dimension of a state's national security approach, over the years access to energy has become essential to the functioning of modern economies. Nowadays, a modern state which is not able to secure sufficient energy resources is considered weak or at the very least vulnerable. And it is a state's primary goal to achieve a secure, sustainable, affordable and sufficient supply of energy.¹ This growing importance of energy for international relations has not gone unnoticed by the academic audience. But while research topics around energy security - or more general energy - usually include terms such as energy demand, resource scarcity or conflict, only little attention has been given to the pressure which growing demand puts on a society's conflicting priorities.

My work should thus look at the topic of energy from a different perspective. In fact, I would only like to use energy and US shale gas extraction as a framework to study the clash between environmental security and economic security, as they were both defined by the UN Human Development report in 1994. The questions which I would like to answer are whether it is the economy or the environment that receives priority when the two topics meet? Or – if not possible to determine – what are the key factors which shift the balance to one side or the other? And why is it so? My working thesis that I would like to confirm or disapprove states that when environment policies collide with policies focused on economic growth, economic growth will win out every time.

1.1 Relevance of the topic

This research topic and research questions have been chosen by me for various reasons, including more „traditional“ reasons such as topic popularity and uniqueness, as well as some special ones, such as my own personal interest in dilemma problems of

¹ *Energy for a Sustainable Future*. The Secretary-General's Advisory Group on Energy and Climate Change (AGECC). New York: United Nations, 28th April 2010. pp.40. [http://www.un.org/millenniumgoals/pdf/AGECCsummaryreport\[1\].pdf](http://www.un.org/millenniumgoals/pdf/AGECCsummaryreport[1].pdf) (downloaded on 15th March 2014).

decision making. In the following paragraphs I would like to explore all of them in greater detail.

The first one is the uniqueness of the topic. As it has already been suggested, various studies deal with topics such as national security, energy security, economic or environmental security on its own and separately from each other, however, they in general fail to address what the dynamics are when two sectors meet. Although the multidimensional natures of various problems are usually broadly recognized, it is omitted to discuss what happens when the needs and interests of contending groups are incompatible. It is, however, necessary to pay significant attention to this as possible conflict topics which involve multiple stakeholders with different interests are more and more common.

I believe that by studying the shale gas boom in US my research can provide some interesting insights into our decision making process in regards to the economy and environment. Hopefully, by the end of this paper I should be able to provide answers which will not just help with our self-understanding but as well will enhance the decisions making process of companies and improve the effectiveness of governmental policies. It is in my opinion, crucial that both legislation passed by governments and decisions approved by companies represent a sound balance of economic and environmental priorities. In other words - I hope that a better understanding of the decision making process can ensure that any new economic development project not only improves the circumstances of someone, but also does not worsen the situation of anybody else.

The reason I am researching this topic through case studies of shale gas extraction in the United States lies heavily in popularity of this topic among current academia and also in popularity of this topic among the broader public. Technological advancements of the past years pay a fair tribute to newspaper headlines speaking of a revolution. Although there are still remaining doubts about the economic viability of shale gas, some of which will be discussed further, shale gas really proved to be a game changer of the current energy arena. There could not be a topic which would help my research better because none of the recent energy controversies (e. g. tar sands in

Canada, deep water extraction in Arctic Sea) have received such overwhelming attention.

Moreover, as my topic regards environmental problematic, I intentionally chose the United States because environmental concerns related to impact of fracking have been much less of an impediment here than in Europe. The American economy is historically more driven by profit and orientation towards success, thus the discussion about environmental security in relation to resource exploitation is not so developed here. It is even more relevant to shale gas regions that have in a majority of the cases a long standing tradition of mining.

1.2 Structure and main questions

The structure of this work is determined (and as such needs to be understood and read) by its „theoretical triangle“ whose three key terms are energy, economy and environment. However, while the realist group of thought in international relations would mostly understand these terms in the areas of power and control, I am using positions of the idealist framework and human security school of thought. My theoretical part is therefore defining the relation of those terms to the conceptualization of security as done by Copenhagen school, UN Human Development Report or by the work of such theorists like Barry Buzan or Simon Dalby. The understanding of these terms and authors should define basic frameworks and dynamics in between environment and security.

The main part of my thesis focuses on specific examples of shale gas extraction in the territory of the United States. While US shale gas exploration is only a case study to confirm or disapprove the thesis, the discussion about specific local fields brings about a different perspective and insight on results. It should not be surprising that in each case the extraction and environment-economy discussion undertook different paths, and it is exactly this reason why I chose Barnett shale play, Marcellus shale play, Bakken shale play and Los Angeles shale play as my case studies within a case study. Deeper discussions within these examples provide the necessary answers for my main research questions.

The structure of this work follows the logic detailed above, therefore, in the first pages I better introduce the theoretical framework that will later be used (chapter 2). An important aspect of the change of the international system in conjunction with the end of the Cold War and the change influence on the conceptualization of security reflected in the first paragraphs, is dedicated to the concept of security and its redefinition and expansion (2.1). In the following chapters (2.2 and 2.3) the focus is aimed at the definitions of both economic and environmental security. The two concepts are not only explained in the theoretical framework but their basic connections to shale gas extraction and purpose of this work are listed as well. Following this, I will have a theoretical look at situations when two different security sectors clash with each other (2.4). The purpose of this chapter is to frame a basic discussion of my case studies. Chapter 2.5 briefly describes the history of shale gas extraction in the United States and at the same time sets the background for discussion by providing a general overview of this industry. The two following chapters (2.6 and 2.7) are then able to research the overall situation of US shale gas extraction in terms of economic, or respectively, environmental security. This description is important in order to better understand the trends and general tendencies of the industry. At the same time, it opens up the work for the core of my research; individual case studies which should provide the answers to the main research questions.

Thanks to this structure the first chapter of my work's third section (3.1) describes one by one the main researched shale gas locations. They were all singled out for specific reasons relating to my research questions and, in addition to an overview of those, the chapter introduces locations from a broader perspective. The next chapter 3.2 is focused on a discussion of their main operators as they were defined for both economic and environmental security. At first, the attention is given to the Forth Worth basin in Texas (3.2.1). I discuss various economic and environmental operators, try to provide the best possible overview of the basin - first from the state level, later from the level of different counties. The problem is approached from the perspective of environmental security and those counties where operators of environmental security have been largely discussed were selected. The same approach was used for the next chapter dealing with the Appalachian basin and Marcellus shale play (3.2.2). The following sub-chapter (3.2.3) takes a slightly different approach, as is with the case in North Dakota it is better to analyze operators only at the state level. However, all the

other parameters have been kept the same as in other examples. One important thing to keep in mind for both this and the following chapter (3.2.4) is the fact that Williston basin and Los Angeles basin are predominantly shale oil dominant. Therefore, my work is trying to carefully distinguish between different effects that different mineral resources may have.

The fourth and fifth sections are meant to serve as a connection in between the theoretical part of my work and the researched part regarding shale plays. Chapter 4 is therefore trying to list all other possible factors which could have influenced the shale gas debate in given locations of interest. By doing so, it aims to self-reflect on performed research and thus provide better answers to my research questions. Chapter 5 then states all clash results when conflicting priorities met. However, the purpose here is not only to list all the results one by one, but to also try to draw the first conclusions of my work. Those will later be all put together in the final summary (chapter 6).

1.3 Discussion of Sources

The reliability of sources in research studies is usually a focal point of controversy. And it is not an exception for this work either. When studying shale gas, one usually finds studies which were funded by one of the interested parties – on one side stakeholders may include industry proponents (corporations, lobby groups, trade unions) and on the other side industry critics (environmental groups, citizen unions). In any event, this leads to the problem that unreliable studies are quite common. It is this exact reason why my main sources of information are various government agencies or local bureaus. Their data should be the least corrupted and least misleading and when approached effectively, they allow enough space for my own interpretation. However, the interpretation of data from an already opinionated group requires quite a high demand for critical thinking. In the end, it still cannot be guaranteed that such information was not chosen selectively.

When it comes to economic security, my main research sources were Bureau of Labor Statistics, United States Census Bureau, Economic Research section of Federal Reserve Bank of St. Louis and Bureau of Economic Analysis under U.S. Department of Commerce. As it will be shown later, each particular agency contains specific official data regarding chosen operators of economic security. Since the same source has always

been used to obtain the same data – for example official census data was always used to evaluate the level of persons living below the poverty level – the consistency and comparability of data was ensured. The same applies to data on operators of environmental security. My main research source here was the United States Environmental Protection Agency, which is the US system tasked with regular monitoring of air and water quality. The agency is also responsible for monitoring any possible impacts on the health and environment of its citizens and ensure that adequate legislature is in place. Other agencies which have been really helpful for the construction of this work are the United States Geological Survey and Energy Information Administration. As sources, they help create for the 'energy part' of my „theoretical triangle“.

It was not possible to find a similar study which would research the true impact of US shale gas extraction in relation to the clash between environment and economic securities. Thanks to this, I had to very often use my own judgement and include local newspaper articles as another commonly used source. Thanks to them I have been able to gain the best possible insight into public opinion regarding shale gas in the given counties. Although this type of source requires a higher level of verification and does not usually provide a critically evaluated point of view, it has been really crucial to use it. Not only because no other source provides better insight into conflicting priorities of economic and environment securities (especially because newspaper articles contain personal testimonies of individuals whose security is directly endangered) but also because it is the most up to date source available. Newspaper sources and - more broadly - internet-based sources were therefore key to my research method of thematic analysis and also for my work in general.

2. Theory discussion

The theory of international relations after WWII has been traditionally focused on problems of national state and national security; therefore, it is no surprise that it has been the same for the field of security studies as well. Security studies experts, usually define security in negative terms such as absence of threat², thus perceived as a dominant source of threat and conflict of military power. However, this traditional concept of security started to be - due to many different trends and tendencies - broadened, deepened and enriched by other dimensions. And although it is not the aim

of this work to describe all those different approaches - most importantly because the extended concept of security is not a single, clearly defined theoretical model - it is still going to be fairly useful to provide a basic overview of some of the key theoretical terms and concepts which will be used here. Moreover, as stated above, this work cannot be clearly understood without defining its position to basic terms of the field.

2.1 Copenhagen school, Human security and Human development report

It should come as no surprise that when I am writing about concepts of environmental and economic security, the broadening concepts of Copenhagen school are mentioned. It is specifically Barry Buzan, Ole Waever and Jaap de Wilde who – as main representatives of the school - bring new and refreshing ideas that help us to not only better understand the process under which threats are created but also allow us to think about security in deeper terms. While the terms of securitization and speech act are in general interesting, they are being omitted in this paper. It is the book „Security: A New Framework for Analysis“ which outlines the single most important contribution of Copenhagen school for the purpose of this work. In this book, the concept of security was broadened to include new players whose security is being endangered, and at the same time, the concept was extended to include new sources of threat (economic, environmental, social). Copenhagen school – or better to specify Buzan's notion of sectoral analysis - thus moves along two axes – a horizontal one, which provides us with new sources of threat, and a vertical one which expresses qualitative changes in reference object.²

These conceptual changes are deeply connected to various themes of this thesis. As Buzan shows, it is not anymore only the state whose security can be endangered, but it can also be an individual or social groups. In the example of shale gas, we are thus talking about the security of various interest groups in exploitation areas (both in favour or opposition of extraction) or about security of oil companies or security of individuals who hold mining rights on their land. The security of new reference objects is however

² WAISOVÁ, Šárka: Od národní bezpečnosti k mezinárodní bezpečnosti, Kodaňská škola na křižovatce strukturálního realismu, anglické školy a sociálního konstruktivismu. IN: *Mezinárodní vztahy*. Vol. 3/2004, pp. 66-86. p. 73.

still connected to national security, and according to Buzan, it should thus be understood in his model of „hourglass“.³

The broadening of sources of threat is equally important as it allows us to completely explore new areas of security. The economic sector describes the relationships of trade, production, and financing of actors. It also describes actors' means of access to resources, finance or markets that are a necessary condition for maintaining a certain level of wealth and power. The environmental sector describes the relationship between human activity and the biosphere of the planet, which is a prerequisite for the existence of mankind. Traditional interaction in this sector used to be the spread of epidemics, but today it has moved more towards the local and global pollution.⁴

In each sector we can count on different types of interactions, sources of threat and types of reference objects. Although the economic sector of Copenhagen School includes only those relationships which arise, on one hand, between economics and military capabilities and, on the other, power and identity of state society (which is not really suitable for purpose of this work), we can also find there a global economy as a potential threat and basic economic needs as a value that can be threatened. It is the latter which is discussed in this work. On the same note, the area of environmental security consists of a threat which the environment represents to human civilization (e.g. earthquake or a meteorite fall), as well as risks to the environment resulting from human activity which in consequence directly threaten the existence of human civilization. The values which are potentially endangered are survival, sustainability or quality of life; all of which are linked to the discussion about shale gas extraction.⁵

³ WAISOVÁ, Šárka: Od národní bezpečnosti k mezinárodní bezpečnosti, Kodaňská škola na křižovatce strukturálního realismu, anglické školy a sociálního konstruktivismu. IN: *Mezinárodní vztahy*. Vol. 3/2004, pp. 66-86. p. 73.

⁴ BUZAN, Barry; LITTLE, Richard: *International Systems in World History. Remaking the Study of International Relations*. Oxford: Oxford University Press, 2000, pp. 71-77.

⁵ WAISOVÁ, Šárka: *Od národní bezpečnosti k mezinárodní bezpečnosti, Kodaňská škola na křižovatce strukturálního realismu, anglické školy a sociálního konstruktivismu*. IN: *Mezinárodní vztahy* 3/2004, pp. 66-86. pp. 74-76.

In broader terms, the tendencies of Copenhagen school, i.e. shift focus from state and define multiple sources of threat, can be generally seen in the concept of Human security. While the main notion of Human security, with a tendency to use it as a referent for an individual's security rather than the state, is nothing new and can be traced back to antic times, it is mostly the United Nations Development Program's 1994 Human Development Report which is nowadays quoted in regards to this term. Here, Dr. Mahbub ul Haq, influential Pakistani economist and theorist, and his team argued that the scope of global security should be expanded to include new threats in a total of seven areas. Those areas are Economic security, Food security, Health security, Environmental security, Personal security, Community security and Political security.⁶ Economic and environmental securities, as defined by this report, are the main focus of my work and on a theoretical basis they are going to be discussed further. This, however, does not mean that other sectors could not be discussed in regards to US shale gas extraction and that there are no local dynamics related to them. While health security could be, for example, consulted for a possible increase of cardiovascular diseases in relation to improved economic standards, community security may have a look at economic exploitation of different micro regions. Political security can be used as a theoretical framework for research on the influence of democratic practices. All this is in relation to Human security mentioned as a possible overlap to the main topic of my thesis. Here and there the topics may emerge, however, it should be kept in mind that it is not focus of my work.

2.2 Economic security

As already suggested, it is a security consideration of basic economic needs that I am particularly interested in. Economic security or financial security, as understood for the purposes of this work, are therefore the „condition of having stable income or other resources to support a standard of living now and in the foreseeable future“.⁷ Under this definition, the standard of living (certain level of wealth and power in the

⁶ *Human Development Report 1994*. United Nations Development Programme. New York: United Nations, 2014. pp.136.
http://hdr.undp.org/sites/default/files/reports/255/hdr_1994_en_complete_nostats.pdf (downloaded on 15th March 2014).

⁷ *Glossary of Demographics Terms*. Population Reference Bureau,
<http://www.prb.org/Publications/Lesson-Plans/Glossary.aspx> (accessed on 20th March 2014).

words of Buzan) is very closely linked to the quality of life and thus includes factors such as: income, quality and availability of employment, class disparity, poverty rate, quality and affordability of housing, hours of work required to purchase necessities, gross domestic product, inflation rate, number of vacation days per year, affordable (or free) access to quality healthcare, quality and availability of education, life expectancy, incidence of disease, cost of goods and services, infrastructure, national economic growth, economic and political stability, political and religious freedom, environmental quality, climate and/or personal safety.⁸

Since it is not possible to research all of the above, my work will have a look at those operators which have also been mentioned by the Human Development Report. Firstly, one of them is „an assured basic income - usually from productive and remunerative work, or in the last resort from some publicly financed safety net.“⁹ Here the focus will be on employment in general, in particular, on employment of groups such as youth, Afro Americans or women, as well as on the ratio of temporary vs. permanent jobs. Another operators, in accordance with the report, are the level of homelessness or the development of average income per person. These quality measures and factors might be researched in order to see what level of importance (if any) they play in the broader decision making process when economic and environmental security clash. From the perspective of a western state, however, they may be adjusted, for example, the figure of the level of homelessness can be much better illustrated based on the amount of people living below the poverty line. Due to limited data sets, there will be no possibility for deep statistical research and correlation discussion and the possibility of operationalization of mentioned items is somewhat limited. All data will be thus analyzed along the lines of thematic analysis. As this analysis focuses on examining and recording patterns within data, I am going to use research data from - for example – United States Census Bureau, IHS or Bureau of Labor Statistics which is

⁸ *Standard of Living*. Investopedia Dictionary.
<http://www.investopedia.com/terms/s/standard-of-living.asp#ixzz1VUli2yEI> (accessed on 20th March 2014).

⁹ *Human Development Report 1994*. United Nations Development Programme. New York: United Nations, 2014. p.25.
http://hdr.undp.org/sites/default/files/reports/255/hdr_1994_en_complete_nostats.pdf (downloaded on 15th March 2014).

registered under Department of Labor. These should provide a reasonable insight into economic security of specific shale gas locations.

2.3 Environmental security

Environmental security is an important concept in two fields, international relations and international development, and as such, is probably the most difficult security to define. Although it is always lingering somewhere in the background, theorists have a hard time to specify environmental security and operate with it as if it were an independent concept. Sometimes it is defined in a purely military context and deals with military damage caused to the environment (typical example here would be the Vietnam conflict), sometimes it is defined in a broader context of power and deals with resource scarcity and conflict (typical example here would be the work of Thomas Homer Dixon).

Nevertheless, as mentioned above, my work focuses on risks to the environment resulting from human activity. The discussion around this topic started to proliferate academic discourse beginning in the 1960s and 1970s when the public expressed deepening concern about degradation of the environment. And it was as early as in 1972 that the United Nations organized a conference which led to the creation of the United Nations Environment Programme (UNEP). This was followed by another milestone report released in 1987 by the commission of Harlem Brundland titled *Our Common Future*. This report placed the environment together with economic and social issues and popularized the term sustainable development. Notable was also the Rio Earth summit in 1992 from which the Human Development Report was released in 1994, only in confirmation of a long evolving trend.¹⁰ But similarly as in the case of Economic security, it is the Human Development report which is being used in this work in order to define key operators of discussion. And as in the case of economic security, the thematic analysis will be used.

¹⁰ BROWN, Oli: *The Environment and our Security, How our understanding of the links has changed*. A contribution to the International Conference on Environment, Peace and Dialogue among civilizations. Tehran, Iran, May 9-10, 2005. pp.10. <http://www.iisd.org/publications/environment-and-our-security-how-our-understanding-links-has-changed> (downloaded on 20th March 2014).

The report distinguished threats to global environment and environmental threats within countries. Although climate change (as the most prominent example of a global threat) is also a very interesting topic to study, in regards to the United States, it is more appropriate to study local problems. Here the report mostly focuses on water as an example of a threat in developing countries, and air pollution as an example of a threat in industrial countries.¹¹ Both of them are clearly applicable to shale gas extraction (for example lower availability of drinking water, integrity of water supply, drought or water contamination are very often cited in shale gas research) and will be used. The same for greenhouse emissions. However, remaining vulnerabilities mentioned by the report such as a loss of agricultural production from air pollution, rising number of disasters, deforestation of land or salinization are linked much less or not at all to shale gas and will not be considered.¹²

2.4 Clash of conflicting sectors

It is very difficult to properly frame the clash of conflicting security sectors. However, as previously mentioned, the issue of mutually competing priorities is tremendously interesting as it carries many difficult and not always easy to answer questions. This is usually the case because the values that are competing cannot be easily labeled as good or bad. One is actually lucky if the values can be prioritized in a certain order. Unfortunately, in the case of UN Human Development report it is nowhere mentioned that a certain sector of human security would be more important than the other. In fact, the report does not really reflect on a possible situation when two sectors (securities) would stand against each other in opposition. It only helps to distinguish in a similar situation by advising that „how individuals regard security depends very much on their immediate circumstances“.¹³

¹¹ *Human Development Report 1994*. United Nations Development Programme. New York: United Nations, 2014. pp.28-29.

http://hdr.undp.org/sites/default/files/reports/255/hdr_1994_en_complete_nostats.pdf (downloaded on 15th March 2014).

¹² Specific example of environmental threat linked to shale mining are tremors or local earthquakes caused by drilling operations. Although these are widely cited as possible risk of operations, they will not be considered for purpose of this work. It is especially caused by controversies regarding their origin and to it related discussion whether it is or it is not shale gas extraction which causes them.

¹³ *Human Development Report 1994*. United Nations Development Programme. New York: United Nations, 2014. p.23.

This makes the task of decision making or policy formulation very complicated. On one hand, it would be wrong to assume that this topic has not yet been researched somewhere else in social sciences. On the other, there can very often be studies found dealing with the relation of energy security and climate change.¹⁴ Or studies which look at the relation of health security and economic security as is the case for the US medical system¹⁵. But specifically in the case for economic security vs. environmental security, the researchers would usually try to approach the clash (or conflict if you want) from a constructivism perspective and would use the work of such postmodern philosophers such as Jacques Derrida or Michel Foucault. This has been, for example, the case of Australian academic Dean Laplonge who looked at shale gas extraction in Canadian maritime provinces as a possible opportunity for exercise in peace-building. He tried to use some modern theories in order to deconstruct the prevailing discourse regarding shale gas and then - based on this – transform the conflict before it would become serious.¹⁶ Similar tendencies can also be found in the work of Simon Dalby who looked at human security policies of the Canadian government and tried to analyze its neo-liberal economic approach versus its general statements regarding environmental security, community security etc. The most applicable example here are Dalby's observations regarding the clash between mining companies and indigenous people of

http://hdr.undp.org/sites/default/files/reports/255/hdr_1994_en_complete_nostats.pdf (downloaded on 15th March 2014).

¹⁴ LEVI, Michael A.: *The Canadian Oil Sands, Energy Security vs. Climate Change*. Council on Foreign Relations. Council Special Report No.47, May 2009. <http://www.cfr.org/canada/canadian-oil-sands/p19345> (downloaded on 16th September 2014).

¹⁵ KOMISAR, Harriet: *Key Issues in Understanding the Economic and Health Security of Current and Future Generations of Seniors*. Kaiser Family Foundation, March 2012. <http://kaiserfamilyfoundation.files.wordpress.com/2013/01/8289.pdf> (downloaded on 16th September 2014).

¹⁶ LAPLONGE, Dean: *Shale gas, Transforming the conflict before it „fracks“*. Preliminary paper, Factive, November 2012. <http://factive.com.au/download/Shale%20Gas.%20Transforming%20the%20conflict%20before%20it%20fracks.pdf.pdf> (downloaded on 16th September 2014).

Alberta. To research the topic, Dalby would directly use Foucault's lectures to define the basic framework of his own research.¹⁷

However, for purposes of this work I will not directly perceive the clash between economic and environmental securities as a conflict. Rather than to research it like that, I am more concentrated on dynamics of the existing clash. Therefore, my approach towards it aims to be as neutral as possible. In accordance with the research questions of my work I am trying to understand whether it is economy or environment that receives priority when both meet. And along the lines of thematic analysis, I am using clash as the ambience which should help me to receive better answers on why it is so.

2.5 Shale gas extraction in US

Although only addressed until this moment, it is also important to give a brief overview of some technical terms and data that are usually mentioned in regards to shale gas extraction, in general, and the US specifically. While this work is not purposed to provide excursion into the industry's long history, nor tries to discuss current extraction methods and/or industry practices and operational standards, such an overview will help to define the basic framework of my thesis.

The term shale gas refers to natural gas that is found trapped within shale formations where it is usually stored as an unconventional source of energy. The fact that it is unconventional means that rock formation has a low permeability and extraction of such gas is thus extremely difficult. In order to get it out, a mixture of water, sand and various chemicals is injected under high pressure below the surface where – hundreds of meters down – it fractures the rock and then allows gas to move and be extracted through the drill hole. This method is called hydraulic fracturing (also known as „fracking“) and today accounts for 95 percent of all new wells drilled in the United States. Although it has existed since the 1860s and has been widely commercially used in the last couple of decades, only recent technological advancement, specifically the method of horizontal drilling, has allowed the current

¹⁷ DALBY, Simon; BALDWIN, Andrew: Canadian Middle-Power Identity, Environmental Biopolitics, and Human Insecurity. IN: HYNEK, N.; BOSOLD, D.: *Canada's Foreign and Security Policy: Soft and Hard Strategies of a Middle Power*. Oxford.: Oxford University Press; 2010. pp.121-137.

economic boom. Horizontal wells, accessing shale formation from side rather than from top, allow much greater access to shale formations than vertical ones.¹⁸

It is not only hydraulic fracturing and horizontal drilling that is being discussed in this work. Especially for the purposes of environmental security (and therefore of this thesis), we need to consider the entire process which surrounds this method. If one wants to extract unconventional gas from the ground, it is first necessary to prepare a site for it. This is later followed by drilling and casing which prepares the well for completion. Other important steps which are going to be considered are: shale gas production; transportation; usage, storage and disposal of chemicals and water; and finally, site remediation.¹⁹ Each of these steps plays an important part in extraction of unconventional gas and may have an impact on environmental security.

The last thing I would like to mention in this chapter is geographical location of shale gas basins across the United States. As in other countries, shale gas is mostly located in Devonian formations and sediments, however, compared to other countries, the US production is much more progressed and commercialized. This allows the U.S. Energy Information Administration to assess not only the number of basins and plays, but also potential recoverable resources. As for last year, the overall estimate for the US was that 1,161 Tcf (trillion cubic feet) of risked, technically recoverable wet and dry shale gas is located in a total of 15 shale basins and 70 distinct shale plays. To name the most important ones, it is necessary to mention Barnett Shale in Texas where first commercial shale development in the US started. This is then followed by Fayetteville in Arkansas; Haynesville in Louisiana; Antrim in Michigan, Indiana and Ohio; Marcellus Shale in New York, Pennsylvania and West Virginia; Eagle Ford in Texas; or by Bakken in North Dakota close to borders with Canada.²⁰

¹⁸ DAVIES, R.J.; MATHIAS, S.A.; MOSS, J.; HUSTOFT, S.; NEWPORT, L.: Hydraulic fractures, How far can they go?. IN: *Marine and Petroleum geology*, vol. 37 (1), 2012. pp. 1-6.

¹⁹ *Natural Gas from Shale: Questions and Answers*. US Department of Energy, Office of Fossil Energy, downloaded from http://energy.gov/sites/prod/files/2013/04/f0/complete_brochure.pdf (accessed on 16th November 2014).

²⁰ *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States*. Washington, DC: U.S. Energy Information Administration, June 2013. pp. 46-55.

2.6 US Shale gas extraction vs. Economic security

In order to evaluate shale gas influence on the American economy I would like to evaluate how the industry performed during the financial crisis from the year 2008. As this chapter is supposed to provide a general overview of my economic security operators in the United States, special attention will be paid to such measures as employment, salary income, or ratio of permanent vs. temporary jobs.

As SBE council report shows, on the jobs front „while total U.S. employment declined by 3.7 percent from 2005 to 2010, jobs grew by 27.6 percent in the oil and gas extraction sector; by 15.1 percent in the drilling oil and gas wells sector; by 38.5 percent in the support sector for oil and gas operations; by 47 percent in the oil and gas pipeline and related structures construction sector; and by 62 percent in the oil and gas field machinery and equipment manufacturing sector.“²¹ This was also supported by other reports. For example, in 2011 IHS claimed that the shale gas industry in 2010 supported more than 600,000 jobs.²² And while their estimate at the same time was that by 2015 the total will likely grow to nearly 870,000 jobs,²³ their more recent figures were already talking about 1,2 million jobs directly or indirectly related to shale gas in 2012.²⁴ State agencies – which generally have more modest data – also agree on positive contribution of unconventional gas for the United States. According to the

<http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf> (accessed on 16th November 2014).

²¹ *New Study Underscores Benefits of Natural Gas Production and Exports for Small Business and Jobs*. Washington DC: Small Business & Entrepreneurship Council, 2nd May 2013. <http://www.sbecouncil.org/2013/05/02/new-study-underscores-benefits-of-natural-gas-production-and-exports-for-small-business-and-jobs/#sthash.MBPQmHYx.dpuf> (downloaded on 4th December 2013).

²² *Shale Gas Supports More Than 600,000 American Jobs Today; by 2015, Shale Gas Predicted to Support Nearly 870,000 Jobs and Contribute \$118.2 Billion to GDP, IHS Study Finds*. IHS Online Pressroom, 6th December 2011). <http://press.ihs.com> (downloaded on 23rd November 2013).

²³ *Shale Gas Supports More Than 600,000 American Jobs Today; by 2015, Shale Gas Predicted to Support Nearly 870,000 Jobs and Contribute \$118.2 Billion to GDP, IHS Study Finds*. IHS Online Pressroom, 6th December 2011). <http://press.ihs.com> (downloaded on 23rd November 2013).

²⁴ *IHS CERAWeek 2013 Preview, The Unconventional Energy Revolution Fueling Economic Growth – A State Look*. IHS, 28th February 2013. <http://unconventionalenergy.blogs.ihs.com/2013/02/28/ihs-ceraweek-2013-preview-the-unconventional-energy-revolution-fueling-economic-growth-a-state-look/> (downloaded on 23rd November 2013).

Bureau of Labor Statistics, which is registered under Department of Labor, in 2012 oil and gas extraction was directly employing 186 thousands people on a monthly average.²⁵ From the same statistics we can also see that between 2008 and 2009 (at peak of financial crisis) there was an annual drop of 4,4% in all non-farm related jobs while the drop for oil and gas extraction business was only 0,44% which is ten times less.²⁶ The gas industry was thus providing jobs at times when other industries were not able to do so. On the other hand when it comes to employment of women, the most recent figures from October 2014 show that only 13,6% of the total workforce is females compare to 48% in all privately organized occupations.²⁷

When it comes directly to income and wages, the statistics – comparing shale gas related jobs to other occupations - usually speak in favor of shale gas. In the year 2013, the average weekly salary in mining and logging industry (where shale gas extraction and directly linked jobs belong) was 1302 dollars. In comparison, the weekly average salary in all private jobs (mining and logging included) was „only“ 825 dollars. With incomplete data for the year 2014 covering only the period from January to October so far, the trend is similar. While mining and logging industry was on average making 1384 dollars a week, all private jobs in total had the average income of 842 dollars. If I then compare the period from January 2008 to October 2014, we can see that on average mining and logging weekly salaries for the whole period are 56,8 percent higher than the salary of the private sector in general. And the difference has been getting bigger over the years.²⁸ The last operator that I would like to provide an

²⁵ *Data Retrieval: Employment, Hours, and Earnings (CES). Employees on nonfarm payrolls by industry sector and selected industry detail.* Bureau of Labor Statistics. <http://www.bls.gov/webapps/legacy/cesbtab1.htm> (downloaded on 23rd November 2014).

²⁶ *Data Retrieval: Employment, Hours, and Earnings (CES). Employees on nonfarm payrolls by industry sector and selected industry detail.* Bureau of Labor Statistics. <http://www.bls.gov/webapps/legacy/cesbtab1.htm> (downloaded on 23rd November 2014).

²⁷ *Data Retrieval: Employment, Hours, and Earnings from the Current Employment Statistics survey (National). Employment of women on nonfarm payrolls by industry sector, seasonally adjusted.* Bureau of Labor Statistics. <http://www.bls.gov/webapps/legacy/cesbtab5.htm> (downloaded on 17th November 2014).

²⁸ *Data Retrieval: Employment, Hours, and Earnings from the Current Employment Statistics survey (National). Average hourly and weekly earnings of all employees on private nonfarm payrolls by industry sector, seasonally adjusted.* Bureau

overview of on the US macro level is the ratio of permanent vs. temporary jobs. Even though it is not the last operator from my list, the other operators are level of state support or level of homelessness cannot be discussed because their figures don't provide enough relevant data on such a level. The amount of temporary jobs, on the other hand, helps us to understand what kind of economic stability shale gas provides. In 2013 there was in total, across all nonagricultural industries, 33 284 000 people working a part time job, out of which 7 823 000 worked part time for economic reasons.²⁹ Mining, including oil and shale gas extraction, was taking a small part of this figure with only 15 000 people working part time for economic reasons in this industry. This figure is even more impressive when we take into account that the only lower number – 6 000 – was provided by unpaid family workers.³⁰

The positive contribution of shale gas is not only related to the creation of jobs. One frequently mentioned feature which I would like to list as well, is that shale gas has one of the lowest market prices of natural gas and has helped to create conditions for very cheap energy supply. Although this may not have a direct impact on income and wages, there is definitely an indirect connection. It is believed that if the United States were to shut down all shale gas production, natural gas related costs for households would increase by at least 50% and all household direct and indirect costs would be increased by \$127 billion a year, which is an amount that American households are theoretically saving now. Still one doubt remains - despite the fact that the case for US economic security is rather strong, given its positive effects on the economy in general, some people are afraid that a positive cycle, so typical of this industry nowadays, will not result in long-term economic benefits. On the contrary, unequal distribution of these

of Labor Statistics. <http://data.bls.gov/pdq/SurveyOutputServlet> (downloaded on 17th November 2014). The data are only showing average weekly wages for different industries. In order to get full dollars I had to round the numbers. Similarly for percentage difference I had to calculate this on my own.

²⁹ This means that these people worked only 1 to 34 hours during the reference week for an economic reason such as slack work or unfavorable business conditions, inability to find full-time work, or seasonal declines in demand. The full time job as defined by Bureau of Labor Statistics is 35 working hours a week and more.

³⁰ *Labor Force Statistics from the Current Population Survey 2013. 21. Persons at work in nonagricultural industries by class of worker and usual full- or part-time status.* Bureau of Labor Statistics, p.49. <http://www.bls.gov/cps/tables.htm> (downloaded on 17th November 2014).

benefits can actually cause a conflict among different communities.³¹ And thus even though the discussion on this topic is not part of this thesis, it is necessary to mention this point here.

2.7 US Shale gas extraction vs. Environmental security

Similarly as in the case of economic security, also in this chapter I would like to provide an overview of the main environmental operators across the territory of the United States. The focus will be on two basic elements – water and air. But before I start a discussion in this area, I would like to first name all possible risks to the environment that can occur here. And the list is long.

When reading through media or government reports, one can usually encounter the following concerns related to water: excessive use of water; impact on water resources from water used in hydraulic fracturing; inadequate transport or treatment of waste waters; contamination of soil, surface water or groundwater due to spills; fluid left underground that could migrate to other formations in the future; contamination of groundwater due to mobilization of solutes or methane or due to poor well design. Similarly, the following concerns can be read in the case of air: emissions from flaring; fugitive emissions of methane from drilling or fugitive emissions of methane from well failure. Other environmental concerns include spillage due to inappropriate transport, processing or disposal of drill cuttings can appear.³² Although all of them are very important, only some of them are perceived as a real threat in the United States. When reading through reports of government bodies such as the Environment Protection Agency (EPA) or through reports of advocacy groups such as Environment America,³³ it is clear that the most prominent issues are availability of drinking water, groundwater contamination, amount of water used and greenhouse emissions. This is particularly good for the purpose of this work as those are also my main operators. Other problems

³¹ RADOW, Elisabeth N.: Homeowners and gas drilling leases: Boon or Burst?. IN: *New York State Bar Association Journal*. November/December 2011, vol. 83, no. 9, pp. 12-21.

³² ELLIS-JONES, Mark: *Onshore oil & gas and the environment: the regulatory framework*. Presentation to the Shale Gas World 2014, Birmingham, 14th May 2014. <http://www.terrapinn.com/conference/shale-gas-uk/index.stm> (accessed on 15th October 2014).

³³ Environment America is a union of different state-based environmental advocacy organizations and is always funded by citizens of given state.

such as surface water contamination or radioactivity – even though discussed - are not the centerpiece of public debate.³⁴ And others (not mentioned until now, air pollution due to contaminants in the air) are more related to health security and thus will not be discussed in this chapter either.

The first operator I would like to have a look at is groundwater contamination which is also linked to the integrity of water supply. Even though there are not so many documented incidents where hydraulic fracking would contaminate groundwater, the topic receives relatively high publicity. This may be given by the fact that the threat in the form of contamination can be highly tangible and easy to imagine as its possible impact – compared to other threats – is immediately visible. Yet still in May 2011, there had not been „any proven case where the fracking process itself has affected water“³⁵ as Lisa Jackson, at that time Administrator of EPA, testified in front of the Senate committee. This has lately changed mostly due to the Pavillion gas field incident in the state of Wyoming. Here EPA investigation concluded that impact to groundwater was most likely caused by hydraulic fracturing.³⁶ But even with this case, the factual impact of shale gas extraction on groundwater supplies is very limited. Far more interesting in this regard are exemptions that the oil and gas industry receives from several environmental laws. For example – unless diesel fuels are used in fracturing fluids, the gas industry is exempted by Energy Policy Act of 2005 from Safe Drinking Water Act's (SDWA) Underground Injection Control (UIC) Program.³⁷ And thus despite numerous

³⁴ For surface water contamination see e. g. BEGOS, Kevin: *Four states confirm water pollution from drilling*. USA Today, 5th January 2014. For radioactivity see e. g. URBINA, Ian: *Toxic Contamination From Natural Gas Wells*, The New York Times, 26th February 2011.

³⁵ *EPA Jackson 'Not Aware of Any Proven Case Where the Fracking Process Itself Has Affected Water'*. U.S. Senate Committee on Environment & Public Works, Press Releases, May 24, 2011. http://www.epw.senate.gov/public/index.cfm?FuseAction=PressRoom.PressReleases&ContentRecord_id=23EB85DD-802A-23AD-43F9-DA281B2CD287 (accessed on 18th November 2014).

³⁶ DIGIULIO, Dominic C.; WILKIN, Richard T.; MILLER, Carlyle: *Investigation of Ground Water Contamination near Pavillion, Wyoming (draft report)*. U.S. Environmental Protection Agency, December 2011. http://www2.epa.gov/sites/production/files/documents/EPA_ReportOnPavillion_Dec-8-2011.pdf (downloaded on on 18th November 2014).

³⁷ *Testimony of Bob Perciasepe, Deputy Administrator, U.S. Environmental Protection Agency, Before the Sub-Committee on Water and Wildlife, Committee on Environment and Public Works. United States Senate, April 12, 2011*. United States

reassurances from industry proponents, EPA and other government bodies over the past years, it is more those exemptions that still cause many questions and raise concern.

Despite the significance of the previously mentioned threat, the real water related issue in the United States is the drought and lower availability of drinking water. Over the past couple of years, there have been documented cases witnessing the withdrawal of large volumes of water due to high amounts used in drilling and hydraulic fracturing. This has sparked national attention and since 2010 - at the request of Congress - EPA is „conducting a study to better understand the potential impacts of hydraulic fracking on drinking water resources“. ³⁸ The study is not yet finished and the progress report which was released in the year 2012 does not provide enough data to draw any conclusion. However, let's have a look at approximate amounts of water that we are talking about. According to EPA, about 50 000 to 350 000 gallons of water is needed to fracture one well in a coal bed formation and two to five million gallons of water is needed to fracture one well in a shale formation. ³⁹ As many wells need to be re-fractured over its lifetime, the average water consumption by well is somewhere in between 3-8 million gallons of water. ⁴⁰ These are quite high numbers, especially when we take into consideration that all this is consumption water, which means that unlike water from a toilet or shower, this water is not again returned to the water cycle. Instead about 80 % of the fracking water remains stuck underground, while a remaining 20% becomes wastewater and is then typically disposed of in deep injection wells. ⁴¹ Additionally – according to data from U.S. Energy Information Administration (EIA) –

Environmental Protection Agency. <http://www2.epa.gov/hydraulicfracturing> (downloaded on 18th November 2014).

³⁸ *Natural Gas Extraction - Hydraulic Fracturing*. United States Environmental Protection Agency <http://www2.epa.gov/hydraulicfracturing> (accessed on 18th November 2014).

³⁹ *Hydraulic Fracturing Research Study*. United States Environmental Protection Agency, June 2010. <http://www.epa.gov/tp/pdf/hydraulic-fracturing-fact-sheet.pdf> (downloaded on 18th November 2014).

⁴⁰ ABDALLA, Charles W.; DROHAN, Joy R.: *Withdrawals for Development of Marcellus Shale gas in Pennsylvania. Introduction to Pennsylvania's Water Resources*. The Pennsylvania State University, 2010. <http://pubs.cas.psu.edu/FreePubs/pdfs/ua460.pdf> (downloaded on 17th November 2014).

⁴¹ JENKINS, Jesse: *Energy Facts: How Much Water Does Fracking for Shale Gas Consume?*. The Energy Collective, 6th April 2013, <http://theenergycollective.com/jessejenkins/205481/friday-energy-facts-how-much-water-does-fracking-shale-gas-consume> (accessed on 17th November 2014).

the United States had 487,286 gas producing wells in 2013.⁴² To understand the issue in full, we need to also look at other numbers which usually try to put this data in perspective. For example, American Petroleum Institute (API), the largest US trade association and lobby group for the oil and natural gas industry, claims that each American golf course uses more than 4 million gallons of water per summer month. And therefore one extraction well does not actually consume so much.⁴³ Also API claims – which is very common argument among industry proponents – that the agricultural sector consumes more than shale gas extraction by far. For example, just in state of Pennsylvania, 61,8 million gallons of water is used per day for livestock.⁴⁴ And even in such arid regions as Texas, all shale gas wells drilled and completed amounted only to less than 1 percent of all water withdrawals in the state.⁴⁵ So is the drought and lower availability of drinking water a real water related issue in the United States or not? I believe that the answer for the whole area of US cannot be given, rather this problem needs to be studied from a local perspective. And that is something which will be dealt with later.

The last but definitely not least operator related to environmental security is the amount of air emissions. In general, natural gas is cleaner in burning as it releases about 50% less carbon dioxide than coal and 33% less than oil.⁴⁶ Thanks to this, it has been promoted by many as clean source of energy and fuel of the future. A great example here could be from the current Obama administration. In the last State of the Union Address, the president compared shale gas to „bridge fuel that can power the economy

⁴² *Natural Gas, Number of Producing Gas Wells*. U.S. Energy Information Administration. http://www.eia.gov/dnav/ng/ng_prod_wells_sl_a.htm (accessed on 23rd November 2014).

⁴³ *Hydraulic Fracturing, Unlocking America's Natural Gas Resources. Water Usage*. American Petroleum Institute. <http://www.hydraulicfracturing.com/> (accessed on 23rd November 2014).

⁴⁴ *Hydraulic Fracturing, Unlocking America's Natural Gas Resources. Water Usage*. American Petroleum Institute. <http://www.hydraulicfracturing.com/> (accessed on 23rd November 2014).

⁴⁵ JENKINS, Jesse: *Energy Facts: How Much Water Does Fracking for Shale Gas Consume?*. The Energy Collective, 6th April 2013, <http://theenergycollective.com/jessejenkins/205481/friday-energy-facts-how-much-water-does-fracking-shale-gas-consume> (accessed on 17th November 2014).

⁴⁶ *Natural Gas, Environmental Benefits, Emission Reduction Potential*. Centre for Climate and Energy Solutions. http://www.c2es.org/technology/factsheet/natural-gas#_edn54 (accessed on 23rd November 2014).

with less of the carbon pollution that causes climate change⁴⁷. This statement has been challenged, however, from many perspectives. Some argue that relying too heavily on shale gas could actually hamper other climatic efforts in the long run and this „bridge“ thus needs to be very short (if any). Others add that methane leakage accompanying gas extraction eliminates any advantage that it has over coal.⁴⁸ In fact, from the perspective of air emissions, although greenhouse gases for shale gas are in general lower, the emissions of natural gas primarily consist of methane, which is about 21 times more powerful in terms of heat-trapping ability than CO₂ over a 100 year time frame.⁴⁹ And some researchers such as Robert W. Howarth from Cornell University thus concluded that the shale gas footprint is much higher than the footprint of any other energy source.⁵⁰ On the other hand, as Michael Levi shows in his paper, Howarth does not ever assume in his paper that natural gas is phased out and therefore he inevitably overestimates the importance of methane.⁵¹ On top of that, in 2012 the EPA issued its first federal air standards that are expected to reduce leakage of methane emissions from hydraulically fractured gas wells to under 2%.⁵² Therefore, it is the general consensus that shale gas helps to reduce greenhouse air emissions.

⁴⁷ OBAMA, Barack: *State of the Union Address 2014*. The White House, Office of the Press Secretary, 28th January 2014. <http://www.whitehouse.gov/the-press-office/2014/01/28/president-barack-obamas-state-union-address> (accessed on 23rd November 2014).

⁴⁸ PLUMER, Brad: *Obama says fracking can be a 'bridge' to a clean-energy future. It's not that simple*. The Washington Post, 29th January 2014. <http://www.washingtonpost.com/blogs/wonkblog/wp/2014/01/29/obama-says-fracking-offers-a-bridge-to-a-clean-energy-future-its-not-that-simple/> (accessed on 23rd November 2014).

⁴⁹ *Natural Gas, Environmental Benefits, Emission Reduction Potential*. Centre for Climate and Energy Solutions. http://www.c2es.org/technology/factsheet/natural-gas#_edn54 (accessed on 23rd November 2014).

⁵⁰ HOWARTH, Robert; SONTARO, Renee; INGRAFFEA, Anthony: *Methane and the greenhouse-gas footprint of natural gas from shale formations*. Springerlink.com, <http://graphics8.nytimes.com/images/blogs/greeninc/Howarth2011.pdf> (accessed on 23rd November 2014).

⁵¹ LEVI, Michael A.: *A New Paper on Natural Gas as a Bridge Fuel*. Council on Foreign Relations. Energy, Security and Climate committee, 4th January 2013, <http://blogs.cfr.org/levi/2013/01/04/a-mixed-verdict-on-natural-gas-as-a-bridge-fuel/> (accessed on 23rd November 2014).

⁵² *Oil and Natural Gas Air Pollution Standards*. United States Environmental Protection Agency, 2012. <http://www.epa.gov/airquality/oilandgas/actions.html> (accessed on 23rd November 2014).

3. Case study

All previously mentioned assumptions and theoretical concepts are now going to be researched and applied to several mini case studies across the entire territory of the United States. The case studies have been chosen with a few key considerations in mind, as well as with regard to the relevance of the entire topic. Among others, the role played (in random order) include: geological and economic significance of given shale gas location, its „popularity“ in the media, relevance of environmental controversy, or different outcomes of public discussion. The locations should represent a diverse enough picture to allow analysis of the topic. First, I would like to introduce them one by one after which I would like to describe which path the discussion took regarding economic and environmental security. The core part is to look into different factors and operators that have played a role in each particular path. Finally, the last section describes the result of the clash between potential future outcomes.

3.1 Main shale gas locations of interest

As previously mentioned in the sub-chapter on shale gas in the United States, there are a couple of key basins in which shale gas extraction currently occurs. The very first one I would like to have a more detailed look at is Barnett shale of the Forth Worth basin in Texas. This basin has been chosen due to its historical and economic importance. It was here that Mitchell Energy, the company closely linked to the first developmental years of shale play, drilled the first horizontal well. Although it took some time before this technology was a technical success, and even longer before it became an economical success, it represents a remarkable milestone in the development of the industry. Many techniques, originally only adopted by Mitchell Energy as experiments, have been later copied and used by other companies. From this perspective, it is therefore impossible to provide any study on US shale gas without mentioning Barnett. Furthermore, without the technologic advancement that horizontal drilling brought, there would be no extraction possible in Barnett as shale gas here is not easy to extract.⁵³ Therefore, this play has a very close connection to the core topic of this thesis. Additionally, the economic significance of Fort Worth basin is also

⁵³ KRUPNICK, Alan; WANG, Zhongmin: *A Retrospective Review of Shale Gas Development in the United States. What Led to the Boom?*. Resources for the Future, April 2013. <http://www.rff.org/RFF/documents/RFF-DP-13-12.pdf> (downloaded on 1st December 2014).

remarkable. Some experts in the past suggested that Barnett might have the largest estimated natural gas reserves in the United States and in 2007 it was expected that even with the current high pace of exploitation the extraction would continue for at least another 20-30 years.⁵⁴ Currently, the newest Energy Information Administration (EIA) report from December 2014 states that proved shale gas reserves in Barnett in 2013 were 26 trillion cubic feet of gas. This figure, together with an annual production of 2 trillion cubic feet, places Barnett in second place behind Marcellus shale play.⁵⁵

The Appalachian basin, and to it linked Marcellus shale play, is the second shale gas location of interest I would like to investigate further. This play is located across multiple states, mainly in Pennsylvania, but also in West Virginia, New York and Ohio and in terms of geology, Barnett and Marcellus are remarkably alike. Despite similarities and the fact that Barnett has more gas per square area than Marcellus,⁵⁶ proved reserves of Marcellus play are much higher. According to the same EIA report which was already discussed, the reserves here are 64,9 trillion cubic feet and the production last year was 3.7 trillion cubic feet. And while Barnett production was actually decreasing, production in Marcellus play has grown by 1,3 trillion cubic feet between 2012 and 2013.⁵⁷ Besides shale gas reserves, another reason why Marcellus play has been chosen is its very close location to high energy demanding markets of the United States East Coast. This obviously brings a lot of attention and lot of pressure to this play and makes the clash issue interesting. In fact, the constantly growing production can also be explained from this perspective.

⁵⁴ *Barnett Shale Economic Impact study*. Texas: The Perryman Group, May 2007. p. 20.
http://web.archive.org/web/20110707212648/http://www.barnettshaleexpo.com/docs/Barnett_Shale_Impact_Study.pdf (downloaded on 4th December 2014).

⁵⁵ *U.S. Crude Oil and Natural Gas Proved Reserves, 2013*. Washington, DC : U.S. Energy Information Administration, December 2014.
<http://www.eia.gov/naturalgas/crudeoilreserves/pdf/uscrudeoil.pdf> (accessed on 4th December 2014). p. 14.

⁵⁶ BRUNER, Kathy R.; SMOSNA, Richard: *A Comparative Study of the Mississippian Barnett Shale, Forth Worth Basin, and Devonian Marcellus Shale, Appalachian Basin*. U.S. Department of Energy, April 2011, pp.2-4.

⁵⁷ *U.S. Crude Oil and Natural Gas Proved Reserves, 2013*. Washington, DC : U.S. Energy Information Administration, December 2014.
<http://www.eia.gov/naturalgas/crudeoilreserves/pdf/uscrudeoil.pdf> (accessed on 4th December 2014). p. 14.

The third shale play which will be discussed in the next paragraphs is the Bakken formation in North Dakota. Bakken is part of the so called Williston basin and compared to the two previous ones, it claims the largest square area. However, despite rapid growth in numbers during the last several years due to more advanced technologies, the amount of proved shale gas reserves is much lower.⁵⁸ Currently, the highest estimate is 6.7 trillion cubic feet of natural gas which is the combined figure for both the Bakken and Three Forks Formations in the Williston Basin. And to be fully clear, this figure is in addition to North Dakota which also covers areas of South Dakota and Montana.⁵⁹ But Bakken is a very interesting case due to another reason which is the amount of produced gas. It is especially the specificity of clash dynamics in North Dakota. While on one hand this state experiences the lowest unemployment rate in the U.S. since 2008 (in fact, oil and natural gas industry in North Dakota supports around 64,000 jobs, 12 percent of the state's total employment),⁶⁰ the state has also some of the most visible environment accidents related to oil and shale gas extraction. In 2013 a unit train derailed and exploded in the town center of Lac-Mégantic, destroying 30 buildings (half of the downtown) and killing 47 people. Even though the accident was related to highly volatile Bakken oil, it brought more visibility to environmental concerns of shale gas extraction as well.⁶¹

⁵⁸ SAKELARIS, Nicholas: *Eagle Ford, Permian are kings of oil, but the Bakken is gaining fast*. Dallas Business Journal, May 21. <http://www.bizjournals.com/dallas/news/2014/05/21/eagle-ford-permian-are-kings-of-oil-but-the-bakken.html?page=all> (accessed on 5th December 2014).

⁵⁹ GASWIRTH, Stephanie B. (eds.): *Assessment of Undiscovered Oil Resources in the Bakken and Three Forks Formations, Williston Basin Province, Montana, North Dakota, and South Dakota, 2013*. US Geological Survey, 2013. <http://pubs.usgs.gov/fs/2013/3013/fs2013-3013.pdf> (downloaded on 5th December 2014).

⁶⁰ *Oil and Natural Gas Stimulate North Dakota Economic and Job Growth*. American Petroleum Institute, July 2014. <http://www.api.org/policy-and-issues/policy-items/jobs/~media/Files/Policy/Jobs/Oil-Gas-Stimulate-Jobs-Economic-Growth/Map/North-Dakota.pdf> (accessed on 28th November 2014). Quoted there based on Information from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages (preliminary data for 2013 accessed July 2014); and PriceWaterhouseCoopers, "The Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy: Employment, Labor Income and Value Added," 7/12/13 (based on 2012 IMPLAN database).

⁶¹ *Search resumes in Lac-Mégantic for 5 still missing*. CBC News, 21st July 2013, <http://www.cbc.ca/news/canada/montreal/search-resumes-in-lac-m%C3%A9gantic-for-5-still-missing-1.1357940> (accessed on 5th December 2014).

Finally, the last shale gas location to draw my interest is the Los Angeles basin of Southern California. The previous examples have all been chosen based on a mixture of various reasons, but the case for the Los Angeles basin has been selected mainly due to the different outcome of public discussion regarding shale gas. It was here, in Beverly Hills, where local residents voted unanimously to ban fracking in their city. Although no fracking has been happening directly in the county itself, extraction is under process in the surrounding county of greater LA and some local residents here have also tried to achieve the same result.⁶² For the purpose of this thesis it is extremely important to research this case as it may shed some light on the decision making process of clashes between different security sectors. It will also be especially interesting when we take into account that according to EIA, the cost for a horizontal well in Los Angeles basin ranges from 5 to 7 million dollars. This may not be as low as the average cost in Marcellus play (3 to 4 million dollars per horizontal well) or Barnett play (2 to 3 million dollars), however, is very similar to the average well cost of 5.5 to 8.5 million dollars in Bakken shale play of North Dakota where the extraction is continuously ongoing.⁶³

3.2 Economic vs. Environmental security, discussion of main operators

Now, when the general introduction of mini case studies within a case study of the United States have been done, I would like to focus on the discussion of their main operators as were defined for both economic and environmental security. It has already been shown that in the United States the economic effect of shale gas extraction is rather positive. At the same time it has been discussed that environment concerns in the United States are present, however, when strong legislation is in place, the public accepts the extraction. For some concerns the research needs to be specific and local. It is the purpose of this chapter to have a closer look at the strength and validity of those general arguments and evaluate them from a more local perspective. Hopefully, along

⁶² FELDMAN, Dana: *Beverly Hills Bans Fracking; First City In California To Do So*. Reuters, 7th July 2014. http://www.huffingtonpost.com/2014/05/07/beverly-hills-bans-fracking_n_5277953.html (accessed on 6th December 2014).

⁶³ *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays*. Washington, DC.: U.S. Energy Information Administration, July 2011. pp. 7, 53 and 71. <http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf> (downloaded on 5th December 2014).

the lines of thematic analysis, we will also be able to find some patterns across the data and thus have a better look at my research questions.

3.2.1 Fort Worth basin

As previously mentioned, I would like to first discuss Barnett shale of the Fort Worth basin in Texas. In general, from an economic perspective, Texas cannot be considered to be a poor state even though some figures here are lower than the United States average. For example - according to the most recent US census which maps data between the years 2009 and 2013 - the average per capita money income in 12 consecutive months was 26 019 dollars, which is lower than the overall US average – 28 155 dollars. Figures of people below the poverty line are similar. This number was 17,6% of the population in 2012, while the United States average was 15.4%.⁶⁴ However, these figures are mostly given by the fact that Texas has a very high population of foreign immigrants who only work for minimum wage. They, however, live predominantly in downtown areas (e.g. Houston) and not in the extraction counties.⁶⁵ In reality, Texas is the second most populous US state after California and the second largest state after Alaska. The local economy in 2014 represented over 9% of the total US GDP and if Texas were its own country it would represent the 13th highest GDP in the world.⁶⁶ Also in terms of employment Texas is doing relatively well. The figures for October 2014 stand at 5,4% unemployment rate with a projected annual average of 5.3%.⁶⁷ For comparison, the United States average unemployment rate in October 2014 was 5.8% with a projected annual average of 6.2%.⁶⁸ And even when looking at historical figures from the same data sets, we can see that Texas is in general doing 0,5-1% better. To conclude this brief overview, I think it is thus safe to claim that from an economic security point of view Texas is doing well as a state, even though

⁶⁴ *State and County Quick Facts: Texas*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/48000.html> (accessed on 5th December 2014).

⁶⁵ *State and County Quick Facts: Texas*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/48000.html> (accessed on 5th December 2014).

⁶⁶ HOLODNY, Elena: *11 Staggering Facts About The Texas Economy*. Business Insider, 2nd November 2014. <http://www.businessinsider.com/facts-about-the-texas-economy-2014-11?op=1> (accessed on 7th December 2014).

⁶⁷ *Data Retrieval: Local Area Unemployment Statistics, Texas*. Bureau of Labor Statistics. <http://data.bls.gov/timeseries/LASST480000000000003> (downloaded on 7th December 2014).

there might be some clear gaps identified as improvement areas. It is now necessary to have a look at individual counties within the Fort Worth basin area and see how operators from both economic and environmental security are doing there. However, as the basin underlies at least 17 counties,⁶⁹ we can have a look only at some of them. For this selection I have approached the problem from the perspective of environmental security and two different counties, where operators of environmental security have been largely discussed, have been selected.

The first county which deserves to be researched from this perspective is Denton county in the larger Dallas–Fort Worth metroplex (DFW). DFW is the fourth largest metropolitan area in the United States and by far the largest metropolitan area in the country. It is also the economic hub of the Northern Texas region.⁷⁰ It was here, on the November 4th 2014, where Denton became the first city in the state of Texas to ban fracking within its city limits. This is very important as the ban, which passed with a majority of 59 percent of the vote, is perceived to be a test case for other cities in Texas that would like to abolish fracking.⁷¹ Not only are the environmental groups in other parts of the state interested in the possible success of this ban, it is equally interesting to observe for industry proponents who claim that the city's decision is illegal and state law should guarantee citizens the right to develop their mineral rights.⁷² The clash between environmental security and economic security is obvious as local residents from „Frack Free Denton“ claim that „extractions rigs are noisy and pollute air“, while local residents from „Denton Taxpayers For a Strong Economy“ claim that extraction

⁶⁸ *Data Retrieval: Labor Force Statistics from the Current Population Survey.* Bureau of Labor Statistics. <http://data.bls.gov/timeseries/LNS14000000> (downloaded on 7th December 2014).

⁶⁹ *Barnett Shale Economic Impact study.* Texas: The Perryman Group, May 2007. p. 20. http://web.archive.org/web/20110707212648/http://www.barnettshaleexpo.com/docs/Barnett_Shale_Impact_Study.pdf (downloaded on 4th December 2014).

⁷⁰ *Texas, The State of Texas.* http://www.netstate.com/states/intro/tx_intro.htm (accessed on 13th December 2014).

⁷¹ BUCHELE, Mose: *Voters Pass First Local Fracking Ban in Texas.* State Impact, 5th November 2014. <http://stateimpact.npr.org/texas/2014/11/05/voters-cast-ballots-in-first-ever-push-to-ban-fracking-in-texas/> (accessed on 13th December 2014).

⁷² BUCHELE, Mose: *Denton Voted To Ban Fracking. So Now What?.* State Impact, November 6th 2014. <http://stateimpact.npr.org/texas/2014/11/06/denton-voted-to-ban-fracking-so-now-what/> (accessed on 13th December 2014).

helps „some grandkids go to college“.⁷³ But how exactly is Denton county performing in regards to researched operators? As it goes for environmental security, the most discussed topic in Denton has been quality of air. According to a report released by another anti-fracking group - Denton Drilling Awareness Group - air samples taken near a local gas well showed increased levels of listed carcinogen, benzene.⁷⁴ At the same time measurements from the Texas Commission on Environment Quality show that much of North Texas has been exceeding 1997 Clean Air Act restrictions on ozone pollution with Denton holding the highest three year average in the state.⁷⁵ Although it has not been proven what is the exact cause of those high figures (possibilities besides shale gas extraction include cement factories south of Dallas, truck idling or meteorological factors), the environment groups have been using this in order to build their environmental security case.⁷⁶ And although the other environment operators researched in this work have not been outside any norms, it is necessary to mention that Frack Free Denton also expresses some concerns regarding water contamination.⁷⁷ This is, however, based on general statements rather than on any specific problem. In fact, according to the EPA the water quality in Denton is actually in the 73rd percentile on a scale of 100 (higher is better) while the overall US score is only 55. For air, the EPA data confirms the groups findings. While Denton is in the 80,7th percentile, the United States average is 93,9.⁷⁸ From an economic security perspective, as has already been stated, Denton county as part of DFW has been economically prosperous in past years. Although the unemployment rate sharply rose at the eve of the financial crisis and

⁷³ BUCHELE, Mose: *Voters Pass First Local Fracking Ban in Texas*. State Impact, November 5th 2014. <http://stateimpact.npr.org/texas/2014/11/05/voters-cast-ballots-in-first-ever-push-to-ban-fracking-in-texas/> (accessed on 13th December 2014).

⁷⁴ ALLEN, Jason: *Data Shows High Chemical Levels in Denton Air*. CBS DFW, May 1st 2014. <http://dfw.cbslocal.com/2014/05/01/data-shows-high-chemical-levels-in-denton-air/> (accessed on 13th December 2014).

⁷⁵ *Four Highest Eight-Hour Ozone Concentrations in 2014as of December 14*. Texas Commission on Environmental Quality. http://www.tceq.state.tx.us/cgi-bin/compliance/monops/8hr_4highest.pl (downloaded on 14th December 2014).

⁷⁶ SILVERSTEIN, Amy: *Why Denton's Air Quality Is the Worst in Texas*. Dallas Observer, 8th November 2013. http://blogs.dallasobserver.com/unfairpark/2013/11/not_ready_why_does_denton_coun.php (accessed on 14th December 2014).

⁷⁷ *10 Reasons to ban fracking in Denton*. Frack Free Denton. <http://frackfreedenton.com/ten-reasons-to-ban-fracking-in-denton/> (accessed on December 14th 2014).

⁷⁸ *Health in Denton, Texas*. Sperling's Best Places. <http://www.bestplaces.net/health/city/texas/denton> (accessed on 14th December 2014).

reached its peak in July 2009 at 7,8 percent, it has been steadily declining ever since and has recently been as low as 4,3 percent in October 2014,⁷⁹ way below the country and state of Texas average. The recent job growth is also three times higher than the US average. On the other hand, we can see that Denton has a higher percentage of lower income families than in the rest of the United States. While the percentage of all households that make less than 15 000 dollars per year is 15,62% in the county, it is 12,61% in the US. And it is also unfavorable for the other income groups.⁸⁰ But at the same time, the amount of the population in poverty is – again according to 2012 Census Bureau – only 8.8%, a very low figure when comparing Texas and the US.⁸¹ And with the average income coming in at 33 855 dollars, this indicates that while not so many people make a lot of money in Denton the relative economic average is very high.⁸²

Before I begin to draw any conclusions out of this, which is the purpose of further chapters, let's have a look at another county in Fort Worth basin. Parker county is going to be discussed due to possible groundwater contamination with methane and to residents complaining about methane gas bubbling up in their faucets. This case appeared for the first time in 2010 and has been treated, at least at the beginning, very seriously. The Environment Protection Agency issued quite a rare emergency order to protect two families directly endangered by floating methane and started an investigation of Range Resources company which was linked to the contamination. However, in March 2012 the EPA dropped the case and all charges in return for Range Resources to participate in a nation wide study on hydraulic fracking. Despite continuing protests from affected families, the fracking in Parker county continues

⁷⁹ *Unemployment rate in Denton County, TX*. Economic Research, Federal Reserve Bank of St. Louis. <http://research.stlouisfed.org/fred2/series/TXDENT2URN> (accessed on 14th December 2014).

⁸⁰ *Economy in Denton, Texas*. Sperling's Best Places. <http://www.bestplaces.net/economy/city/texas/denton> (accessed on 14th December 2014).

⁸¹ *Denton County Profile*. The County Information Program, Texas Association of Counties. <http://www.txcip.org/tac/census/profile.php?FIPS=48121> (accessed on 14th December 2014).

⁸² *State and County Quick Facts: Denton County, Texas*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/48/48121.html> (accessed on 5th December 2014).

without any limitation.⁸³ From an economic security perspective, the county's average income is 30,692 dollars per year, three thousand dollars less than the average income in Denton county, however, still four thousand more than the average income in Texas. The amount of people below the poverty level is 10,9 %.⁸⁴ The unemployment rate in Parker underwent a very similar pattern to the one in Denton – from a peak in July 2009 it went steadily down to the current 4,3 percent in October 2014. This is exactly the same figure as in the Denton county case.⁸⁵ So what is it that makes both counties so different in result if Parker's economic situation is actually a very similar one? If we look at the problem from an environmental security perspective, the predominant problem in Parker is water contamination by methane and to it linked the integrity of drinking water supply. Greenhouse emissions are not being discussed, nor is drought. However, according to the EPA, water quality in Parker is in the 87th percentile, a figure which is significantly better than the US average or even the situation in Denton.⁸⁶ And despite claims that methane contamination is caused by drilling companies, the Texas Railroad Commission, which is responsible for oversight of oil and gas extraction, recently released a report stating that „the level of methane in private water wells in Parker County has worsened but “evidence is insufficient” to link it to drilling activities“.⁸⁷ This, together with the fact that the issue is affecting a lower amount of people, could be a possible explanation of the fact that Denton banned fracking within the city limits while Parker County has been continuing in the extraction.

⁸³ *EPA halted 'fracking' case after gas company protested.* USA Today, 16th January 2013. <http://www.usatoday.com/story/news/nation/2013/01/16/epa-gas-company-protested/1839857/> (accessed on 14th December 2014).

⁸⁴ *State and County Quick Facts: Parker County, Texas.* United States Census Bureau. <http://quickfacts.census.gov/qfd/states/48/48367.html> (accessed on 5th December 2014).

⁸⁵ *Unemployment rate in Parker County, TX.* Economic Research, Federal Reserve Bank of St. Louis. <http://research.stlouisfed.org/fred2/series/TXPARK7URN> (accessed on December 14th 2014).

⁸⁶ *Economy in Parker County, Texas.* Sperling's Best Places. <http://www.bestplaces.net/health/county/texas/parker> (accessed on 14th December 2014).

⁸⁷ *United States Environmental Protection Agency: Railroad Commission says methane in Parker County wells can't be tied to Barnett production.* Star Telegram blog, 28th May 2014.

http://blogs.star-telegram.com/barnett_shale/environmental-protection-agency/#storylink=cpy (accessed on 14th December 2014).

3.2.2 Appalachian basin

The second researched shale play is Marcellus shale in Appalachian basin of Pennsylvania, West Virginia, New York and Ohio. The play encompasses an area of approximately 95,000 square miles, with the state of Pennsylvania taking the highest portion of it.⁸⁸ Therefore, it is not a coincidence that my research is being performed within the borders of this state only. In the following paragraphs I will - as already discussed in the case of Forth Worth basin – first discuss the state dynamic in general, then focus my attention on individual counties. Pennsylvania, like Texas, is a state with a very strong economic foundation. In 2013, Pennsylvania’s total gross state product was 645 billion dollars, which ranks the state 6th in the United States.⁸⁹ According to the most recent US census data collected between 2009 and 2013 the average per capita money income in 12 consecutive months was 28 502 dollars and the percentage of persons below the poverty line was 13,3%. Both of these figures are better than the United States average.⁹⁰ And in terms of employment Pennsylvania is also doing well. The figure for October 2014 stand at 5,4% unemployment rate with a projected annual average of 5,7%.⁹¹ As a reminder, the United States average unemployment rate in October was 5.8% with a projected annual average of 6.2%.⁹² But not only to repeat similar (and most importantly dry) data, I would like to mention a very important figure in the state’s economic approach and relation to shale gas. It is the current state

⁸⁸ ARTHUR, J. Daniel; URETSKY, Mike; WILSON, Preston: *Water Resources and Use for Hydraulic Fracturing in the Marcellus Shale Region*. ALL Consulting, LLC., p.2

https://fracfocus.org/sites/default/files/publications/water_resources_and_use_for_hydraulic_fracturing_in_the_marcellus_shale_region.pdf (accessed on 18th December 2014).

⁸⁹ *Gross domestic product (GDP) by state (millions of current dollars)*. U.S. Department of Commerce, Bureau of Economic Analysis. <http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=1#reqid=70&step=10&isuri=1&7003=200&7035=-1&7004=naics&7005=-1&7006=42000&7010=0&7036=-1&7001=1200&7002=1&7090=70&7007=2013&7093=levels> (accessed on 20th December 2014).

⁹⁰ *State and County Quick Facts: Pennsylvania*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/42000.html> (accessed on 20th December 2014).

⁹¹ *Data Retrieval: Local Area Unemployment Statistics, Pennsylvania*. Bureau of Labor Statistics. <http://data.bls.gov/timeseries/LASST4200000000000003> (downloaded on 20th December 2014).

⁹² *Data Retrieval: Labor Force Statistics from the Current Population Survey*. Bureau of Labor Statistics. <http://data.bls.gov/timeseries/LNS14000000> (downloaded on 7th December 2014).

governor, Republican Tom Corbet. Corbet assumed his office in January 2011 (his tenure, as he was not re-elected, will expire in January 2015) and since the very beginning he defined himself as a pro-fracking person. One of his first acts in the office was that he introduced budget cuts for education, while at the same time rejected the idea to tax natural gas exploration.⁹³ At the same time Corbet's office repealed policy designed to minimize the environmental impact of drilling in state parks by de facto allowing exploitation of mineral rights even in cases when they are located in protected areas.⁹⁴ This has happened in order to provide higher level of jobs and to support the state's economy. Something which Corbet's office has been especially proud of, claiming to create more than 140 000 jobs in the private sector since the day Corbet took office.⁹⁵ To be fair, there is independent evidence which support this claim and which also support my previous statement that economic effects of shale gas extraction are rather positive. As the study of Manhattan Institute for Policy Research shows, Pennsylvania counties with hydrofractured gas wells have performed better across economic indicators over counties that have no wells. The study also indicates that the more wells a county contains, the better it performs from an economic perspective. And it was the counties with the lowest per-capita income which experienced the most rapid growth.⁹⁶ However, the purpose of the next paragraphs is to research Pennsylvania's shale gas extraction from the perspective of environmental security and to see up to what extent environment issues have been a concern here and what happened when two conflicting priorities clashed.

⁹³ LEVY, Marc: *Corbett defends education cuts, stance against taxing gas drilling*. Republican Herald, 29th March 2011. <http://republicanherald.com/news/corbett-defends-education-cuts-stance-against-taxing-gas-drilling-1.1124937> (accessed on 21st December 2014).

⁹⁴ HOPEY, Don: *Corbett repeals policy on gas drilling in parks*. Pittsburg Post-Gazette, 24th February 2011, <http://www.post-gazette.com/news/state/2011/02/24/Corbett-repeals-policy-on-gas-drilling-in-parks/stories/201102240458> (accessed on 21st December 2014).

⁹⁵ FARLEY, Robert: *Corbett's Not So 'Remarkable' Job Boast*. FactCheck.org, 4th March 2014, <http://www.factcheck.org/2014/03/corbetts-not-so-remarkable-job-boast/> (accessed on 21st December 2014).

⁹⁶ ROTH-FURCHTOTT, Diana; GRAY, Andrew: *The economic effects of hydrofracturing on local economies: A Comparison of New York and Pennsylvania*. Growth and Prosperity Report, No.1 May 2013, Manhattan Institute for Policy Research. http://www.manhattan-institute.org/html/gpr_01.htm#.VJX_-mcAAE (downloaded on 20th December 2014).

The most prominent concerns in Pennsylvania are all related to water. It does not matter whether it is groundwater contamination, surface water contamination or inappropriate water usage and to its related problems of water supply, the topics around water seem to fully dominate the area of environmental security. For this reason, I would like to have a look at Susquehanna county in the northeastern part of the state. It has been here, more specifically in the Dimock Township, where a drinking water contamination incident occurred which was highly publicized by the documentary movie Gasland. In 2009, 13 water wells were contaminated with methane, and on top of this, further investigation discovered unacceptable levels of carcinogenic chemicals such as arsenic in all 13 wells.⁹⁷ And even though in May 2012 the Environmental Protection Agency declared that drinking water is safe to consume here,⁹⁸ Dimock town still remained a symbol of anti-fracking activists. Moreover, the county is part of the Susquehanna River Basin which is linked to controversy over improper and extensive water usage. For example, in 2012, Susquehanna River Basin Commission (a federal-interstate commission) approved numerous water withdrawals for fracking, an act which according to environmental groups and many locals had an impact on drought and water supply integrity.⁹⁹ Thus, it may be somehow surprising when we have a look at EPA's data for water quality in Susquehanna County. According to this data, water quality is in the 93rd percentile out of 100 (as a reminder, the US average is in the 55th percentile) and air quality is in the 96.9th percentile (US average 93.9).¹⁰⁰ This may, however, be explained by the importance that local inhabitants give to their water which suggests that even a small impact can be taken very seriously. Or by a claim which has been already suggested for the entire United States and could fully apply in Pennsylvania – if insufficient regulation is in place, people have a much lower tolerance

⁹⁷ MOUAWAD, Jad; KRAUSS, Clifford: *Dark Side of a Natural Gas Boom*. The New York Times, 7th December 2009. www.nytimes.com/2009/12/08/business/energy-environment/08fracking.html (accessed on 21st December 2014).

⁹⁸ GARDNER, Timothy: *Water safe in town made famous by fracking-EPA*. Reuters, 11th May 2012. <http://uk.reuters.com/article/2012/05/11/usa-fracking-dimock-idUKL1E8GBVGN20120511> (accessed on 21st December 2014).

⁹⁹ GILLILAND, Donald: *SRBC approves water withdrawals for Marcellus drilling over chants from protesters*. Penn Live, 15th March 2012. http://www.pennlive.com/midstate/index.ssf/2012/03/srbc_approves_water_withdrawal.html (accessed on 21st December 2014).

¹⁰⁰ *Health in Susquehanna County, Pennsylvania*. Sperling's Best Places. <http://www.bestplaces.net/health/county/pennsylvania/susquehanna> (accessed on 21st December 2014).

for environment concerns. It is also very important to mention here that Susquehanna County has 776 documented environmental violations, most of them related to Cabot Oil & Gas Corp. operations in Dimock.¹⁰¹ From an economic security perspective, the county experienced a similar drop in unemployment rate as we could see in Texas' counties and the drop here was actually even more significant. From a peak in January 2010 which was 10,9 percent, the unemployment rate went down to 3,8 % in October 2014.¹⁰² Something which many commentaries directly link to shale gas extraction as it is the main industry in the county and it is also responsible for double digit job growth in the area.¹⁰³ At the same time according to the US census, the amount of persons below the poverty level is 12,9 %, only slightly below Pennsylvania's average, and in between 2009 and 2013 per capita money income in the past 12 months was 24 477 dollars which is four thousand dollars lower than both the Pennsylvania and US average.¹⁰⁴

The next Pennsylvanian County I would like to have a look at is Allegheny county in the western part of the state. Here, my attention has been drawn to Pittsburg the second largest city in the state which in 2010 introduced a ban on hydraulic fracturing within its city limits.¹⁰⁵ At the time, Pittsburgh was the very first municipality in the nation to introduce a ban like this and later many others followed. According to former Pittsburgh City Councilman, Doug Shields, the city's ordinance was introduced

¹⁰¹ *Natural Gas Drilling in Pennsylvania, Susquehanna county*. State Impact Pennsylvania, 21st December 2014, Data obtained based on lists from the state Department of Environmental Protection. <http://stateimpact.npr.org/pennsylvania/drilling/counties/susquehanna-county/> (accessed on 21st December 2014).

¹⁰² *Unemployment rate in Susquehanna County, PA*. Economic Research, Federal Reserve Bank of St. Louis. <http://research.stlouisfed.org/fred2/series/PASUSQ5URN> (accessed on 21st December 2014).

¹⁰³ *Economy in Susquehanna County, Pennsylvania*. Sperling's Best Places. <http://www.bestplaces.net/economy/county/pennsylvania/susquehanna> (accessed on 21st December 2014).

¹⁰⁴ *State and County Quick Facts: Susquehanna County, Pennsylvania*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/42/42115.html> (accessed on 21st December 2014).

¹⁰⁵ DEMELLE, Brendan: *Pittsburgh Bans Natural Gas Drilling Over Fracking Threat*. The Huffington Post, 16th November 2010. http://www.huffingtonpost.com/brendan-demelle/pittsburgh-bans-natural-g_b_784489.html (accessed on 21st December 2014).

due to lack of regulation from higher state bodies.¹⁰⁶ Nowadays, despite numerous attempts to cancel the ban, Allegheny County has only 44 active wells used for drilling natural gas.¹⁰⁷ This is a very low number if we compare it with data for Susquehanna County where 957 active drilling wells are located.¹⁰⁸ Nevertheless, the interesting question remains: Why did Pittsburgh's City Council decide to take this action despite documented positive effects of shale gas extraction on the economy and despite the economic hardship the city has been facing since the financial crisis of 2008? The ban on hydraulic fracturing was introduced in November 2010 and in February of the same year the unemployment rate in the county recorded a high of 8,4 percent, steadily growing during the period of the last two years.¹⁰⁹ It seems somehow illogical to introduce a ban like this. On the other hand, during this time Pittsburgh was transferring from its past legacy as the city of steel into a modern high technology and robotics center. According to data from December 2010, one month after the ban introduction, there were 1 600 technology companies located in the city and the path was already changing.¹¹⁰ Nowadays, Pittsburgh is ranked second in terms of upward mobility among large metropolitan areas¹¹¹ and the city's current unemployment rate in October 2014

¹⁰⁶ MCCLAIN, Heather: *Discussing Municipal Bans on Fracking*. WESA, 24th September 2013. <http://wesa.fm/post/discussing-municipal-bans-fracking> (accessed on 21st December 2014).

¹⁰⁷ *Natural Gas Drilling in Pennsylvania, Allegheny county*. State Impact Pennsylvania, 21st December 2014, Data obtained based on lists from the state Department of Environmental Protection. <http://stateimpact.npr.org/pennsylvania/drilling/counties/allegheny-county/> (accessed on 21st December 2014).

¹⁰⁸ *Natural Gas Drilling in Pennsylvania, Susquehanna county*. State Impact Pennsylvania, 21st December 2014, Data obtained based on lists from the state Department of Environmental Protection. <http://stateimpact.npr.org/pennsylvania/drilling/counties/susquehanna-county/> (accessed on 21st December 2014).

¹⁰⁹ *Unemployment rate in Allegheny County, PA*. Economic Research, Federal Reserve Bank of St. Louis. <http://research.stlouisfed.org/fred2/series/PAALLE3URN> (accessed on 21st December 2014).

¹¹⁰ BOBKOFF, Dan: *From Steel To Tech, Pittsburgh Transforms Itself*. NPR, 16th December 2010. <http://www.npr.org/2010/12/16/131907405/from-steel-to-tech-pittsburgh-transforms-itself> (accessed on 21st December 2014).

¹¹¹ CETTY, Raj; HENDREN, Nathaniel; KLINE, Patrick; SAEZ, Emmanuel: *Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States*. National Bureau of Economic Research Working Paper Series, June 2014, p.26. http://obs.rc.fas.harvard.edu/chetty/mobility_geo.pdf (downloaded on 22nd December 2014).

was only 4.2 percent.¹¹² When it comes to other economic figures, it really depends whether we research only the city of Pittsburgh itself or whether we have a look at Allegheny County in total. As many people from higher income groups live outside the city borders, it may be interesting to have a look at both. The Allegheny County has an average per capita money income in the past 12 months of 31 593 dollars and a poverty rate of 12,9 percent.¹¹³ On the contrary, the average income for the city of Pittsburgh is 26 892 dollars and the percentage of persons below the poverty level is 22,6 percent.¹¹⁴ From this perspective, it is once again expected that city inhabitants will be more in favor of shale gas extraction. From an environmental security point of view, even though both city and county don't have any significant case of controversy regarding shale gas extraction itself, their environmental operators are very negative. While the air quality is in the 75.4th percentile over the United States average of 93,9th percentile, water quality goes as low as the 52nd percentile.¹¹⁵ This is largely caused by the city's past which was based on heavy industry, however, the numbers are alarming enough to provide possible explanation for the decision that the city took.

3.2.3 Williston basin

The third shale gas location of interest, Williston basin of North Dakota and to its related Bakken shale play provides a very strong case for economic security. The economic importance of shale gas for the state has already been suggested in previous chapters, however, only when provided with full data, can one fully appreciate it. The importance goes so far, that in February 2014 The Economist magazine called North Dakota the happiest state in the country. Such a claim has been based on Gallup-Healthways Well-Being index, a regular polling of US citizens, where North Dakota has displaced Hawaii as the number one place where people are most likely to be healthy

¹¹² *Unemployment rate in Pittsburgh, PA*. Economic Research, Federal Reserve Bank of St. Louis. <http://research.stlouisfed.org/fred2/series/PITT342URN> (accessed on 21st December 2014).

¹¹³ *State and County Quick Facts: Allegheny county, Pennsylvania*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/42/42003.html> (accessed on 21st December 2014).

¹¹⁴ *State and County Quick Facts: Pittsburgh (city), Pennsylvania*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/42/4261000.html> (accessed on 21st December 2014).

¹¹⁵ *Health in Pittsburgh, Pennsylvania*. Sperling's Best Places. <http://www.bestplaces.net/health/city/pennsylvania/pittsburgh> (accessed on 21st December 2014).

and feel good about their life and work. And The Economist commentaries have directly linked it to the shale gas boom.¹¹⁶ Many others have a similar opinion though. For example, the Council on Foreign Relations, a top US non-profit think-tank specializing in foreign policy and international relations, attributes thanks for the highest employment growth rate in the country to shale exploration in North Dakota and also speaks in a complimentary manner about shale in regards to other economic factors.¹¹⁷ In general, it does not matter whether one reads independent university research, the website of North Dakota Petroleum Council or statements from top North Dakota politicians, they all agree that the economic effect of shale has been tremendous. However, let's have a look at the defined economic operators and try to compare them with operators for environmental security. Then we can have a look at what happens here when a clash occurs.

In the example of North Dakota and Bakken play I will not discuss individual counties as has been the case for two previous plays. The state's population of around only 700 000 people is more supportive to analyze the state as a whole. Although the need here might be for a different distinction. While Bakken play is rich in both shale oil and gas, my work is only focusing on shale gas. That one – although growing faster – still represents a smaller part of the state's extraction business as Bakken shale is primarily an oil play. According to data from the Energy Information Administration from December 2014, the daily oil production in Bakken has surpasses the magical number of 1 million barrels per day, while shale gas production is somewhere around 1 200 million cubic feet per day.¹¹⁸ Therefore, even though I will try to carefully distinguish between the two, it is necessary to keep this information in mind when

¹¹⁶ *Well being America, Shale gas buys you happiness.* The Economist, Democracy in America section, February 21st 2014.

<http://www.economist.com/blogs/democracynamerica/2014/02/well-being-america> (accessed on 26th December 2014).

¹¹⁷ BROWN, Stephen P. A.; YUCEL, Mine K.: *The Shale Gas and Tight Oil Boom: U.S. States' Economic Gains and Vulnerabilities, A CFR Energy Brief.* Council on Foreign Relations, October 2013. <http://www.cfr.org/united-states/shale-gas-tight-oil-boom-us-states-economic-gains-vulnerabilities/p31568> (accessed on 26th December 2014).

¹¹⁸ *Drilling Productivity Report for key tight oil and shale gas regions.* Washington, DC: U.S. Energy Information Administration, December 2014. p.2. <http://www.eia.gov/petroleum/drilling/pdf/dpr-full.pdf> (accessed on 26th December 2014).

looking at the economic operators of North Dakota. For example, all the jobs created in the past few years are linked to both. Currently, the unemployment rate for November 2014 is only 2,7 percent, a figure which is the lowest in the country.¹¹⁹ The amount of employed people has steadily been growing since April 2009. At that time there were about 363 000 employed people, it is now 473 000 people in all non-farming related jobs.¹²⁰ Out of this, many different jobs have been directly created in the mining and logging industry. This sector would directly employ 5,600 people in January 2008, while nowadays it is over 35 000 people.¹²¹ And we have to really remember that it does not include all the industry related jobs, from truck drivers delivering water for fracking sites to restaurants or motel owners providing hospitality service for workers. Especially in the year 2011, when the shale gas rush was fairly new and many job opportunities were created, the companies were overpaying people in order to get them to move to North Dakota. Some people would make twice as much as in their previous locations earning, for example, 15 dollars per hour working at a fast food chain behind the counter.¹²² Other figures besides employment, however, do not show such an overwhelming improvement in the economic situation. According to the last census data, the percentage of persons below the poverty line was 11,9 % and per capita money income in the past 12 months was 29 732 dollars, slightly above the United States average.¹²³ This could be caused by the fact that North Dakota's government does not distribute tax revenues evenly among all citizens and also does not give enough money back to road construction, school system or police patrolling. Some have criticized the government for this and it was suggested that the budget surplus of 1,6 billion dollars

¹¹⁹ *Midwest Information Office, North Dakota.* Bureau of Labor Statistics. http://www.bls.gov/regions/midwest/north_dakota.htm#eag_nd.f.1 (accessed on 27th December 2014).

¹²⁰ *All employees: Total non-farm in North Dakota.* Economic Research, Federal Reserve Bank of St. Louis. <http://research.stlouisfed.org/fred2/series/NDNA> (accessed on 27th December 2014).

¹²¹ *Data Retrieval: State and Area Employment, Hours, and Earnings. North Dakota, Mining and Logging, seasonally adjusted.* Bureau of Labor Statistics. http://data.bls.gov/timeseries/SMS38000001000000001?data_tool=XGtable (accessed on 27th December 2014).

¹²² BLAKE, Ellis: *Double your salary in the middle of nowhere, North Dakota.* CNN Money, 20th October 2011. http://money.cnn.com/2011/09/28/pf/north_dakota_jobs/index.htm (accessed on 27th December 2014).

¹²³ *State and County Quick Facts: North Dakota.* United States Census Bureau. <http://quickfacts.census.gov/qfd/states/38000.html> (accessed on 27th December 2014).

coming from shale tax should be directly used to repair roads damaged by heavy truck traffic.¹²⁴ Other have suggested that it should be used to improve security inside extraction counties as the boom has also brought a lot of violent crime, drug addiction and robberies.¹²⁵ Such criticism seems to be fair if we look at the numbers coming to citizens from shale gas royalties. For example, Mountrail County had an average income of 52 027 dollars per person in 2010 and it was estimated that the boom in North Dakota could be creating up to two thousand millionaires a year.¹²⁶

Let's now have a look at North Dakota's environmental operators. In this state the biggest concern exists over gas flaring and to it related greenhouse emissions. Flaring produces CO₂ gases and as such is less harmful than direct venting of methane to the atmosphere. Nevertheless, it still represents a serious environmental problem. In the year 2011, in the United States alone, flaring was responsible for 360 million tons of greenhouse gases, which is equal to the exhaust from 70 million cars. North Dakota represented one fourth of this amount with 36% of all produced gas flared and was also directly responsible for the fact that while flaring has slowly been declining worldwide, it sharply rose in the United States.¹²⁷ Moreover, according to EIA, the percentage of flared gas in North Dakota is considerably higher than the national average.¹²⁸ There are many reasons for these high figures. Among the ones most commonly quoted we can find the lack of pipeline infrastructure and processing facilities to take care of already

¹²⁴ Study: \$ 7B bill for ND road upkeep over 20 years. Associated Press, 21st September 2012. <http://fuelfix.com/blog/2012/09/21/study-7b-bill-for-nd-road-upkeep-over-20-years/> (accessed on 27th December 2014).

¹²⁵ KOLPACK, Dave: *Top federal law enforcement agents tour Bakken oil field*. The Missoulian, 27th October 2013. http://missoulian.com/news/state-and-regional/top-federal-law-enforcement-agents-tour-bakken-oil-field/article_66246b84-3f52-11e3-92e5-001a4bcf887a.html (accessed on 27th December 2014).

¹²⁶ BAILEY, David: *In North Dakota, hard to tell an oil millionaire from regular Joe*. Reuters, 3rd October 2012. <http://www.reuters.com/article/2012/10/03/us-usa-northdakota-millionaires-idUSBRE8921AF20121003> (accessed on 27th December 2012).

¹²⁷ CLAYTON, Mark: *Thanks to North Dakota, US waste of natural gas grows rapidly*. The Christian Science Monitor, 13th July 2012. <http://www.csmonitor.com/Environment/2012/0713/Thanks-to-North-Dakota-US-waste-of-natural-gas-grows-rapidly> (accessed on 27th December 2014).

¹²⁸ *Over one-third of natural gas produced in North Dakota is flared or otherwise not marketed*. U.S. Energy Information Administration, 23rd November 2011. <http://www.eia.gov/todayinenergy/detail.cfm?id=4030#> (accessed on 27th December 2014).

extracted gas. Also, North Dakota legislation allows gas flaring for one year without paying taxes or royalties on it and producers can apply for an extension of this period due to economic hardship. All this is also related to the industry's novelty in the area and to the relatively rural character of the countryside.¹²⁹ But all these explanations would not really matter in the event that public opinion would be really concerned by this heavy flaring. Yet in case of North Dakota it seems that public opinion is rather a supporter than an opponent of the industry. There are some concerns and worries regarding the high level of flaring and, for example, North Dakota's Industrial Commission (NDIC) has now finally established targets that decrease the amount of flared gas over the next several years.¹³⁰ However, there are still no highly publicized public protests. The only visible exception could be the Fort Berthold Indian reservation. The reservation is located on the shores of Lake Sakakawea in the northwestern part of the state and is home to about half of the 14 000 members of the Three Affiliated Tribes of Mandan, Hidatsa, and Arikara Nation. It is also one of the centers of North Dakota's shale gas and oil boom with 25 million dollars from tax revenue coming into the reservation's treasury each month.¹³¹ During recent elections, two candidates opposing current reservation chairman Tex Hall have both expressed their intention to outlaw fracking within reservation borders. They also accused Hall of being too crony with the fracking industry.¹³² All this was nevertheless happening as part of an election campaign, not as public movement. And even though former tribal

¹²⁹ SALMON, Ryan; LOGAN, Andrew: *Flaring Up, North Dakota Natural Gas Flaring More Than Doubles in Two Years*. Ceres, July 2013, <https://www.ceres.org/resources/reports/flaring-up-north-dakota-natural-gas-flaring-more-than-doubles-in-two-years> (downloaded on 27th December 2014).

¹³⁰ *North Dakota aims to reduce natural gas flaring*. U.S. Energy Information Administration, 20th October 2014. <http://www.eia.gov/todayinenergy/detail.cfm?id=18451> (accessed on 27th December 2014).

¹³¹ DONOVAN, Lauren: *Tribe sees election as the most significant*. The Bismarck Tribune, 14th October 2014. http://bismarcktribune.com/bakken/tribe-sees-election-as-the-most-significant/article_71941d8e-5423-11e4-b572-f7c174003c7c.html (accessed on 27th December 2014).

¹³² MCDONNELL, Tim: *How 3,500 Voters in North Dakota Could Put the Brakes on America's Biggest Fracking Boom*. The Mother Jones, 3rd November 2014. <http://www.motherjones.com/environment/2014/11/north-dakota-oil-reservation-election> (accessed on 27th December 2014).

tax director Mark Fox is now a new chairman of Fort Berthold reservation, only time will tell what action he will take towards the industry.¹³³

The Indian reservation, due to its location next to Lake Sakakawea, is also involved in problems with another environmental security operator – water contamination. In the most recent incident from July 2014 around one million gallons of saltwater was leaked from an underground pipeline and an unknown amount of it reached the bay of the lake.¹³⁴ Saltwater, which is an unwanted byproduct of natural gas production, is between 10 and 30 times saltier than seawater and is considered to be an environmental hazard. In 2006 a similar accident happened nearby one of North Dakota's creeks and until now it is considered the worst environmental disaster in the state's history.¹³⁵ In fact, over the past two years North Dakota has recorded more than 300 pipeline spills and in most cases the Health Department did not notify the public as, according to them, there is no need to so if there is no threat to groundwater, surface water, public health or environment. But once again, even though the public starts to be more and more alert, no big protests around these spills are actually happening and protests are mostly limited to a couple of individuals who are taking the stance.¹³⁶ So is the water situation in North Dakota really an issue? In order to put water quality in perspective, let's have a look at EPA data as done in the previous chapters. According to those, water quality in the state is in the 53rd percentile out of 100, compared to 55th percentile which is the United States average (air quality is in the 91,1 percentile).¹³⁷ Therefore, it seems that there should be more than enough reason for public protest regarding environmental security. But maybe the reason why there are no such protests regarding water is the fact that unlike in Texas or California, there is plenty of it.

¹³³ WOOD, Josh: *North Dakota tribe hopes for shift with new leader*. The Bismarck Tribune, 6th November 2014. http://bismarcktribune.com/bakken/north-dakota-tribe-hopes-for-shift-with-new-leader/article_f47e8566-65c3-11e4-bea1-33bc8d049c85.html (accessed on 27th December 2014).

¹³⁴ WOOD, Josh; MACPHERSON, James: *North Dakota Saltwater Spill story*. Associated Press, 11th July 2014. <http://bigstory.ap.org/article/saltwater-pipeline-leaks-nd-indian-reservation> (accessed on 27th December 2014).

¹³⁵ WOOD, Josh; MACPHERSON, James: *North Dakota Saltwater Spill story*. Associated Press, 11th July 2014. <http://bigstory.ap.org/article/saltwater-pipeline-leaks-nd-indian-reservation> (accessed on 27th December 2014).

¹³⁶ BROWN, Curt: *Life in the Boom, Taking a stand on their sacred land*. The Star Tribune, 30th November 2013 <http://www.highbeam.com/doc/1G1-351305750.html> (accessed on 27th December 2014).

¹³⁷ *Health in North Dakota*. Sperling's Best Places. http://www.bestplaces.net/health/state/north_dakota (accessed on 27th December 2014).

Actually, there is so much that in the past years the private and state companies have been fighting over the rights to sell it to the thirsty shale gas industry.¹³⁸ On the other hand, we have seen in the case of Susquehanna county in Pennsylvania that public protest regarding water can happen even if water quality is at a very high level. This explanation, therefore, does not seem to be the right answer.

3.2.4 Los Angeles basin

The last location where I will examine different operators is the Los Angeles basin of Southern California. While all the other shale gas locations of interest already operate a high number of wells and the industry there is booming, Southern California's situation is quite different. The purpose of the next paragraphs will be to have a look at these differences and once again compare defined operators of economic and environmental security. In order to do this, I will start with a general overview of the shale gas industry in the Southern California region, i.e. in the ten southernmost counties of the state.

California has a very long history of oil extraction which goes all the way back to the 19th century. Before the beginning of the first world war, the state was actually accounting for 37% of the United States consumption at that time, which was the highest proportion from all major producing areas.¹³⁹ Even now the state oil production helps to retain a significant position in the US energy market. However, it would not be until later when gas production would become an integral part of the energy market as well. The big boom would only happen in the 30s of the last century when a pipeline connected southern gas fields of Kern County with San Francisco. At that time the city would become fully gasified and demand rapidly grew, a trend that continues until today. In reaction to this, many new gas fields which were not associated with oil were discovered. Still, at the end of the second world war, the state would no longer be

¹³⁸ SCHEYDER, Ernest: *Fracking boom triggers water battle in North Dakota*. Reuters, 20th May 2013. http://investigations.nbcnews.com/_news/2013/05/20/18376353-fracking-boom-triggers-water-battle-in-north-dakota (accessed on 27th December 2014).

¹³⁹ WILLIAMSON, Harold F.; ANDREANO, Ralph L.; MENEZES, Carmen: *The American Petroleum Industry, the Age of Energy 1899-1959*. IN: *Output, Employment, and Productivity in the United States after 1800*. National Bureau of Economic Research, 1963, p.390. <http://www.nber.org/chapters/c1572.pdf> (downloaded on 28th December 2014).

sustainable with its own production resulting in the need for the transportation of gas via pipelines from Texas and New Mexico to satisfy the ever growing population. In 1999, the state of California would import 86% of its natural gas consumption.¹⁴⁰ Therefore, it was a big relief and very positive news when in July 2011 EIA released its report which estimated that the largest US shale oil formation is the Monterey/Santos play in Southern California. According to this report, the play was supposed to hold 64 percent of the total US shale oil resources and there was also the potential for shale gas resources to be found in the same area.¹⁴¹ The newspaper headlines were comparing California to North Dakota and similar or higher economic growth was expected.¹⁴² However, after a more careful analysis was conducted and a couple of test wells drilled, the numbers had to be significantly adjusted. Only one year later did the EIA release new estimates where the number of predicted barrels went down from 15,4 billion to 13.7 billion.¹⁴³ Finally in May 2014 the agency declared that due to resource movements in the rock and inadequate existing technology, the figure needed to be lowered to a disappointing 600 million barrels.¹⁴⁴ This means that shale gas figures on the west coast were significantly lower than in other examples discussed so far. In fact, this is the first difference that needs to be pointed out. The second difference is the level of urbanization that is present in all ten counties of Southern California. While the region does not represent even half of the state's square area, the population there exceeds 60% of state inhabitants. On top of this, the counties of Los Angeles, San Diego, Orange, Riverside and San Bernardino are among the top 15 most populous

¹⁴⁰ *Oil and Gas production, History in California*. California Department of Conservation, p.8. ftp://ftp.consrv.ca.gov/pub/oil/history/History_of_Calif.pdf (downloaded on 28th December 2014).

¹⁴¹ *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays*. Washington, DC.: U.S. Energy Information Administration, July 2011. p.8. <http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf> (downloaded on 5th December 2014).

¹⁴² AHMED, Nafeez: *Write-down of two-thirds of US shale oil explodes fracking myth*. The Guardian, 22nd May 2014. <http://www.theguardian.com/environment/earth-insight/2014/may/22/two-thirds-write-down-us-shale-oil-gas-explodes-fracking-myth> (accessed on 28th December 2014).

¹⁴³ *Geology and technology drive estimates of technically recoverable resources*. Washington, DC.: U.S. Energy Information Administration, 20th July 2012. <http://www.eia.gov/todayinenergy/detail.cfm?id=7190> (accessed on 28th December 2014).

¹⁴⁴ *UPDATE 2-U.S. EIA cuts recoverable Monterey shale oil estimate by 96 pct*. Reuters, 21st May 2014. <http://www.reuters.com/article/2014/05/21/eia-monterey-shale-idUSL1N00713N20140521> (accessed on 28th December 2014).

counties in the United States and they are also the most populous counties of the state. Los Angeles County itself is almost twice as big as the second most populous county in US.¹⁴⁵ The third and final point I would like to mention in California's overview is the Senate Bill 4, a state regulation which was adopted in September 2013 in order to regulate hydraulic fracturing. The bill which will enter into practice on January 1st 2015 should fill in the legislative vacuum that California currently experiences. In the past few years the state was not able to keep up with the rapidly changing industry and thanks to this it does not have enough relevant data on chemicals and fluids used in wells or the amount of wells with hydraulic fracturing technique. Currently, if a company wants to use fracturing technology or acidize shale formation it does not need to ask for a permit. The Bill should change this and later give both the government and public more transparency.¹⁴⁶

Let's now have a look at economic and environment securities operators. Even though it was suggested in previous statements that shale gas exploration is not as much developed in Southern California as in other locations, there are still over 50 000 oil and gas combined wells in the region.¹⁴⁷ And many of them are using hydraulic fracturing techniques in order to tap unconventional resources. It was previously mentioned that the most interesting case to research from this perspective is the ban introduced in the city of Beverly Hills. In this ban we can see some similarities with the ban introduced by the city of Pittsburgh in Allegheny County, Pennsylvania. Here the action was also taken by local residents who were afraid of the negative impact that fracking would have on the quality of their lives. But even to a higher degree in this case as there were no documented accidents related to shale gas or the extraction industry in general. Still,

¹⁴⁵ ROSENBERG, Matt: *Largest Counties by Population, The 38 Largest Counties With a Population Above One Million*. About Education, 2005.
<http://geography.about.com/od/lists/a/countypop.htm> (accessed on 28th December 2014).

¹⁴⁶ OLSON, Laura; THOMPSON, Don: *California Lawmakers Approve Fracking Bill*. NBC Bay Area, 12th September 2013.
<http://www.nbcbayarea.com/news/local/California-Lawmakers-Approve-Fracking-Bill--223542121.html> (accessed on 28th December 2014).

¹⁴⁷ *Well counts and production of oil, gas and water by county – 2013*. California Department of Conservation, Division of Oil, Gas & Geothermal Resources, 10th January 2014.
ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2013/2013%20County%20Production.pdf (downloaded on 28th December 2014).

the city council first voted in 2011 to bring to an end to drilling in the Beverly Hills High School neighborhood which had been occurring there for decades. Following this decision, the council unanimously decided to ban fracking on May 6th within the city limits, doing so on the basis of a potentially negative impact on the community.¹⁴⁸ When we have a look at the economic operators of Beverly Hills, we can see that the average per capita money income over the past 12 months for the community was 75 890 dollars.¹⁴⁹ This is a very high number even when we account for the fact that the city is a well known luxurious residence for the „rich and young“. The other figures also look good. The unemployment rate in September 2014 was 5,3 percent¹⁵⁰ and the amount of persons below the poverty level was 8,8 percent¹⁵¹ which is only comparable with Denton county in Texas. From an environmental security perspective, the quality of water is in the 53rd percentile (55 is US average) and the quality of air is in the 15th percentile (93.9 is US average).¹⁵² Both figures are very low, especially for air quality which is the worst figure present in this work, something predominantly caused by Los Angeles County's heavy traffic and notorious traffic jams. Nevertheless, when we compare two operators, it seems that the cause for environmental security has been very strong here (even though maybe not directly related to fracking), while the cause for economic security has been rather weak.

Once attention is given to other cities or counties within the Southern California region, one will notice a very strong opposition to the fracking industry among citizens. The possible examples could include Santa Barbara County's moratorium on fracking

¹⁴⁸ FELDMAN, Dana: *Beverly Hills Bans Fracking; First City In California To Do So*. Reuters, 7th May 2014. http://www.huffingtonpost.com/2014/05/07/beverly-hills-bans-fracking_n_5277953.html (accessed on 28th December 2014).

¹⁴⁹ *State and County Quick Facts: Beverly Hills (city), California*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/06/0606308.html> (accessed on 28th December 2014).

¹⁵⁰ Data from U.S. Bureau of Labor Statistics, updated on December 3rd 2014. https://www.google.cz/publicdata/explore?ds=z1ebjgk2654c1_&met_y=unemployment_rate&idim=city:CT0606308000000:CT0644000000000:CT0670000000000&fdim_y=seasonality:U&hl=en&dl=en (accessed on 28th December 2014).

¹⁵¹ *State and County Quick Facts: Beverly Hills (city), California*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/06/0606308.html> (accessed on 28th December 2014).

¹⁵² *Health in Beverly Hills, California*. Sperling's Best Places. http://www.bestplaces.net/health/city/california/beverly_hills (accessed on 28th December 2014).

and the so called Measure P¹⁵³ or another Los Angeles County moratorium in the city of Compton on fracking, acidizing, or any form of well-stimulation.¹⁵⁴ The most outspoken proponent of this opposition is a citizen group called Environment California. This group releases various videos, studies or public statements, for example, urging California's governor Jerry Brown to follow the example of New York state and completely ban fracking.¹⁵⁵ However, the biggest concern of theirs, and of citizens of Southern California, is excessive water usage as California is a state which very often fights drought. According to a report released by the World Resources Institute, the global research organization which promotes sustainable development, the Californian gas deposits are located on the aquifers that are losing water at a higher rate than the natural recharge rate.¹⁵⁶ On the other hand, thanks to a specific underground geology, compared to other states California uses less water in each operation. The California Department of Conservation even estimates that „about 300 acre-feet of water were used for hydraulic fracturing operations in California during 2013“ but that „the average family of four uses about an acre foot of water per year“. ¹⁵⁷ The fact that California does not use millions of gallons of water, as is the case on the East Coast, is also supported by independent figures from advocacy group Ceres which concluded that the average fracked well in California used only 166,714 gallons of water.¹⁵⁸ But no matter how low

¹⁵³ Santa Barbara County anti-fracking activists wildly outspent. Cal Coast News, 23rd September 2014. <http://calcoastnews.com/2014/09/santa-barbara-county-anti-fracking-activists-wildly-outspent> (accessed on 28th December 2014).

¹⁵⁴ MILLS, Mike: *Industry Group Sues Compton for Moratorium on Hydraulic Fracturing*. California Environmental Law blog, 25th July 2014. <http://www.californiaenvironmentallawblog.com/oil-and-gas/industry-group-sues-compton-for-moratorium-on-hydraulic-fracturing/> (accessed on 28th December 2014).

¹⁵⁵ JACOBSON, Dan: *Environment California Calls on Governor Brown to Follow Governor Cuomo and Ban Fracking in California*. Environment California, 23rd December 2014. <http://environmentcalifornia.org/news/cae/environment-california-calls-governor-brown-follow-governor-cuomo-and-ban-fracking> (accessed on 28th December 2014).

¹⁵⁶ BANERJEE, Neela: *Limited water presents challenge for natural gas fracking*. LA Times, 2nd September 2014. <http://www.latimes.com/nation/la-na-fracking-water-20140903-story.html> (accessed on 29th December 2014).

¹⁵⁷ *Water Usage in Hydraulic Fracturing in California*. California Department of Conservation, <http://www.conservation.ca.gov/Index/Pages/Index.aspx> (accessed on 28th December 2014),

¹⁵⁸ BAKER, David R.: *Nearly half of fracking happens in places short on water*. SF Gate, 2nd May 2013. <http://blog.sfgate.com/energy/2013/05/02/nearly-half-of-fracking-happens-in-places-short-on-water/> (accessed on 29th December 2014).

the figures may be, the water availability still remains a high concern. And in the case of Compton, the economic operators are very low as well. The per capita money income over the past 12 months is only 13 548 dollars, less than half of California's average, and the amount of persons below the poverty level is 26,3 percent of the population.¹⁵⁹ Thus it may be interesting to see whether the moratorium which was passed there will actually sustain. In the case of Santa Barbara County the economic operators are 30 352 dollars as an average income and 16% of persons below the poverty level.¹⁶⁰

4. Other factors in play

After an introduction of various shale gas locations and presentation of some basic data regarding economic and environment securities, in this chapter I would like to discuss some specific things that may or may not have influenced the shale gas debate as well. The purpose of this list is not to provide an encompassing overview of all possible factors, nor does it aim to research possible causal relationships between them. I would rather use the following paragraphs as a self-reflection exercise which should serve to provide better answers to my research questions.

One of the factors which needs to be mentioned here is the specific economic situation of the United States when it comes to shale gas exploration. Someone who is not completely familiar with the background of US extraction could assume that scenario(s) applied there could also be easily replicated in other world countries. For example, the United Kingdom shale gas proponents can very often be heard suggesting this.¹⁶¹ However, it is really important to realize that a couple of different factors have played a role in the development of the industry in the United States. First off, there has been long existing support from the side of the state into shale gas. As latest studies show, there have been at least three decades of US federal government support towards

¹⁵⁹ *State and County Quick Facts: Compton (city), California*. United States Census Bureau <http://quickfacts.census.gov/qfd/states/06/0615044.html> (accessed on 29th December 2014).

¹⁶⁰ *State and County Quick Facts: Santa Barbara County, California*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/06/06083.html> (accessed on 29th December 2014).

¹⁶¹ LEAKE, Jonathan: *Gas find is enough to last 70 years*. The Sunday Times, 12th February 2012. http://www.thesundaytimes.co.uk/sto/news/uk_news/Environment/article871567.ece (accessed on 30th December 2014).

research programs on development of new technologies and also of government subsidies for drill testing performed by private companies. At the same time the United States government would provide certain tax exemptions for the entire shale gas industry.¹⁶² Many, for example Statoil Vice President for Exploration, would view the US system as both the main source of success and contrarily blame legislation in other countries as the reason why things are slowing there.¹⁶³ One can therefore understand why this state support is mentioned as a possible other factor in play for discussion relating to securities clashes. In situation where a country highly supports and subsidize one industry from an economic perspective, it could be assumed that the case for economic security is somewhat stronger. Another factor which needs to be mentioned and makes the US economic situation specific, is very easy access to land from the industry side. While in other countries it can take months, years or even decades before the well drilling permit is given and the industry can somehow purchase the land where they would like to operate, in the United states this is very easy. It is also linked to the fact that landowners usually hold mineral rights and is therefore entitled to sell them to drilling companies without the involvement of government. In the case of already mentioned United Kingdom (and in majority of other countries), the landowners only hold surface rights and mineral rights belong to state. Thus it cannot happen, as is the common case in Marcellus shale of Pennsylvania, that mineral rights very often change owners and are also used by speculators to be sold for the best offer on the market.¹⁶⁴ Here once again external factors could be supporting the case for economic security. The same can also be said for pipeline infrastructure that has been in some cases (Marcellus, Barnett) present and supporting the economic boom, while in others

¹⁶² SHELLENBERGER, Michael; NORDHAUS, Ted; TREMBATH, Alex; JENKINS, Jesse: *New investigation finds decades of government funding behind shale revolution*. The Breakthrough, 20th December 2011. http://thebreakthrough.org/archive/new_investigation_finds_decade (accessed on 30th December 2014).

¹⁶³ TERRAPINN, Cristina: *Why Statoil is disappointed with shale outside the U.S.*. The Shale World, 16th April 2014. <http://www.shale-world.com/2014/04/16/statoil-disappointed-shale-outside-u-s/> (accessed on 30th December 2014).

¹⁶⁴ KING, Hobart: Mineral Rights. Basic information about mineral, surface, oil and gas rights. Geology.com. <http://geology.com/articles/mineral-rights.shtml> (accessed on 30th December 2014).

(Bakken) non-existent in the area.¹⁶⁵ However, as already said, I am not going to research any possible causal relationships since this could be a possible topic for another work. As stated, it is quite clear that the existing pipeline in Los Angeles did not help to build the case for economic security on its own, while in the case of Bakken the lack of pipeline did not really prevent the exploration.

All of the above mentioned factors are quite obvious and it should not be a big problem to figure them out while brainstorming. Similar to this could be political orientations in given states. It is generally known that the republican electorate is more supportive of a less controlled economy and extraction, while democrats are more focused on the environment. Or that regions which have a long tradition and dependency on the mining sector of the economy (for example coal mining in Pennsylvania) are more prone to continue with the extraction of different resources. We can also expect that the level of education of inhabitants in a given area would have certain effect on the shale gas debate. Or in the case of California, we have to account for the living-on-the-fault-line experience of local citizens and thus to its related sensitivity towards topics touching environmental security. But there are also some factors which may not be so clear and for which better knowledge of the industry is needed. The first one is the quality of exploited shale gas. During the past 100 years, the industry became used to conventional gas which more or less demonstrates the same qualities like heating value, hydrocarbon dew point or contaminant content. However, shale gas very much varies and the figures can be very different from one location to another. Also the amount of shale gas or its accessibility (here we speak about qualities of shale gas acreage) is very different from one location to the other as was demonstrated in the case for Southern California.¹⁶⁶ From the other end, a similar factor relating to this is the quality of land for agricultural use. For example, Denton County in Texas is located in the less fertile and more rocky soil than the majority of Texas blackland prairie. For this reason the land is used for ranching cattle rather than for

¹⁶⁵ WATERS, George: *Shale gas development strategies*. Schlumberger, 13th February 2014. <http://www.shale-world.com/2014/02/13/download-shale-gas-development-strategies/> (accessed on 30th December 2014).

¹⁶⁶ GEORGE, Darin L.; BOWLES, Edgar B. Jr.: Shale gas measurement and associated issues. IN: *Pipeline and Gas Journal*, July 2011, Vol. 238 No. 7. <http://www.pipelineandgasjournal.com/shale-gas-measurement-and-associated-issues> (accessed on 3rd January 2015).

agricultural production.¹⁶⁷ And it also may be another possible reason why economic security has a higher chance for success here than environmental security.

Further to this, my research lead me to discover a couple other factors which could have an interesting effect on the clash between two securities as well. The first one is the fact that unequal amounts of water are being used from one drilling well to another. Although this does not seem to be such a big surprise, what is quite shocking is the sheer amount that the difference represents. Thanks to different rock formations several million gallons can be the difference from one well to another, and in the case for California this difference plays a big role. It is also very crucial to mention that as for the fracking industry, the search for technologies which would use less water is like the quest for the holy grail and thus the amount of water used represents very significant operators for both economic and environmental security.¹⁶⁸ The second factor I came up with while doing research on my work is that not every shale play is only rich in gas. Some of them are rich in both gas and oil and since both of these energy sources represent different challenges and serve different markets, it is very important to differentiate this. My work is dealing with four examples within the United States and the later two – Bakken formation and Los Angeles basin – are both examples where such differentiation is needed. It is a common mistake among the media to mix the two resources together. Since this influences public opinion, it is necessary to mention it here as another factor as it may also have quite a big influence on the public debate.

The last two factors I would like to list are closely overlapping with the conclusions that my research reveal. The first one is the density of population in the given area and also the distance of this population from extraction sites. The second one is the previously mentioned development status and clarity of environment regulations. I could see in numerous examples that those two are extremely important and that they play their own role in the way the clash between economic and environmental securities

¹⁶⁷ *Cross Timbers and Prairies Ecological Region*. Texas Parks and Wildlife. http://tpwd.texas.gov/landwater/land/habitats/cross_timbers/ecoregions/cross_timbers.phtml (accessed on 15th November 2014).

¹⁶⁸ CONTI, David: *Reliable alternative to water could ease economic, environmental issues for gas drillers*. The Pittsburgh Tribune-Review, 28th December

develop. For instance, the amount of persons per square mile in North Dakota has been according to the last census data only 9,7 while the United states average is 87.4 persons.¹⁶⁹ This low density in the state, nine times smaller than is common in the country, is seen as one of the main reasons for development of the industry there. Or in California the insufficient visibility on environment regulations of the industry would lead to very strong public protests even though the industry would hardly start to develop there. Therefore, due to the significance of these two factors, they will also be mentioned in the following sub-chapter and additionally in the summary of this work.

5. Results of clash

Some of the conclusions which will be discussed in this chapter have already been suggested in the previous sub-chapters, however, I would still like to provide a basic overview of clash results in different shale plays. At the same time I would like to provide some more general observations on those results. It should already be clear by now that all shale plays are different, complex and there is no plug and play solution to the clash. Anyway there are some patterns that may help us to gain a better understanding of the problem. And as already mentioned multiple times, the purpose here is to understand which human security sectors received priority, and why, in specific cases. Together with this I would like to see whether it is possible to verify my working thesis which says that when environment policies collide with policies focused on economic growth, economic growth will win out every time.

In the case of Forth Worth basin I have researched two specific counties, Denton and Parker. From an economic security perspective the operators of both counties have been similar, both generally achieving above average as Texas Forth Worth area is quite rich. From an environmental security perspective, the concern in Denton County was mostly regarding air quality and proximity of wells to inhabited area, while in Parker County there have been documented cases of water contamination with methane. But while in Denton the situation ended with a fracking ban, in Parker County the individual Steven Lipsky, who first drew attention to water contamination, faced a defamation

2014. <http://triblive.com/business/headlines/7306534-74/gas-environmental-fracking#axzz3NITKbldr> (accessed on 3rd January 2015).

¹⁶⁹ *State and County Quick Facts: North Dakota*. United States Census Bureau. <http://quickfacts.census.gov/qfd/states/38000.html> (accessed on 27th December 2014).

lawsuit demanding over 3 million US dollars.¹⁷⁰ A similar situation has been researched in the Appalachian basin where I studied Susquehanna County and Allegheny County. While in Susquehanna County the extraction still continues despite documented cases of water contamination and despite the fact that the industry uses quite a high amount of water from naturally protected reserve, in Allegheny County the city of Pittsburgh introduced a fracking ban. Here as well the economic operators were similar; however, in both counties the figures were quite low especially in Pittsburgh. In the case of Williston basin I have researched the area of the entire state with a particular focus on Fort Berthold Indian reservation. The most prominent problems here from the perspective of environmental security are gas flaring and water contamination due to pipeline leakage. However, despite some highly negative numbers on environment, the extraction is still growing and experiences a continuous boom. The economic operators which have been relatively negative in the past are now constantly improving in relation to this. Finally, in the case of Los Angeles basin I have focused on the area of Southern California with a particular emphasis on Beverly Hills City. From an economic security perspective the operators here were the highest in the country and in general (with exception of Compton city) California performed very well. From an environmental security perspective, the highest concern in Southern California that exists regards water consumption. And on the contrary, as is the case of North Dakota, environmental security won the clash in Southern California.

Now, when this overview has been provided, I would like to see whether it is possible to say that economic security always “wins” in clash with environmental security. In my opinion, the answer to this question must be no. Therefore, I also need to state that my working thesis has been falsified. There are several examples which lead me to this conclusion. Probably the most important one is the example of the city of Pittsburgh which has, despite negative economic operators, still introduced a fracking ban. But also the example of Compton city in California is quite striking. And generally speaking, in every single case where hydraulic fracturing has been banned due to reasons of environmental security, we can see that my working thesis cannot be taken as

¹⁷⁰ DERMANSKY, Julie: *Fracking Victim Steve Lipsky's Flaming Water is No Joke*. Desmogblog.com, 6th November 2013. <http://www.desmogblog.com/2013/11/06/steve-lipsky-s-flaming-tapwater-no-joke> (accessed on 4th January 2015).

an answer. So what is it that moves the balance to one of the sides? One could argue that it may be a certain ratio between economic and environmental securities. Once one is endangered much more than the other one, the balance will be moved. This could be, for example, supported by the case of Beverly Hills where economic security has been performing quite well and, therefore, we could say that people could focus on environmental security. Or as in the case of North Dakota where it was economic security operators that needed to be improved. Also in the city of Compton we can see some industry complaints on the ban and their support could be linked to low data on economic operators. However, neither argument can be applied to all cases as we could see in the Pittsburgh example. Therefore, maybe it is better to speak about a mixture of possible reasons. And it is now when I would like to discuss the aforementioned density of population and clarity of environmental regulations.

If there is something which all discussed fracking bans have in common, it is the higher density of population in the given area. The Southern California region with the examples of Beverly Hills, Compton and Santa Barbara is a very densely populated area. The city of Pittsburgh also has a very high concentration of inhabitants. Similarly in the case of Denton city the main argument for a fracking ban has been about the close proximity of extraction sites to houses. On the contrary, the example of North Dakota represents one of the lowest population densities in the United States. And also when we compare similar counties within Pennsylvania (Susquehanna and Allegheny) or Texas (Denton and Parker), we can safely claim that the difference here is represented by the amount of people involved. While in the case of Parker County we speak about one individual Steven Lipsky who decided to pursue his cause and in the case of Denton we speak about an organized environmentalist group. This difference is so visible that it almost seems like human security in environmental sector is indeed about individual security, however, you need more individuals to make it really matter.

I have already said once that it needs to be a mixture of reasons and density of population on its own would not be able to make the full difference. Usually we can see that stronger cases for environmental security go hand in hand with uncertainty on environment regulations in place, sometimes which are completely missing. It happened in Denton where environment groups would protest against regulations that wouldn't provide them with enough protection. It happened in Pittsburgh where they claimed to

introduce a ban due to lack of satisfactory action from the side of the state. And finally it happened in Southern California where the state would be lagging behind with a satisfactory regulatory framework. Also these stronger cases usually happen when there is some clearly proven environmental problem. This would be the case of not only Denton, but also of Pittsburgh and Beverly Hills. No matter if the environmental concerns here, like quality of air, would usually not be linked to shale gas extraction; they were significant enough to mobilize public opinion.

The last general observation on the result of clash I would like to mention is the state support which was given to the fracking industry in Pennsylvania and Susquehanna County. In the mixture of the reasons for this example it was not only about the low density of inhabitants in Dimock Township or problematic evidences on environment regulations violations, but political constellation in the state would also play a strong role here. And the same tendencies can also be found in other examples. With this last factor in mind, it is now possible to see that there are multiple reasons that move the balance from one side to another.

6. Conclusion

Before coming to the conclusion of the entire paper, please allow me to provide a short list of other cases where economic and environmental securities already met and clashed. This list for further research could include such examples such as tar sands in Canada, building of new water dams around the world (particularly in Asia where good examples exist on the borders of India and Pakistan or within mainland China) or coal mining regions in Czech Republic. Since there was not enough space in my work to test its own results, such a list can serve as potential navigation for future research in order to see whether conclusions drawn here make sense. At the same time, the list will help to evaluate whether my researched topic is exclusively reserved to US shale gas extraction or whether some of its dynamics are more general. At this moment, it is very important to remember that my conclusions are only applicable to the area of United States or perhaps to similar countries within Western developed world, however, it would require further research to evaluate whether they could be applied more holistically. I have also not exhausted all the possible options within US shale gas extraction. There are still many other developing shale plays and counties which were not covered. For example – as it is in both cases touching Marcellus shale play - it could

be very interesting to research the differences in between the fracking ban in New York state and the continuation of extraction in Pennsylvania state. Nevertheless, let's now have a look at my results.

As already stated in the previous chapter, my conclusion on the preliminary working thesis is that it cannot be proven that economic security would always dominate in situations when it meets with environmental security. While I believe I was able to prove that the economic effect of US shale gas extraction is positive and with strong environment regulations in place the environmental security cause is not so strong, there are examples where environmental security is the one which has dominance. It was therefore necessary to have a look at what the key factors were which can move the balance to one of the sides. Those, are in my opinion, mainly two: density of population and clarity of environment regulations. However, they are also supported by the severity of environmental problems and official political position.

When I think about these factors further, it brings me to very interesting results. It is definitely true that people make decisions about their lives based on their immediate social, economic and ecological surroundings, however, it seems that in the case of environmental security the density of population is very important and, therefore, the perspective of one individual is not enough. Apparently, there needs to be more people in order to make their security really matter. To further develop on this thought, we can, for example, assume that companies may be less afraid to break the law if they are operating far away from people's settlement. Or since insufficient environment regulations mean more protests, in cases where good regulatory framework are in place the public would not be so easily alarmed. Or it can be assumed that in densely populated areas companies will face higher opposition even in cases when they are strictly applying all the restrictions and they are very environmentally friendly. Or we can assume that when environmental problems are not so severe and state will support economic security over environmental security, the issue will go unsolved.

On the other hand, thinking about those factors can also have positive effects; some of which I would like to use as possible recommendations for the end of my work. These recommendations should hopefully enhance the decision making process of companies and improve effectiveness of official policies. I wish that every state's

passed legislation and every companies approved decision would represent a sound balance of both economic and environmental priorities. Thus, from a company perspective, if stronger regulations represent less of a concern from the public and less of a negative impetus to their economy, it should be in the company's best interest to promote them. For example, they should fully disclose fracturing fluids that they use. Or they should properly measure data on their sites and provide such data in a transparent way to the public. Also the companies should always try to find a common language and engage with environmental groups, because as shown their environmental security cause is very strong. The state or government, on the other hand, could see that local politics can have a significant influence on which security will gain dominance. If it wants to behave responsibly, it should promote such politics which will represent a benefit to both economic and environmental security. An example of such politics is to promote technological advancements in the industry. This will not only reduce costs and increase profitability for the companies, but also avoid a possible negative environment impact. Another example of a beneficial policy is to introduce better standards for well completion. Once again, this will allow good companies to profit while the environment will be more secure. In general, any state introduced policy which will minimize the impact to the environment will also decrease protests from citizens and companies can then better operate. As said in one of the first chapters of this work, for all parties involved the main concern should be to ensure that new economic development projects not only improve someone's circumstances, but also does not worsen the situation for anyone else.

Summary

The purpose of this work is to research possible situations when economic security and environmental security (as defined by 1994 Human Development Report) meet and clash. The working thesis which has been used states that when the two meet, economic security always wins. In order to research this topic, the case study of shale gas extraction within the United States was used and the topic was researched from this perspective. Various operators for both economic security (level of persons below poverty level, unemployment rate, basic income) and environmental security (water quality, air quality, integrity of water supply) have been defined. The topic was then researched on various mini cases studies within the case study of the United States. The main research method used was thematic analysis. The result of the research in this work could be then divided into a couple of different sections. The preliminary working thesis has been disapproved as there are documented cases when environmental security would be more important to the citizens. It has, however, at the same time been proven that economic effects of US shale gas extraction are in general positive and that the environmental concerns are not as big when clear regulations are in place. Following this, the work has looked into the factors which move the balance from one side to another when two security sectors clash. Two main factors were identified, the clarity of environment regulations and density of population. In addition to this it has also been proven that the severity of environmental problems and the main political stance in the given area play a significant role. The paper conclusions stem from identified factors, to mention just one of them, it is argued that human security requires a higher amount of individuals when it comes to the environmental sector. The very last part then uses working conclusions in order to provide recommendations for both the state and private sectors and ensure new economic development projects always improve someone's circumstances, while they don't worsen the situation of anyone else. To name just one, it is argued that strict environmental regulations are in the best interest of both the state and given company.

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