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## **GREAT TURNING POINT: OIL PEAK AND DISINTEGRATION OF INDUSTRIAL CIVILIZATION<sup>1</sup>**

### **I. A rise of industrial civilization and fossil fuels**

Wood and labour of living beings (humans and domestic animals) were the chief sources of energy<sup>2</sup> in the agrarian civilizations. Coal was used in some regions – as in England from 14th century on or in the Song China - but that was exception. So, the vast majority of the population had to live as peasants and in an urban environment – cities and towns – were living only 5-10 % of the population. In favourable circumstances human population rose, depending on available food, and then crashed by hunger and various diseases. Majority of population in agrarian civilizations was living on the brink of hunger and demographic-social crises were often. Many agrarian civilizations – Maya, Roman Empire, ancient Summer – badly damaged ecological foundations of their existence and perished or significantly weakened. Main ideological forms in agrarian civilization were axial religions – christianity, islam, buddhism, confucianism etc. – which were originally protest against social repression and other anthropogenic problems in their society but quickly became consolation for supposedly inevitable human misery.

Faith in «historical progress» - the fundamental metanarrative of all modern secular ideologies<sup>3</sup> – was created due to the discovery of the New World, but became widespread due to new energy sources. Traditional economy, from 17th to

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<sup>1</sup> Article's last update: 6/18/2010.

<sup>2</sup> In modern physics energy is usually understood as a capability to do some work. On Earth, practically all available energy comes from the Sun, including fossil fuels (oil, gas and coal). Some experts argued, in recent years, for sc. abiotic theory of oil – which holds that there is limitless pools of liquid primordial hydrocarbons at great depths on Earth with continual replenishing by abiotic processes - but it's very unlikely and very minor position (Heinberg 2004b). About energy in history of human societies see: Smil 1994, 2003, Price 1995, Heinberg 2005, Crosby 2006, Ruddiman 2007, Pimentel-Pimentel 2008, Markus 2009b.

<sup>3</sup> About liberalism, marxism and other modern ideologies and their ecological implications see: Hay 2002, Sunderlin 2003, Dryzek 2005, Barry 2007, Dobson 2007.

the middle of 19th century, often acknowledged natural limits, especially in very influential population theory of Thomas Malthus. But mass urbanization and gradual harnessing of oil and gas, from the middle of 19th century on, created faith in unlimited natural resources or, what was the same, unlimited human power in exploiting these resources. After that, modern economy was builded on the negation of natural limits and on faith in free market's capability to overcome all (temporarily) restraints. For sc. scientific economy resources depletion has no meaning, because free market will always find some solution, either by increase of production (and price falling), or finding alternatives. Liberalism, marxism and other modern secular ideologies also proclaimate their faith in unlimited power of human „conquest of nature“. For them, nature is just storehouse of resources existing for human exploitation and consumption.

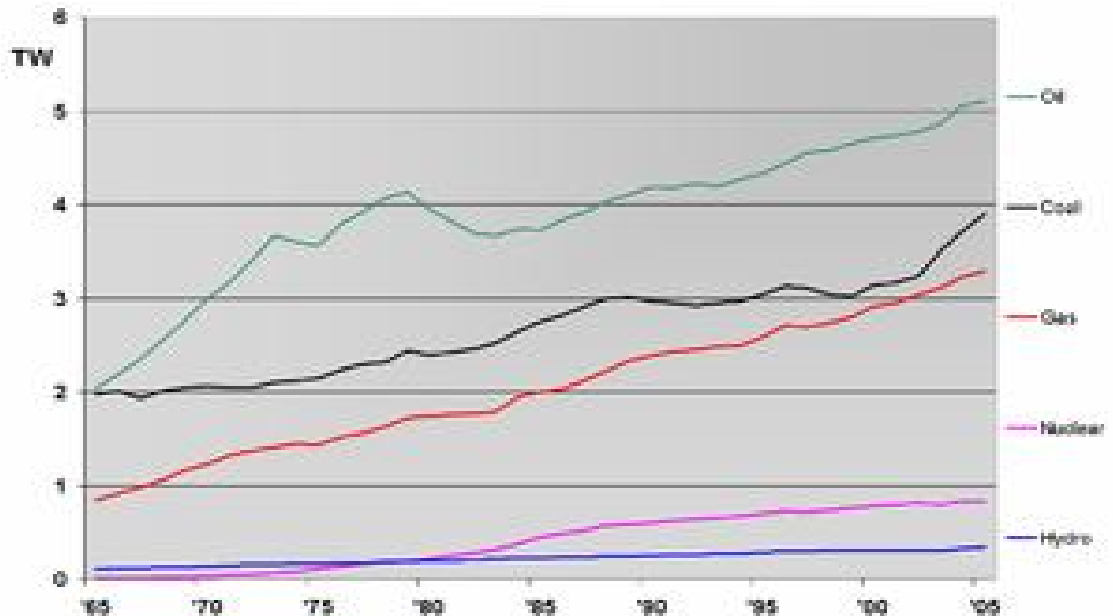
The most common explanation of sc. industrial revolution – lack of wood in the Great Britain - remains the best one, despite many criticisms. Other countries had to follow British example if they didn't want to stay behind in the international competition. Industrial revolution had many deep social and ecological consequences but it was, in the main aspects, deepening and accelerating of fundamental trends of the last several thousand years: expansion of population, agriculture and cities, ecological destruction, centralization and bureaucratization etc. Industrial societies, with mass urbanization and mechanization, in the last 200 years are created by finding and exploiting new energy sources: coal as fundamental mover of the first and oil and gas as movers of the second industrial revolution. New energy sources were crucial factors for vast increase of human population, from below 1 billion around 1800 to cca 7 billions around 2010.<sup>4</sup> Fossil fuels – energy sources with high quality and density and high net-energy value - are the main factor in creating an industrial civilization in the 19th and 20th century, including mass urbanization, mass transportation and consumer society.<sup>5</sup> All industrial megastructure, in the last two centuries, was building on the fossil fuels and their consumption was steadily growing in the last several decades (see graphs I and II). Oil dependence is not „addiction“ (famous sentence of former American president Bush Jr., that „America was addicted to oil“), because drug addict can overcome his/her addiction and leave his/her drug behind. Industrial society can't „leave behind“ oil, certainly not in some easy-going fashion. In some vital parts, like transportation or

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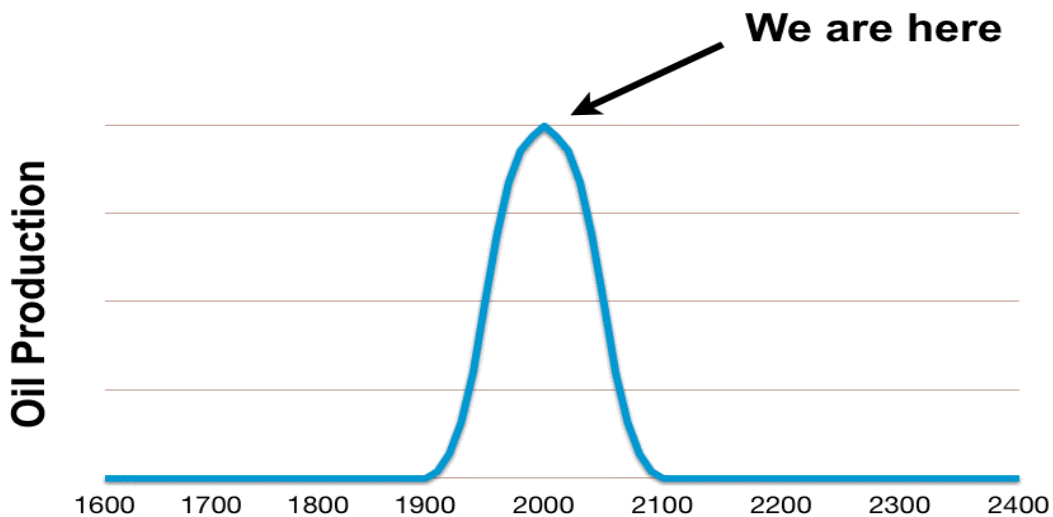
<sup>4</sup> Some contemporary analysts warned against constant neglect of energy factor - including fossil fuels - role in modern demographic theories (Zable 2002, Pimental 2008, Chefurka 2009).

<sup>5</sup> That process was not fast but very gradual. In the whole world, 19th century was still the era of wood and in 20th century coal was (and is even today) main energy source and oil secondary. Moreover, rate of coal extraction will be augmented in the near future as oil extraction is stagnating on the *peak plateau*. About history of exploitation of oil and fossil fuels in general see: Catton 1980, Smil 1994, Youngquist 1997, Heinberg 2005, Klare 2005, Duncan 2006, Kunstler 2006, Dekanic 2007, Greer 2008a, Yergin 2008.

industrial agriculture, oil is absolutely crucial. Technology is not a some kind of autonomous force, but only a transformer of energy. Technology never creates energy, but only uses up available energy, that is, in industrial society, fossil fuel energy and its derivatives.



Graph I: world consumption of several chief energy sources 1965-2005<sup>6</sup>



Graph II: oil „production“ in the long-term perspective from 17th to 25th century

<sup>6</sup> All graphs can be found in: [www.wikipedia.org](http://www.wikipedia.org) and in [www.energybulletin.net](http://www.energybulletin.net).

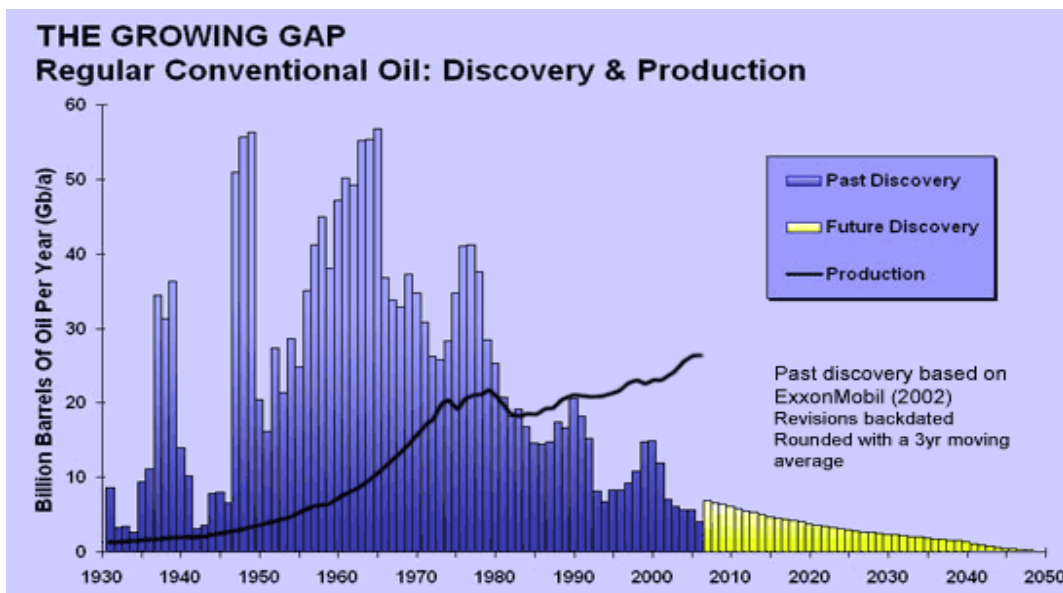
Energy – and in industrial society this means fossil fuels – is not one aspect of economy or one resource among others, as economists think, but *the* basis of all economy and the fundamental resource for all others. Oil and other fossil fuels are the life-blood of the industrial economy and for all important activities: manufacturing, transport, agriculture, industrial and mass-production, tourism, military, mining, production of electricity etc. Without them, nothing can work. Especially oil - with its versatility, ease of transportation and storage, high thermodynamic quality and density - had crucial significance for demographic and technological expansion in the last 100 years. Conventional oil always had very favourable rate (although decreasing one) of EROEI (energy returned over energy invested): 1:70 (one barrel consumed for 70 barrels extracted) in 1970, 1:30 in 1970 and 1:10 today. Basis of optimism and economic expansion of the industrial societies, especially in great boom after WWII, always were the low prices of fossil fuels, primarily oil. The golden age of neoliberal globalization, in the 1980s and 1990s and till recently, was possible only because of the constant flow of cheap energy in the world economy and trade. And, on the contrary, the most economic contractions and increase of unemployment („recession“ in terminology of conventional economics), in the last 60 years, were caused primarily by increase of oil prices. „Cheap energy“ here means cheap net-energy flow (that is, amount of energy usable for some industrial purpose, not amount of extraction). Low price of net energy usually (but not necessarily) means low market price of oil and other energy sources.

Fossil fuels are non-renewable energy sources and there were always warnings about their exhaustion, especially oil, from the 1920s on. But the discovery of new oil-fields were coming up continuously, with a big discoveries first in North America in the 1920s and 1930s and then in the Middle East after 1940. The peak of discovery was in 1960s (see graph III), but, although there were some big findings after that, as in the North Sea in the 1970s, the rate of discovery was continuously slowing down. Since discovery cannot replace existing oilfields, peak is inevitable and only datation can be matter of dispute. American geologist King M. Hubbert predicted in 1956 that *peak oil* for the USA (lower 48 states) will peak in 1970. Original Hubbert's curve (see graph IV) suppose that oil „production“<sup>7</sup> follows ascending line, comes to peak and then start to fall, at first

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<sup>7</sup> Quotation marks mean that there is no such thing as „oil (or gas, coal) production“. Like air or water, fossil fuels cannot be produced, they can only be found, extracted and re-made in the different industrial derivatives. We can talk about „production“ of electric energy or machines but

slowly and later faster.<sup>8</sup> Hubbert predicted peak oil for world-extraction first in 1995, then in 2000. („if current trends continue“), but nobody listened to him – his home company (Shell) even tried to suppress his analysis - and he died in 1989, forgotten. His name became famous in the last ten years, when men from different background and professions – retired oil geologists, journalists, academic analysts – reaffirmed his original ideas with more sophisticated models and with some different conclusions. The first generation were retired petroleum geologists, like Colin Campbell, Walter Youngquist, Jean Laherrère<sup>9</sup> and Kenneth Deffeyes, and the second one were writers, journalists and academicians, like Richard Heinberg, James Kunstler, Nate Hagens, Jan Lundberg, Michael Lardelli, Jeremy Leggett, Ugo Bardi, Guy McPherson, Gail Tverberg, Dmitry Orlov, John Greer, Sharon Astyk, Michael Klare, Rob Hopkins, Peter Goodchild, George Mobus, Carolyn Baker and many others.



**Graph III: rate of discovery of oil fields from 1930s to today with future forecasts. Notice significant slowing of increase of oil „production“ after 1980. After 2005. rate of increase of „production“ was almost zero. Two last successful years were 1999 and 2000, but after that there was**

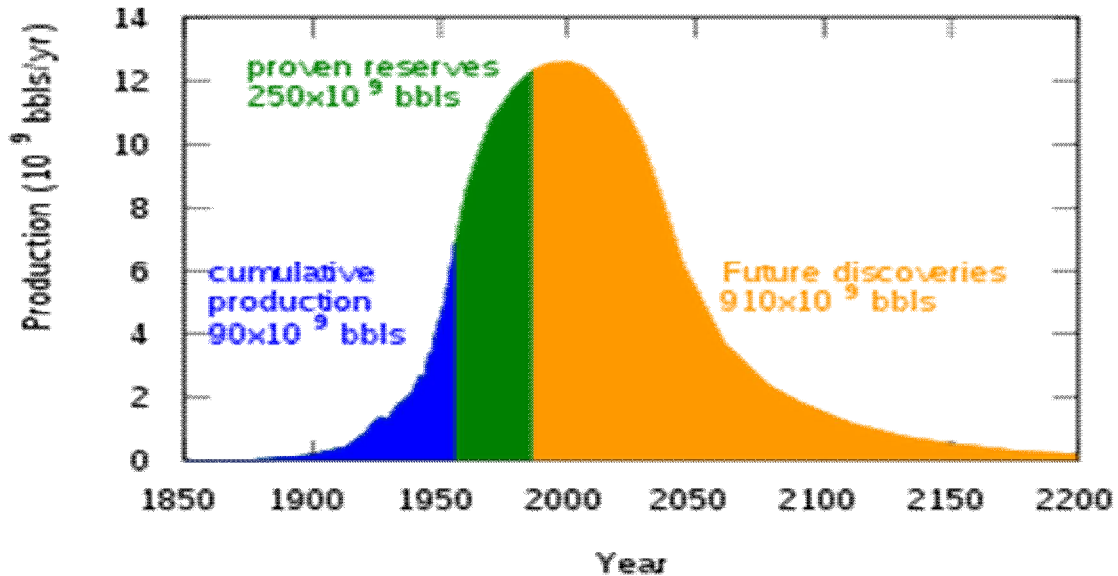
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not about production of fossil fuels. As many writers in peak oil circles pointed out, correct word is not production, but extraction.

<sup>8</sup> About Hubbert and his original analysis see: Heinberg 2005, Deffeyes 2008 (see also graph IV). William Catton was first author who warned, in book-length analysis, that fossil fuels are Achilles' heel of industrial societies (Catton 1980).

<sup>9</sup> Campbell and Laherrère published famous article „The End of Cheap Oil?“ (*Scientific American*, march 1998), when oil prices were very low, about 10-12 d/b. Their main conclusion – that era of cheap energy will end very soon and abruptly, probably before 2010 – was ridiculed or, in popular press, completely ignored.

no significant discovery till 2007-8. There is a big lack in discoveries in 2001-2007 and this is oil which should be come on line 2009 and after.



Graph IV: Original Hubbert's curve from 1956.

Peak oil doesn't mean end of oil, but end of *cheap* oil or extraction and consumption of the most easily extracted and the best quality.<sup>10</sup> Peak oil means end of the first (ascending) phase of fossil fuel's era. Peak oil is diminishment of ability to produce high quality cheap and economically extractable oil on demand. The most relevant thing is not when oil „production“ is gone, but when „production“ begins to taper off. Peak oil means maximum of oil production in one year or in one quartal but it can also mean sc. *pick plateau*, longer period in which oil production is more-less flat (unlike original Hubbert's curve which supposes sharp decline in oil „production“). Contemporary peak oil, as we will see, is just the case of pick plateau after 2004. Term „peak oil“ is, however, a bit unfortunate - it has not mean an extraction of the first half of oil reserves, as is often said - because there can be vast resources of sc. unconventional oil, like Canadian tar sand or Venezuelan heavy oil. But EROEI – or extraction of useful net-energy – is crucial for peak oil, because vast resources of „unconventional oil“ can't help much if too much energy (and water) must be consumed for extraction. F. e., big parts of „unconventional oil“ can be extracted only if oil prices are above 100 d/b, but economy can't tolerate such prices for long. So, peak oil is *not* necessarily a classical case of depletion/scarcity of resources (which can

<sup>10</sup> Here peak oil means absolute number of extracted oil, but it can also mean maximal quantity of extracted oil per capita. In that second sense peak oil has happened around 1990 (4,5 barrels per capita).

be substituted for something else) but something more important – end of favourable rate of EROEI, start of decreasing of net-energy and end of economic growth on the world level (although not in every single country).

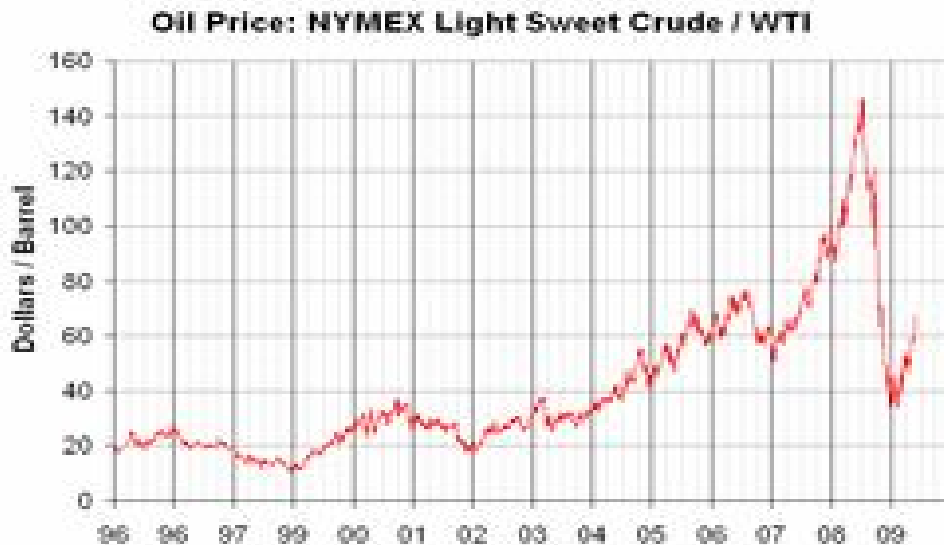
The first (1973) and second (1979) oil shock clearly showed up the big vulnerability of „advanced“ industrial society on oil import, especially from the Middle East and that dependence was steadily increasing. The USA was importing cca 30% of its oil in the 1970s, and today imports cca 70%. The first and second oil shock caused big problems and interruptions of normal functioning of western economies, but their effect did not last for long because they were caused by political factors – the Arabian embargo and Iranian revolution – which change quickly. These were minor inconvenience in the long first phase of the fossil fuels' era with ever increasing production. The discovery and exploitation of a big Western oil field in the North Sea and Alaska from the 1970s on mitigated the situation as well and helped in the overcoming of the energy crisis. But these shocks were an early warning for the future. From 1985. to 2002, the average price of oil was 15-20 d/b: the basis for the so called informational revolution and big neoliberal globalization.

After 2000, the price was, with minor fluctuations, continuously, rising untill the summer of 2008 (see graph V). In analysis of oil prices we have to look for long-term trends, not for short-term fluctuations. In period 2003-2009 the average price of oil was cca 80-85 d/b, enormous increase from period 1985-2002. The great oil spike 2007-2008, with a price of 148 d/b in early summer 2008, was partly caused by stock market speculations, but only because of expectations of an ever increasing demand.<sup>11</sup> Unlike the first and the second oil shock, which were caused by artificial shortage, the third was caused by objective geological limits. The OPEC was controlling oil prices from 1970s to ca. 2002 and Saudi Arabi was a so called swing (crucial) producer, but in the last several years this was not the case anymore. In 2009 Russia became the biggest oil producer in the world with

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<sup>11</sup> There is widespread opinion in public that market speculation is the main cause of oil price rising. That can be true – in rising, but also in falling direction – but speculations always are founded on fundamentals, that is, constellation between demand and production. If oil extraction is more-less stagnant, as it was in the last several years, then expectation of increase of demand will cause fast increase of prices. That was a case 2007-2008 and again now (summer-fall 2009), with the first signs of economic recovery. Also, there hoarding policy and much violence in some oil rich countries (Nigeria, Iraque) that prevent exploration and extraction, but it is possible only because of limited amount of oil. In ideal world – with maxium investments and international cooperation and no hoarding and violence – extraction rate will probably be higher than present pick plateau – but not much. Or perhaps extraction rate can be significantly higher but that is oil of 80, 100 or 150 d/b, something what economy can't endure for long and of *low quality* . And such high prices should be stable for ten years or so – investments don't like volatile prices – but it exists neither.

oil extraction above 10 m/b per day, but, regarding bad condition of its old fields, it will difficultly sustain this level of extraction.



**Graph V: oil prices from 1996 to summer 2009. After that prices grew faster, above 80 d/b in October 2009. Notice big oil spike 2007-8, but also continued increase of oil prices from 2002 to summer 2008.**

In the last 15-20 years there is the last big industrial revolution in China, India and some other „developing“ countries. Demand was growing fast but supply was growing much more slowly, especially after 2004. At the end of 2004, the world extraction of all liquids (oil, gas, ethanol) was cca. 85 millions of barrel and in the early summer of 2008, when extraction-efforts were at maximum due to very high prices, was cca 87,5 millions of barrel.<sup>12</sup> World liquid fuels extraction reached a plateau in late-2004 and has fluctuated within a narrow range ever since. Peak oil was in 2005, and peak energy (or all liquids peak) in 2008. This is the so called *peak plateau*, when world extraction is more or less flat and probably<sup>13</sup> can't be significantly increased, no matter how high prices are (see graph VI). Peak oil as an event was in 2008 and peak oil as a process are continuing today as the

<sup>12</sup> There is opinion that the production numbers for 2008 were inflated, and that the May 2005 (85 m/b) record is an all-time record that has never been (and probably will) exceeded. But there is also a difference between oil peak (2005) and all liquids peak (2008).

<sup>13</sup> There is some uncertainty here because exact data of world oil (recoverable) reserves are not known. Saudi Arabia and other OPEC-countries don't want to show all relevant data, regarding them as state top secret. But stagnation of world oil extraction 2005-2008 can be understood as indirect proof of often statement about inflated or overblown official data by OPEC. There is no reason, if proclaimed facts are correct, why OPEC does not repeat the same strategy as in 1980s: significant increase of extraction, overflowing of market by cheap oil, decrease of prices and – *voilà*, no more crisis. Events of the second half of 2008 have shown that fast and big increase of prices is dangerous for not only importers of oil but for exporters as well. In this articles terms peak oil and peak energy are used as synonyms.



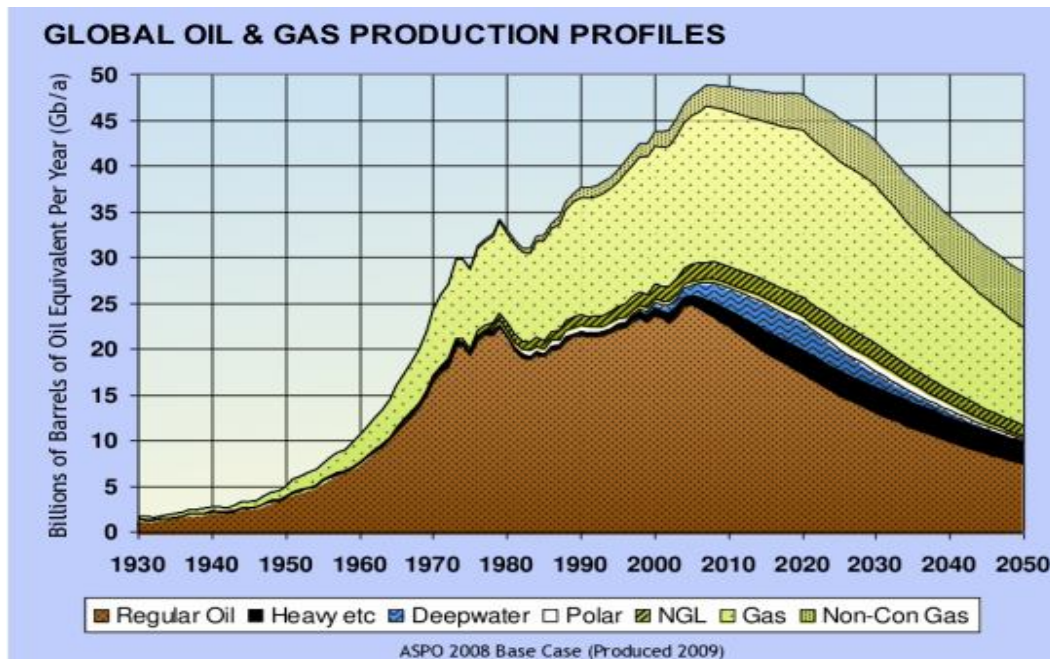
second phase in the fossil fuels era. Domestic consumption in OPEC countries and Russia rises so fast that these countries have less oil for export every year. High prices means possibility of big subventions of domestic consumers and encouragement of domestic consumption and, given stagnating oil extraction, less oil for export and endurance of high prices in western countries, despite deep economic crisis.<sup>14</sup> Peak oil can be identified with *pick plateau* or the second phase in the fossil fuels era. In the first phase oil extractions was continually rising, in the second phase it stagnates and in the third phase – which can start in any year, but probably not before 3-5 years, depending on demand – it will decline. The oil industry has been running on a treadmill since 2005 with production staying essentially flat despite record high oil prices. Capital for oil infrastructure investments, which might have seen new production continue to offset declines for a few more years yet, has withered. Between 2005 and 2008 supply fell short of demand. Real fact of peak oil will be known only after oil extraction will begin to fall from peak plateau, but this fact – incapability of significant increase of „production“ despite high prices – shows that peak oil is already here. Coming of peak oil – or the end of the first phase of fossil fuels era and start of the second phase - means also coming a big economic crisis, the worst world crisis after Great Depression of 1930s.<sup>15</sup> Ironically peak energy is masked by the economic downturn, from summer 2008 on, which was primarily caused by – peak energy. Year of 2008 was, as Richard Heinberg points out, fundamental break from past decades, year in which industrial civilization smash into the wall of ecological constraints.<sup>16</sup> Long-held predictions about „limits-to-growth“ were finally realized.

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<sup>14</sup> See good analysis in Rubin 2009.

<sup>15</sup> There are often analogies and comparisons with Great Depression and today's crisis, but similarities are superficial and differences are much more important. Great Depression had nothing with energy prices, in fact, oil prices in USA and other developed countries was very low (peak of oil discovery in USA was exactly in 1930s). It was primary caused, as most earlier crisis in capitalistic economy, by overproduction and low consumption. Later crises, including three oil shocks (1973, 1979 and 2007-8), were primarily caused by increase of energy prices. Today, situation is quite different and much more difficult. Contemporary crisis was primarily caused by peak oil (or, more correctly, peak energy) which is part of process of end of fossil fuels'era, combined with climate changes and many „minor“ problems. So, neo-Keynesianism will not much help.

<sup>16</sup> Heinberg 2010b.



**Graph VI: „production“ (real and anticipated) oil and gas „production“ 1930-2050 in billions of barrels. Notice *peak plateau* 2005-2015.**

A big increase in oil price was the main cause of the contemporary economic crisis – the economy and especially credit-and-debt economy with continual „growth“ can't normally function without abundant cheap energy<sup>17</sup> – and there is only the question what was the cause for that. Facts tell us that the chief reason was an ever more unfavourable relation between increasing demand and stagnating supply. Oil companies and organizations like International Agency Energy think that the chief reason of the third oil shock was a lack of investment (in tankers, drill-technologies, refineries etc.) due to low oil prices in 1985-2002. That is the opinion of many analysts, especially those working inside the oil industry or some pro-government agencies, like IEA or CERA.<sup>18</sup> But that can't explain the low level of investment after 2002, when oil prices was going up. Oil companies know that available (namely, suitable for extraction with favourable relation of EROEI) oil reserves are much smaller than is officially stated and that big investments will not be worth the trouble. In oil business investments can be profitable after ten and more years, but for ten years there will be (much) less oil

<sup>17</sup> Obsession with „growth“ is not some subjective mistake – as many adherents of „steady state economy“ or „living within limits“ think – but objective consequence of economic system based on revolving debt and credit. Without „growth“ old credits and debts can't be payed back, banks go down, unemployment fast rises and whole system starts to fall apart. Massive state interventions can temporarily slow down this proces, but, without return of cheap energy, cannot restore the old economy.

<sup>18</sup> Mills 2008, Yergin 2008. We'll analyze details of peak oil debate in separate essay.

than now, so – no big investments.<sup>19</sup> For non-conventional oil (tar sand, heavy oil) it is needed triple-digit price (100-150 d/b) for extraction, but economy can't endure such high prices for long.

For mainstream economists – only academic intellectuals with some measure of political influence – the basis of the economy is money and human labour, not energy and natural wealth („resources“ in anthropocentric terminology). For them, only constraining factors are capital and human labour, not ecological limits. They think that energy is only one resource, but, in real world, energy is resource of all other resource. Contemporary economic theories are product of recent decades of robust economic growth, so it's natural that they accept faith in eternal economic expansion. After 2008's crash many economists abandoned neoliberal free market fundamentalism and accepted neo-Keynesianism. Now they think that lack of state regulation in financial industry has caused big problems and near-collapse. So, their advice to governments is: pump the money into the bank system, give stimulus packages and bail-outs, run strong fiscal politics and the economy will recover.<sup>20</sup> This should stop repetition of Great Depression of 1930s. Contemporary mega-crisis is, they think, just a „recessic cycle“, one among many, perhaps a bit stronger and longer than usual. For them and for governments, this is just „financial crisis“ with no connection with energy factor at all. Responding to deepening „financial crisis“, most states were trying to expand their money supply. These measures can bring some short-term effects, like a very limited revival of economic activity in the second part of

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<sup>19</sup> True, there were some significant discoveries in 2007-2008 in deep waters (Brazil's coast, Gulf of Mexico) and some other hardly accessible places (and there will be future discoveries as well), because high oil prices make sense for exploration. But it will be needed 7-10 years of mass investments - and stable oil price, not too low (collapse of investment), not too high (collapse of economy), cca 70-80 d/b - for start of extraction. This is not realistic prospect regarding deepening of economic crisis (big overspending and deficit in budget of the most „developed“ states) and big volatility of oil prices in the recent years. From where will money needed for investment in future oil extraction come? EROEI will be much smaller because new deposits are less accessible than older ones. If „production“ ever start, only small amount of oil will be extracted, cca 15-20 %, after 2016 or so. In the meantime, old gaint oil fields, which give cca 70 % world „production“, will fall 40-50 %. So, there is no room for enthusiasm, often present in mass-media presentations, about „new discoveries“. These discoveries only affirms central peak oil thesis: humans were already extracting and consuming about half of oil, the most easily to get and the best quality. If there are really vast amounts of oil worldwide, as critics of peak oil approach argue, it should be expected that rate of discovery, in the last 5-6 years, will be much greater than it was. A lot of confusion is also caused by failure to distinguish between resources (total estimated amount of oil in oil reservoir) and reserves (recoverable part under present operating conditions). After oil peak, only small part of resources are really reserves and can be extracted. For the sake of convenience, I am here retaining habitual anthropocentric talk about „resources“, „reserves“ etc., but my sympathy is with radical ecocentric philosophy, which acknowledges intrinsic worth of wild nature and other species.

<sup>20</sup> There are many short but good analysis of economic myopia in peak oil circles (f. e. Hanson 1999, Heinberg 2008, 2009b, Rubin 2009, Lardelli 2009c).

2009 and cheap benefits for governments which look only for the next election, but in the long-term it goes nowhere. It only creates new problems, like the great dangers of a dollar-collapse and deficit-bubble which can easily explode and create a fast deepening of the economic crisis.

Political and economic elites try to supply the banks with fresh money which can be loaned to companies for creating new jobs and restoration of the old economy. Idea is simple and – wrong, because there is no (cheap) energy in this equation. Without cheap energy there can no be cheap credits. Obsession with money is a consequence of the simple fact: quantity of money can be expanded endlessly, but quantity of energy – especially cheap net-energy – can not. „Recession“ and „depression“ are terms from conventional economics and they, because of implicated „recovery“, are not useful here. Coming of peak energy means start of deep structural crisis of world economy and industrial civilization as a whole. Traditional economics – either liberal or marxist one - is simply not prepared to deal with it because of its negation of ecological limits and, in the liberal case, blind faith in free market mechanisms. Traditional Right and Left were and are joining their hands in human godlike power over nature and human omnipotence in transcendence of natural limits. As one peak oil theorist suitably says, Right blames foreigners, „terrorists“ and leftist and Left blames riches and corporations but neither approach can do much to solve fundamental predicament of crucial energy depletion and deepening of mega-crisis. Public blames governments and companies, governments blame „speculators“ and oil extractors etc. Scapegoating is a typical example of old-fashioned thinking, trapped in anachronistic paradigm of endless growth.

For public and politicians 148 d/b in summer 2008 was not wake up call but stimulus for witch hunt or scapegoating (choose your pick and blame the speculators, OPEC, oil companies, government etc.). Many people thought that increase of oil prices was speculative bubble, and, for them, big decrease of prices, after 2008 summer, was „proof“ for that. There is popular opinion that peak oil is a propaganda of oil companies and their vindication of high oil prices. But oil companies ignore question of peak oil or argue that it is in far future. They think that illusions about abundant quantities of oil and gas are in their interest. But, if it is true, then high oil prices are, in part at least, consequences of manipulation of oil companies. For high prices there can be only two meaningful explanations: either peak oil or manipulation with significant involvement of oil business. Official spokesmen of the political and economic elites argue that there are much greater reserves of oil left in the ground than had previously been believed to be recoverable and that "new technology" will make that oil recoverable. But, even if it's so, crucial factor – very unfavourable EROEI – is usually not mentioned. One of the reasons world economy has grown so abundant so quickly over the last few generations is precisely because oil has had an unprecedentedly high EROEI ratio.

In the early days of oil, for every barrel of oil used for exploration and drilling, up to 100 barrels of oil were found. More recently, as oil recovery becomes more difficult, the ratio has become significantly lower. Certain alternative energy 'sources' may actually have EROEI ratios of less than one, such as many methods of industrially producing biodiesel and ethanol, or extracting oil from shale and tar sand.

International Energy Agency (IEA) is energy „watchdog“ of developed countries – created after first oil shock 1973. to supervise energy prices - and many governments make their energy policy according to its predictions of future world energy demand, supply and production. IEA always insisted peak oil was decades off and even in the two last reports (*World Energy Outlook*, 2008 and 2009) global oil extraction is not expected to peak before 2030. Moreover, in 2009 report there was no sense in urgency – unlike those in 2008 and unlike public comments of some IEA officials in 2009 – about oil fields depletion. In these two reports IEA predicted increase of world oil production, reaching 105 mb/d till 2030 (very unrealistic prediction, as we already said). Among peak oil circles IEA has been often accused for deliberately underplaying a looming shortage for fear of triggering panic buying and that US has played an influential role in encouraging Agency to underplay the rate of decline from existing oil fields while overplaying the chances of finding new reserves.<sup>21</sup> Almost all – public, governments, industry, bankers etc. – are interested not to say or know what truth is. If stock market speculators know the truth, oil prices would be over 200 d/b in one week or so with devastating effects for world economy. There is no plan B – or any meaningful strategy for near future – among political and economic elites; there is big possibility of mass panic in stock markets and public and other dangers. Politicians (like technicians) can think only in the perspective „problem-solution“, but here there is no such thing as „solution“. And they, as professional optimists, can't talk about bad news, except as some temporary „problems“ waiting for „solutions“. So – why tell the truth anyway? Moreover, peak oil is – unlike climate change - new player in town, more often debated only in last ten years or so. It has natural connection only with long forgotten 1970s' discourse of limits to growth.

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<sup>21</sup> In November 2009. two „whistleblowers“ (anonymous sources inside Agency) confirmed these statements. This is the first *internal* recognition that governments have been intentionally overstating the amount of oil that we have and could pump out of the ground. Of course, this is old news for anyone familiar with peak oil topic. In fact, these statements were often said and written by many peak oil theorists and writers in last several years. IEA is not neutral institution striving for scientific objectivity, but institution created and sponsored from western governments, established in 1974 as a quasi-political body to prevent another oil crisis, track and study the global oil market and safeguard oil supplies to the West. It always had to say what Western (especially American) governments wanted to hear. And there are other problems with IEA (and similar institutions, like US Department of Energy) which now includes in “oil production“ all liquid fuels, including ethanol and synfuels, synthetic fuels, obviously for rising production numbers.

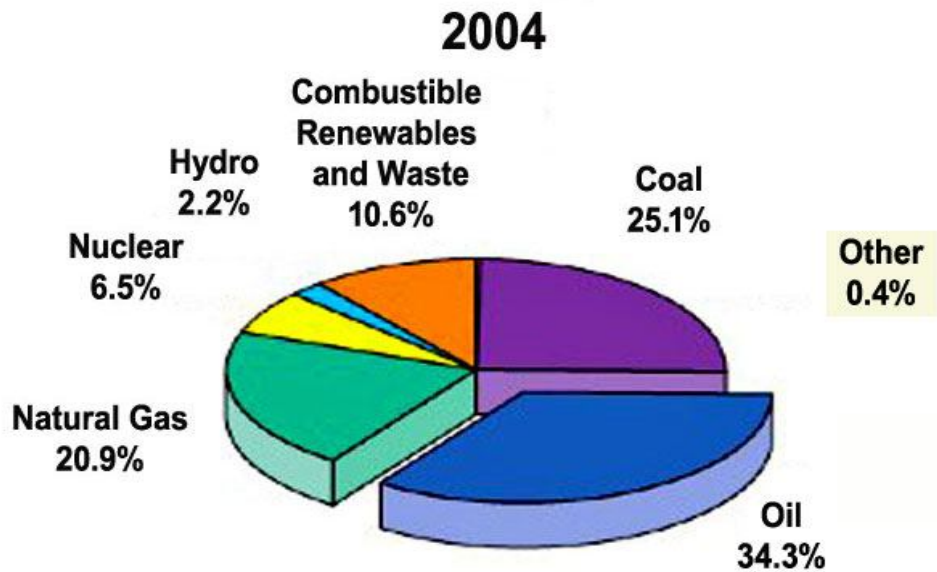
Some western governments, especially in North America, are probably aware oil peak for several years. American military adventure in the Middle East, especially invasion on Iraq in 2003, is meaningful only in this context.<sup>22</sup> But political elites in USA, Canada or any other country don't speak publicly about peak oil, believing that peak oil is not peak energy. They probably know that peak oil is real cause of economic crisis – not lack of state regulation of financial industry or something like that – but they believe that cheap energy will return and make possible a return of old economy and business-as-usual. This cheap energy will not come from conventional oil, but from combination of „alternative“, like coal, gas, nuclear fission, wind, solar, unconventional oil plus some new forms of energy, depending of future technological breakthrough, like nuclear fusion. New American president Barack Obama's<sup>23</sup> program for «clean energy» and «clean technologies» (for conventional thinking, energy and technology are the same thing) has very wide support and popularity inside and outside the USA. There is great enthusiasm about technological „breakthroughs“, „natural capitalism“, „clean energy“, „solar revolution“, „energy independence“, „green revolution“ and many other forms of quick „solutions“ and „miracles“.<sup>24</sup> There is widespread popularity of different institutions and groups, like Breakthrough Institute, with many promises of technological wonders. But this is a big illusion and a symptom of faith in technological miracles, very often a phenomenon in industrial society.

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<sup>22</sup> About it see Klare 2005, 2009.

<sup>23</sup> Obama is the first non-white president of the USA and his election was for many protest against politics of Bush' regime. But in 2009 nothing was really changed and old (domestic and foreign) politics was and is continued (see: Cohen 2009). Obama's politics was (and is) mere extension of old late-Bush failed politics, trying to restore some fragments of the old economy. This is not Obama's fault because he is part of the system (especially Too-Big-To-Fail Wal Street banks) and, in peak oil world, system cannot normally function anymore. Personality is more-less unimportant. Obama's obsession for reform of health care system is a another symptom of his complete misunderstanding of situation and concentration on insignificant problems. Health care system – or, more correctly, medical society and industrial medicine – is typical product of era of cheap energy which cannot be sustained – much less expanded - when that era is over. Obama's program for massive development of „alternatives“ – unrealistic goal in any case - is consequence of climate changes and „energy independence“ from foreign oil, not awareness about energy predicament.

<sup>24</sup> F. e. see: Huber 2004, Frazier 2004, Hawken 2007, 2008, Pernick-Wilder 2008, Friedman 2008, Nordhaus-Shellenberg 2009. These authors think that talk about natural limits is self-defeating and superfluous, because there are vast resources and only problem is lack of appropriate technology and investment. Certainly, it's not ideologically correct to talk about peak oil and other ecological limits in industrial societies, even in post-peak oil era.



**Graph XII : World's energy sources and consumption in 2004. Today (2010) situation is similar, but percent of coal and nuclear were increased. Note the absolute primacy of fossil fuels which is much bigger in indirect terms (that is, as energetic basis for all other energy sources).**

Seppo Korpela's apt words – that „humanity is hopelessly trapped in a predicament unlike anything it has faced before“<sup>25</sup> – are often reiterated in peak oil literature. The vast majority of people – public, mass media, political and economic elites – are not aware how serious the human predicament is. There is a widespread hope that either oil reserves are huge, or we can develop alternative energy sources, just on time «to leave oil before oil leaves us». Unfortunately, there is no such thing as «alternatives». So called alternatives<sup>26</sup> – nuclear power, solar, wind, geothermal etc. – are just technologies for electric energy production. Technology is not energy and «alternatives» are really just derivatives of fossil fuels. That means, we must have vast amounts of cheap oil and gas for the development of alternative technologies, but, because of peak oil, we haven't. It takes «oil energy» to make «alternative energy» or all non-fossil fuel energy sources depend on fossil fuel-driven economy. Faith in „clean energy technologies“ is just wishful thinking. In the real world there are only fossil fuels

<sup>25</sup> Korpela 2008.

<sup>26</sup> Many authors wrote about problems with «alternatives». See: Catton 1980, Youngquist 1999, 2000, Goodstein 2005, Heinberg 2005, 2009c, Kunstler 2006, Homer-Dixon 2006, Greer 2008a, Holmgren 2009, Hall-Day 2009). There is some limited faith, in peak oil circles, that some sustainable energy mix, with primacy of „renewables“, will be possible in distant future (f. e. Leggett 2006, Klare 2006, 2009b, Heinberg 2009c), but overall there is no big enthusiasm. Dark warnings about painful energy transition, with probable mass die-off, are quite common and main reason for habitual accusation for „doomsterism“.

and their derivatives (for electricity production). „Alternative“ energy sources are simply increasing along with (rather than displacing) fossil fuels energy sources. Industrial societies are builded, in the last 200 years, on fossil fuel-energy and can't create quickly – if can at all – some different energy base. Consumption of other energy sources only increases along with consumption of fossil fuels, but it doesn't replace them. In the post-peak oil world development of «alternatives» will mean a big increase of demand for oil and gas, price will go up and the economy will or crash or retreat into an even deeper recession. Development of «alternatives» is possible only by constant economic growth, but the fundamental precondition for it - cheap fossil fuels – exists no longer.

«Alternative» forms of energy simply can't replace 30 billion annual barrels of oil (the problem of «net energy») and they always were, are and (probably) will be net-energy losers. There are other problems with «alternatives» as hard collecting, because sun, wind or water are not simply in the ground, as oil, gas and coal are, but they are not always available and depend much on (fast changing) climate. If oil prices are low (below 40 d/b) „renewables“ are not market competitive, and if prices are too high (above 90 d/b or so), they, as oil-derivatives, cannot be extensive developed. Hydrogen is energy carrier (and very inefficient one), not energy source. Nuclear power, which only can produce bigger quantities of electricity, is too expensive and dangerous.<sup>27</sup> There are significant amounts of coal, but much less then is usually thought and its masive use will drastically increase climate changes and pollution in human habitats. Coal can't help in some sectors, like transportation or agriculture, which are completely depended on oil and gas.<sup>28</sup> Extraction of tar sand (bitumen) in Canada and some other countries is particularly expensive in money, oil (big problem in the context of peak oil, EROEI is just 1:1,5) and water and has dire ecological consequences, from pollution of immediate environment to contribution of climate changes. The

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<sup>27</sup> About different perspectives on nuclear power see: Goodstein 2005, Mahaffey 2009, Cooke 2009. Adherents of nuclear power – James Lovelock, „father“ of Gaia theory, is probably the most famous one – often argue that it doesn't contribute to climate change and pollution. But this is true only if we see on nuclear chain reaction which doesn't produce carbon dioxide and other greenhouse gasses. All other activities (mining and refining uranium ore, transportation, building of nuclear power plants etc.), necessary for nuclear power, produce vast amounts of carbon dioxide and pollution of environment and are very expensive. And there are other very big problems, from waste to proliferation of nuclear weapons. Iranian nuclear program, for example, should be banned by the same people who are ardent believers in nuclear power (but, of course, they are enlightened democratic and peacefull leaders, not fanatical theocratic mullahs...).

<sup>28</sup> About coal see Heinberg 2009a. Heinberg – and some other analysts and institutions (as German Energy Watch Group - predicts peak coal in the next 15-20 years, perhaps even less, depending of its use as substitutive for dwindling supplies of oil and gas. Some experts question Heinberg's analysis and think that recoverable quantities of coal are much bigger but they usually ignore central problem of peak oil. Another problem with coal is that we don't live in 19th century with 1 billion humans or so whose great majority were traditional (not-yet-included in industrial order) peasants.



same can be said for offshore drilling, even if ecological disasters – like recent one in Mexico Gulf, when oil platform sank in April 2010 – remains isolated „accident“.

The second problem with „alternatives“ is that there is simply no time for such massive energy transition. The first oil shock (1973) was a good (but wasted) opportunity for the beginning of the energy transition, because it takes cca 30-50 years. The increasing supply gap in the next 10-20 years or so can't be closed by all other energy sources combined. Investing in «alternatives» means a waste of money. So, the era of cheap energy can't be returned and without it there will be no long-term recovery. Mainstream economists simply can't understand that because for them resource shortage is not possible. If prices go up either production will be increased or alternatives will be found quickly. But today neither is possible. That means that all propositions about „sustainable development“, „ecological modernization“ and similar concepts are simply illusions and self-deceptions. Technology is not energy and technological innovations cannot much help if mass dependence of fossil fuels remains.<sup>29</sup>

At present, world economy is in difficult situation.<sup>30</sup> Despite great economic crash 2008 worldwide oil usage has dropped only 2,7 %, fact which shows well how oil-dependent world economy is. When economic activity picks up, demand for oil and oil prices will rise exponentially again because supply will not follow demand. Oil price in the last several months – cca 75-80 d/b – is really astronomic for condition of crisis. Fundamental condition for recovery is plentiful cheap energy or return of oil prices to cca 15-20 d/b. Of course, this is not possible. Amidst deep (and deepening) crisis oil prices were climbing to 70 d/b in summer 2009 and above 80 d/b in October 2009. Airline industry – that means big companies, many smaller were already gone – is on the brink of collapse with such high prices and remaining automobile industry is not in much better situation. Federal Reserve Bank in USA issues more and more currency and credit to prevent banks and mutual funds from collapse. American Government intentionally depreciates its national currency (often measure of government in the case of big debt) but weaker dollar means higher oil prices and – no economic recovery. Unemployment continually rises in almost all countries. There are many bubbles waiting to burst in next year or two. Governments and mass media see „green shoots“ and „signs of recovery“ everywhere but these are just temporary quasi-recoveries in the long-term rate of economic contraction.

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<sup>29</sup> Hypothesis about sc. abiotic oil – that oil is continuously created and replenished in the Earth's mantle by anorganic processes – was often mentioned several years ago. But it is probably scientifically wrong and, even if correct, its practical consequences are nil. Natural replenishment cannot compensate for human extraction (Heinberg 2004b).

<sup>30</sup> For a good discussion of economic situation from peak oil perspective see: Rubin 2009, Heinberg 2009b, Tverberg 2009a, b.

Bailouts and stimulus packages won't have long-term effect without return of the cheap energy. There is not and there will be not energy bail-out. They can only slow down a rate of economic contraction and, because of big increase of public debt and state deficit, postpone of financial bankruptcy of the world economy. Financial institutions cannot function without economic growth which is not possible without cheap energy. If economy really recovers oil supply crunch (physical shortage of oil, not just high prices) and skyrocketing prices will be probably inevitable. In the era of cheap energy many people could live beyond their means, but not more. Massive stimulus packages have created massive public debt – and transformation of private to public debt – and deficits in state-budgets, intolerable situation for next several years. Even mainstream institutions – like french bank *Société Générale* in November 2009 - are warning on great danger of economic collapse. The biggest government-sponsored bubble is, of course, in China (and its phantomic 8+% growth), where buildings with no tenants, roads with no vehicles and shopping malls with no consumers or employees are builded. Massive government interventions show that economy is on the life-support system, unable to stand on its own feet. There were no „fundamental changes“ – promised by American president Obama - to institutions and regulations in the last year, just temporarily propping up, by massive increase of debt, of growth-based institutions. Without cheap energy there is no growth, without growth there is no repayment for loans, and without repaying loans whole building of debt-and-credit economy begins to fall apart. Already, governments in many countries, must impose „austerity measures“ – cuts of public spending, increase of taxes, cuts of salaries, pensions and jobs – hoping for decrease of intolerable deficit and keep confidence of foreign investors. But these measures either will remain pure cosmetics gestures or, if seriously implemented, they will a death of social state, much deeper stagnation and economic contraction and suicide for government. It is doubtful that governments can insist to implement restrictive measures against will of its own public., Nevertheless, even harsh measures can't prevent states bankruptcy under the crashing deficit and debt in the next year or two.

## **II. Future trends**

At this moment in time, we are in the middle of the first (introductory) phase of a mega-crisis, when world oil production is flat. Or, if we look at modern epoch in the energy context, we are in the middle of the second phase. The first phase was the ascending one, with ever increasing of oil production (with minor fluctuation, chiefly because of geopolitical problems). Oil „production“ and supply were always ahead of demand. This phase ended about 2005. The second – or stagnant - phase began in the last quartal of 2004. with slowing down of the increase of rate of oil „production“. From 2005. till today oil „production“ has been stagnating between 85 and 87,5 m/b per day for all liquids or between 72 and 74 m/b per day for crude oil. Oil demand started exceeding supply in 2006 and in

the near future it can be expected a growing gap (graph VII). In the next several years we can expect the deepening of the crisis with a further rise of unemployment and a decrease of demand<sup>31</sup> due to high oil prices (cca 70 d/b is the minimal acceptable or „fair“ price for OPEC; „fair price“ was 20 d/b in 2002 and 40 d/b in 2004). In the near future (1-4 years or in the time of pick plateau) oil prices will fluctuate wildly; deepening of economic crisis will them push lower, but OPEC-measures and constantly rising demand in non-OECD countries (sc. emerging economies) will them push higher; market speculations will work in both directions, depending on „signs of recovery“ or „signs of depression“ in 60-80 d/b range. In the long-term, especially after 2012., oil and energy prices will go up due to ever increasing gap between rising demand and declining extraction. The third or descending phase will begin when extraction will start to fall from peak plateau,<sup>32</sup> at first slow, then faster, probably after 2012, perhaps even earlier, depending on demand and OPEC's capability to compensate for non-OPEC's continual falling extraction. Only big demand destruction – and deep depression – can postpone the end of the second phase of the end of fossil fuels era for several years. This will be the start a real crisis with an increase of supply shortages, energy blackouts, mass unemployment, high inflation and prices, no matter of demand. Then, even falling demand will not help in decrease of prices. Relative low oil prices 2009-10 are just calm before the storm.

Year 2008 is a fundamental breaking point in history of modern civilization, end of (expanding) globalization and beginning of de-industrialization and re-localization. That year will be understood, by future historians, as a beginning of end of industrial civilization. Of course, it has to be understood as a long-term process, not singular event.<sup>33</sup> Traditionally, peak oil analysts have been focused on global supply-side maximum rate of oil extraction. But, net oil export is the biggest problem today, because oil extraction is stagnating on plateau and

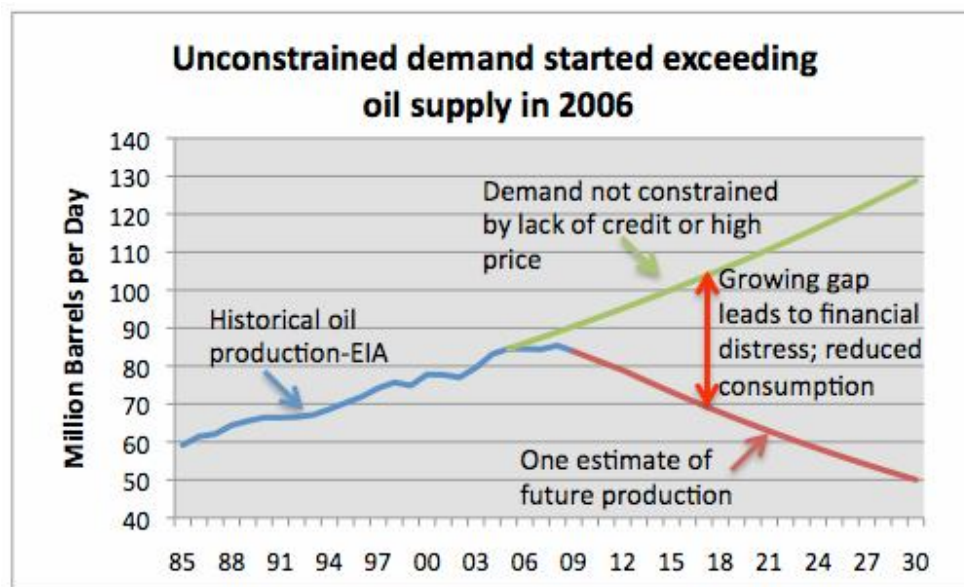
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<sup>31</sup> Some economists and eternal-growth analysts found „solution“ in „peak demand“ in rich countries. But peak demand means end of growth and no escape from permanent ever-deepening crisis. Peak demand is just a consequence of peak energy, that is, intolerable rise of energy prices. Peak demand thesis – and previously mentioned *peak plateau* – are the last line of defence of peak energy deniers. As M. Lardelli aptly says, this is nothing but delusion to disguise the fact that dwindling oil supplies have ended economic growth in „developed“ world (Lardelli 2009b).

<sup>32</sup> From 2009 on, CERA maintains that *peak plateau* will last for several decades, but this is likely its one more incorrect prediction. Considering basic factors – rate of depletion of old oil fields, slow rate of discovery of the new fields, increase of oil consumption in oil exporting countries, cancellation of many mega-projects about non-conventional oil etc. – it is realistic to argue that pick plateau will not last more than 5-10 years, even if the West will submerge into second full-blown Great Depression. Of course, every increase of consumption in the West – symptom of „recovery“ – will make plateau shorter. But, even if CERA prognosis is correct, there will be no help for western oil-importing countries, because of rising net-export crisis. Oil „producing“ countries consume even more quantities of oil and there is less and less oil for international market.

<sup>33</sup> See good analyses in Kunstler 2006, Greer 2008, Rubin 2009 and other peak oil writers.

domestic consumption in oil exporting is countries is constantly increasing. So, every year less oil have on the international market even if rate of extraction is the same. Many peak oilers think that net oil export crisis may be the defining geopolitical event of the next decade.<sup>34</sup> We are probably rushing towards the „net energy cliff“ with falling of energy profitability of oil extraction and energy starvation of ever increasing sectors of society. So, there will be no gradual decline in oil extraction in post-peak oil world, but much faster.



**Graph VII: growing gap between oil demand and supply**

In general, there are two possible scenarios for near future: 1) continual deepening of crisis or continuation of the trends of the last 16 months towards the second Great Depression (the most likely scenario), and 2) short recovery, especially in China and India, and then sudden crash due to explosion of prices and hyper-inflation. Both scenarios lead to economic crash due to collapse of bubble economy and mass bankruptcy of many states and their incapability to repay their credits and debts. From the perspective of peak oil awareness, the second scenario – recovery-price increase-contraction-price decrease-recovery etc. - is perhaps the best one. Most people can take peak oil seriously only if oil prices are going up and they think, quite wrongly, that peak oil is irrelevant is prices are going down. Oil peak analysts have usually predicted, before escalation of crisis in 2008, that oil/energy peak will cause economic contraction, oil prices will fall, there will be partial and short recovery, prices will rise again, new contraction etc.

<sup>34</sup> Rubin 2009, Chefurka 2009, Heinberg 2009a, 2009c

Cycles contraction-recovery-contraction will repeat itself but every time on much deeper and harder level. But there is other scenarion, which today (spring 2010) looks more probable for unfolding. It seems that financial-kredit system – in overdebted countries like USA, most European countries and Japan – is beyond repair and that its further implosion is inevitable due to impossibility to restarting of economic growth. Bail-outs and „stimulus packages“ can buy some time, but they can't stop further contraction of economy. Deepening of crisis, with relatively lower prices, will mask oil/energy peak – the most important event of our era - for a long time. In 2010, as protectionism and the economic and social depression will increase, many states will be compelled (and some allready are) to choose between three hard options: (hyper)inflation, high taxation and reduction of public spending (with big increase of unemployment, hard social tensions, fall of governments etc.) or defaulting on their debt (that is, bankruptcy). Bankruptcy – or burst of bail-out/debt bubble, „mother of all bubbles“<sup>35</sup> – is probably inevitable for most countries. Greece crisis, in early 2010, in only beginning of this trend.

Mass discontentment, strikes and street unrest are a very real possibility in the next couple of years, because, without the constant supply of the cheap (or not too expensive, as now) energy, big cities are casks of gunpowder. Food crisis will be rampant due to rise of energy prices, lack of investment and bad weather. This will be the end, among other thing, plural liberal democratic and multicultural society. In the era of cheap energy, government can be relatively tolerant and various ethnic and religious groups can live together in relative peace. But in the era of scarcity and ever increasing energy and economic crisis, social tension will increase and governments will pursue more repressive politics and more draconian measures: capital punishment, closing of borders and ban of imigration, restraints of civil freedoms. Constant increase of prices, unemployment and taxes will cause impoverishment and disappearance of middle classes. Ethnic majority will look for scapegoats and these will be often some (racial, ethnic, religious) minorities. Some of these measures – mild indication of the future trends - we can se already today.<sup>36</sup> Some peak oil thinkers, like John M. Greer, predicts sc. catabolic

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<sup>35</sup> Marshall 2009a. Marshall – although without knowledge about oil peak and energy-economy connection – points out that massive stimulus packages were only delaying the inevitable (economic collapse and Great Depression), making it much worse when debt-bubble bursts. Sc. economic recovery is just illusion, existing only in stock market financial speculations. This time Keynesian economists will be proven wrong, because public spending and easy kredit is not way out (Marshall 2009a, 2009b). This is, of course, true, but real reason is that era of cheap energy is over – forever. However, in classic Keynes's theory public spending doesn't mean increase of state deficit and public debt, contrary to contemporary practice, because Keynes has been living in the era of cheap and plentiful energy.

<sup>36</sup> Demographer William Stanton predicted death of multiculturalism and liberal regimes several years ago due to coming era of scarcity and energy depletion (Stanton 2003). Not suprisingly, he was attacked from the right and from the left because his malthusian statements – banning of immigration, every woman has right on one (healthy) child, obligatory infanticid of deformed

collapse, or long-term processes of social desintegration over several centuries.<sup>37</sup> More probably, it will take shorter time, maximum several decades or so, especially because of perfect storm (about it little later) and complete dependence of industrial economy on oil and other fossil fuels. It's hard to expect long-term desintegration, like, f. e., Roman Empire or classic Maya civilization.

In the further future, after 2025 or so, we can expect a real desintegration of industrial societies and fastening processes of demographic (decrease of population) and social (decrease of political, technological and economic complexity) collapse.<sup>38</sup> In 2030 the world oil production will be half of the 2008-level, with ca. 8,5 billions humans, not a rosy prospect in any case. This is not apocalypse or doomsday thinking, but a new case of collapse of complex societies, a frequent topic of scientific study. The recent drop of oil prices, from summer 2008 on, is payed for future supply crunch (psychical shortage of oil, perhaps in the next 3-4 years) because many projects of discovery of oil fields and investments are cancelled. These cancellations increase probability that concrete peak „production“ – 87,5 m/b per day in July 2008 – will never be surpassed. Economic activity can rebound a little (as in the summer of 2009) in the short-term because of government's fiscal politics (bail-outs, stimulus packages etc.) but a long-term and real recovery can't be attained without a return of the era of abundant cheap energy. Increasing geopolitical violence and hoarding policy (keeping adequate exploration and „production“ resources from being applied to reserves) will in addition decrease quantity of available oil in world market in the future. Conflicts about remaining energy reserves will grow in the near future.<sup>39</sup> Globalization would be relegated to the dustbin of history and big mega-cities – supposedly too-big-to-fall – will collapse and disappear. Also, most states will disappear too. After collapse of American empire there will be no the next world hegemon – eventually short-term primacy of Russia, only super-power with significant oil and gas reserves. Burdened by increasing deficit and rise of energy prices China will collapse as well. But collapse has to be understood as gradual

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childs, voluntary euthanasia is legalized and forced euthanasia is obligatory for terminal patients – are not just politically incorrect, but anathema for liberal, leftist, christian and other humanists. But in the post-peak oil era, era of increasing scarcity and social tensions, these will be quite reasonable propositions and their opponents will be treated as lunatics.

<sup>37</sup> Greer 2008. There are also many excellent Greer's articles on the Internet.

<sup>38</sup> About different approaches and visions of future trends see: Price 1995, Smith-Lyons-Moore 2000, Cocks 2003, Heinberg 2004, 2009b, 2009c, Kunstler 2006, Thompson 2006, Chew 2008, Smil 2008, Smith-Shearman-Positano 2008, Hopkins 2008, Greer 2008a, 2009, Holmgren 2009. Many survivalist-books, often in novel form, were published in recent years about survival in gradual collapsing industrial civilization (f. e. Kunstler 2008, Rawles 2009). We can talk about the most probable trends in the near future, situation can be changed, f. e. with sudden discoveries of many easy to recoverable oil and gas fields (very unlikely, but possibly).

<sup>39</sup> About energy and geopolitics see: Homer-Dixon 2001, 2006, 2009, Heinberg 2004a, Klare 2005, 2009a.

and long-term process, although within just several decades. Different regions will be affected differently, depending on population density, geo-political environment, homogenous or heterogenous ethnic/racial/religious structure of society, level of industrialization etc.

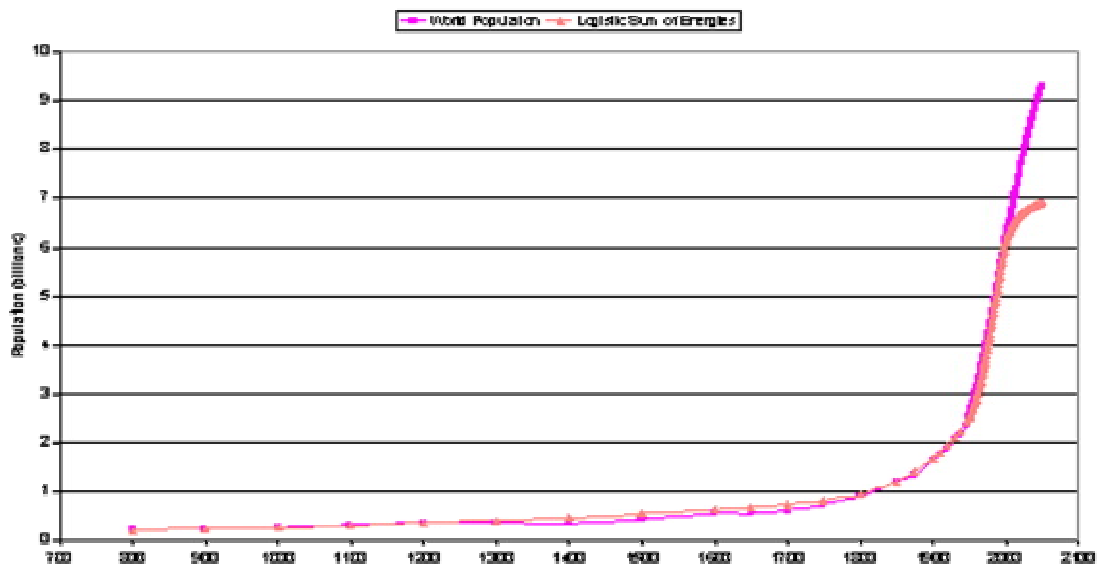
End of the first phase in the fossil fuels era has great significance for human population.<sup>40</sup> From neolithic domestication to 18th century population was increasing but very gradual and with many local and regional demographic crashes. World population was 800 million in 1800, 1.6 billion in 1900 and 6.8 billion today (see graph VIII). Big increase of population in the last two centuries was only minor consequence of genetic engineering on edible plants and agricultural exploitation of new arable lands. For the most part, it was consequences of fossil fuels, especially use of oil and in agriculture. First industrial revolution in agriculture in the middle of 19th century, based on peruvian guano and nitrogen fosfates (beginning of agricultural chemistry), made possible big increase in European population. The second industrial revolution in agriculture – or sc.sc. green revolution (ironic name, because of mass destruction of wild habitats) - after 1950 was causing big increase of food production and was completely depended on massive use of cheap oil and gas. Fertilizers, pesticides and herbicides are made from oil and gas. Traditional organic agriculture can support no more that one billion people, probably much less. Many former arable land are (or will be) useless for agriculture because of climate change (desertification), lack of water or industrial chemicals poisoning.

Peak energy means also peak population, which will grow for the next several years, cca 7,5 billions, and then start to fall, slower or faster, depending on circumstances. Without cheap energy, there would be no the second „green revolution“. Conventional demographic projections – rise of population till 10 billions or so and then its stabilization – is symptom of demographers' wishes, not the most probable trends. Only rational mean for population decrease is decrease of produced food (inevitably in any case), because every increase of food is cancelled with increase of population. But violent and abrupt demographic collapse in 21th century, probably below one billion – and much less (below one

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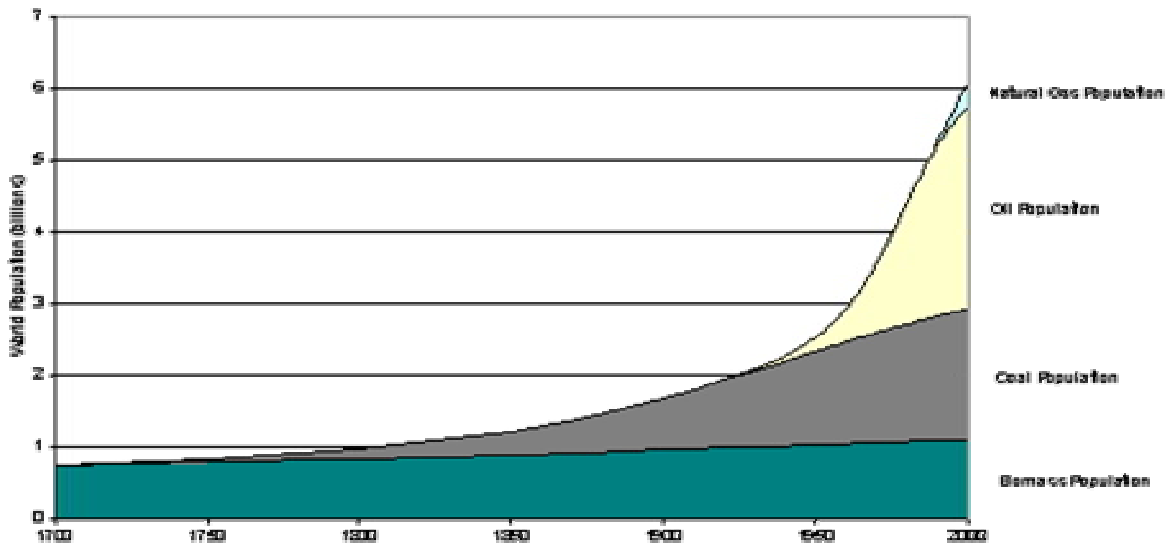
<sup>40</sup> Except some courageous thinkers, like P. Erhlich and G. Hardin, there was long silence, in ecological and other circles about demographic explosion after 1945. It was slowly changed in the recent years and many thinkers and activist openly problematize demographic question, emphasize that demographic explosion was and is a big (probably the biggest) problem and/or argue for population reduction (Catton 1980, 1998, 2009, Youngquist 1999, Smail 2002, 2008, Stanton 2003, Sunderlin 2003, Heinberg 2004a, 2007, Linner-Ola 2004, McKee 2005, Pimentel 2008, Hall-Day 2009, McKillop 2009, Lardelli 2009a). Of course, their concrete propositions are very different. Michael Lardelli thinks that poor overpopulated countries are the true enemies of human survival, because hitting the ecological limits is much harder with larger population. Demographic growth can't be so fast stopped and reversed as economic growth (Lardelli 2008, 2009a)

hundred million in the case of the worst scenario (termonuclear war + pandemic diseases) - is the most realistic outcome of perfect storm, convergence of fossil fuel depletion, climate changes and many other troubles. Diseases, social (internal and external) violence and famine will be the main mechanisms of demographic collapse in 21st century. Overshoot and collapse becomes possible when species finds rich stock of resources that promotes its reproduction and depletes it in some periods of time. In the context of the peak oil all aspirations to „American way of life“, among poor population in Third World countries (and in „developed“ countries as well), must be abandoned forever, because affluent minority will not sustain its profligate lifestyle for a long either. End of global industrial civilization will be, for the long time, end of civilization as such. In recent history, collapse of one civilization made possible a rise of some other complex society. But today there are no longer any frontier or empty space for such rising. Also, restoration of complex agrarian civilization will not be possible because of lack of fertile soil. Only in the distant future, for several centuries or more, complex societies perhaps will rise again, but industrial civilization will be never restored. It is/was one shoot affair because fossil fuels can't be restored on the human time-scale.



Graph VIII: increase of world population from 9th to 21th century





**Graph VIIIa: how many people can survive depending on specific energy source**

Peak oil and energy crisis is the main theme of this article. There is many other troubles (not: problems), making human situation particularly difficult, like soil erosion, lack of water, new diseases etc., but we can't write about them in detail here. The most important are, of course, fast climate changes, probably man-made for the most part. Climate change theorists and activists usually ignore peak oil or, ironically, hail it as stimulus for faster abandonment of fossil fuel's economy (as if it is possible). There is much talk about climate changes in public, mass media and even in political circles – perhaps because this is *external* threat, suitable for technocratic thinking „problem-solution“. But climate change's impact is slower and industrial societies perhaps could adapted itself if unlimited quantities of cheap energy exist. Consequences of climate changes will be probably devastating only in convergence with the end of fossil fuel's era. Peak oil, although founded on firm geological facts, is *internal* (that is, it threatens foundations of normal functioning of industrial societies) and much bigger threat than climate change.<sup>41</sup>

<sup>41</sup> As recent experience shows up, only very high oil prices, above 100 d/b can make peak oil discourse visible in mass media and in political circles. Otherwise, there is prevailing silence not only because talk about absolute ecological limits is incorrect but because politicians simply don't have any plan about energy crisis. If you don't know what to do about peak oil don't talk about it at all. However, level of understanding of peak oil problematics in governments remains mystery. Oil depletion was important stuff in American administration from 1998 on, especially after

Peak oil and climate change are two fundamental parts of the perfect storm – and they must be understood together, not separate, as is often the case – as probable cause of demographic and social collapse in 21st century. But they have no equal significance as many writers and analysts think.<sup>42</sup> As Kjell Aleklett and several peak oil analysts pointed out, dominant scenarios of Intergovernmental Panel on Climate Change are unrealistic due to ignorance of peak energy problematics.<sup>43</sup> These scenarios take for granted business-as-usual scenario and continual increase of extraction and consumption of fossil fuels.<sup>44</sup> But, in the light of peak oil and peak energy, it is wrong assumption and the most catastrophic scenarios cannot be realistic. Probable collapse of industrial civilization in 21st century will be consequence of lack of net-energy, not of lack of stable climate.

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2001. (see: Klare 2005). Main goal of American occupation of Iraq in 2003. was control of its big oil reserves. There were some early official warnings – like famous Robert Hirsch's 2005 report for US Energy Department about „Peaking of World Oil Production“ – but with no lasting effect. Governments in some minor countries (Ireland, New Zealand) latently appointed commissions for investigating peak oil question in 2007-2008, but this effort was abandoned after collapse of oil prices. This silence will be probably broken in the next several years after oil prices will start to rise exponentially and governments will no be adherents of status quo anymore, simply because there would be no status quo any longer. Even arch-defenders of industrial society, like IEA, already recognize that traditional way of life is „patently unsustainable“ (World Energy Outlook 2008). IEA has argued, in 2007 report, that world oil resources will be sufficient to meet growth in demand to 2030. In 2008 (and 2009) report peak oil is projected till 2020, and a rate of decline in oil fields output by 6.7 %, not 3.7 % as in 2007 report. But for governments and public – if they recorded it at all - this was just minor technical changes in numbers.

<sup>42</sup> Heinberg 2007, 2009a, Holmgren 2009. Heinberg admits that energy factor and peak oil are the fundamental present threat but thinks that technological innovation can make profitable future extraction of coal and non-conventional oil with catastrophic climate effects (Heinberg 2009a:113-127). We don't think so, because deepening of economic and social crisis, in the near future, will cripple economy and make impossible vast extraction efforts. Technological innovations are possible if there are stable and growing economy, plentiful cheap energy and normal functioning of industrial megastructure – but that situation doesn't exist anymore. And Heinberg emphasizes that, due to coal (and fossil fuels) supply constraints, the worst scenarios for climate changes will not be realized (Heinberg 2009a:146). Heinberg has aptly criticized leaders in Copenhagen's summit in december 2009, for living in fantasy world with no mention about oil peak and energy crisis, faith in eternal growth and world-wide urbanization (Heinberg 2010a).

<sup>43</sup> Aleklett-Campbell 2003, Aleklett 2007, 2010. Here we can't talk about question about cause(s) of climate changes in detail. There is a numerous minority of „sceptics“ among climate scientists who don't deny that climate changes are real but question hypothesis about crucial anthropogenic factor and its use of fossil fuels. For our position, this is not particularly relevant because energy peak is much more significant predicament than climate changes.

<sup>44</sup> Recently, several short climatological articles tried to include peak oil problematics (f. e. Lynas 2008, Kharecha-Hansen 2008; for overview see: Bardi 2009) but they think that coal will be used as a substitution for declining supply of oil and gas. This is problematic position, because oil peak and all liquids peak mean beginning of great crisis of industrial civilization, as we can see in the last 2-3 years. Many projects for extraction of coal and non-conventional oil had to be cancelled due to lack of capital and decrease of prices. Increasing disintegration of industrial infrastructure, in the near future, will make normal extraction of coal (and other substitutes) even harder. About that see good analysis in Heinberg 2009a.

Industrial societies will collapse long *before* the worst consequences of climate change show up. Contemporary mega-crisis and shaking of foundations of the world economy 2008-9 has nothing with climate changes but (almost) all with energy factor or peak oil. Phenomenon of climate change is overstated and peak energy is understated in political circles and the public. Kurt Cobb has given two reasons for that: first, governments can hide true data about oil reserves but not about climate, and second, oil is deep underground, hard for measurement and its recovery is dependent on political, financial, technological and other factors.<sup>45</sup>

Systematic approach to resource management and slow population reduction is surely the most desirable option. Gradual decrease of production, consumption, technology, population and cities should be the most fundamental priority of governments and public. Instead suppression of symptoms, our priorities should be elimination of deeper causes of human predicament. But this is not realistic option, because humans hardly can work in long-term and global vision. Worse, rational option is in direct opposition to fundamental ideological values of the modern world: faith in technological miracles, technological and demographic expansion as something good, faith in „historical progress“ („we can't turn back“), humanistic prejudices about „human rights“ etc. Predicament is and will be interpreted, by government and by public, as „problem“ for some (technological) „solution“. But even human self-deceptions must end.

Different responses were are created as social and ecological crisis of industrial civilization was/is increasing. One such response has to be mentioned, that is, sc. Transition Towns movement in Great Britain, New Zealand, USA and several other countries. These movement contains programs and preparations for coming energy shortages and climate changes. Its main goal is de-globalization and localization, especially in energy security and food production. Its central idea is that town, village or other small area can make the energy and food transition to post-petroleum world by using efforts of local people, not big government or big business. Permaculture and other forms of local living are especially emphasized. Citizens of Transition Towns would live with, ideally, with complete self-sufficiency and localized infrastructure for agriculture, clothes, metal working and othe other basics of life.<sup>46</sup> Transition Towns movement is, so far, the best practical

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<sup>45</sup> Cobb 2006.

<sup>46</sup> Briton Rob Hopkins, probably the most notorious person of Transition Towns movement, recently wrote one handbook (Hopkins 2008) which contains analysis of different aspects of future energy transition and re-localization. There are several friendly critiques of different aspects the movement, from too big optimism (Greer 2008) to limited questioning of middle-class consumer culture and capitalism in general (Trainer 2009a, b, c). However, there is also other criticism, that Transition Towns movement is too radical, giving too much attention to collapse (Steffen 2009) but this is not valid description of the most Transition Towns participants. Peter Goodchild's critique is much sharper, postulating that TTM is some kind of middle-class show which ignores sheer enormity of the human predicament (Goodchild 2010). This is probably

and constructive approach to present predicament and justly tries to connect peak oil and climate changes. Great value of transition town movement is its community-based approach. Human beings are social animals and they will certainly live in some kind of society/societies after collapse of industrial civilization, not as Robinson Crusoe with armoury of weapons and 10 acres of land.<sup>47</sup> But this transition must be understood in context of demographic and social collapse (*through collapse*), not as a mean to prevent it (*against collapse*). Otherwise, it will be another case of unjustified optimism of members of middle class who firmly believe that future „will be what we want to be“. Hopkins personally thinks that future energy descent and more local life are inevitable, but Transition Towns movement includes many people with more reformistic convictions. This reformistic orientation can be, as Trainer argue, dominant at the present, but future desintegrative trends will certainly increase more radical options. In Transition Towns movement there is widespread conviction that alternative (renewable) sources of energy are possible „solutions“ for fossil fuels dependency and climate changes, but, as we saw, this is not correct. For many Transition Towns members „transition“ mean toward reformed industrial society, based on new (renewable) energy and with some lower (but still very complex) technological scale. Anyway, Transition Towns movement is an example how concept of industrial collapse should not be doom-and-gloom or nihilistic doomsterism. On the contrary, it can and should be call for constructive disintegration of industrial megastructure and affirmation of local communities as new/old human social context. Subjective reformistic convictions of the most of its members are not crucial because objective processes of social and demographic disintegration will force people to adapt to new circumstances. It is currently placed on the light-green spectrum but it can be changed very quickly.

Peak oil theorists and activists were and are often accused for dark vision of human future. This interpretation is often reinforced by their positive thinking about industrial society in principle. Namely, great majority of peak oilers believe that contemporary industrial civilization – in present form, at least – is unsustainable and that some collapse, or reduction in population and technological/political complexity, is inevitable in the near future. But, at the same time, many peak oilers, especially retired geologists (Campbell, Deffeyes and others), believe also in many aspects of official ideology of industrial society: in myth of „historical progress“, civilization as „rise and achievement“, industrial order as a „pinnacle of progress“, liberal democracy as society of freedom and

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correct, taking prevalent middle-class optimism in TTM, but transition to post-industrial future must start from something.

<sup>47</sup> This community-based approach is emphasized by other peak-oil analysts, like John M. Greer, Guy McPherson, Richard Heinberg and many others. Obviously, peak oil „movement“ – if that is correct label - is not simple „doomsterism“ or even „survivalism“ as its detractors think.

prosperity etc.<sup>48</sup> This interpretation is not just wrong – about reasons I wrote elsewhere<sup>49</sup> - but makes additional dilemmas. By acceptance of this ideology they unnecessarily weakens their own case. If people firmly believe in official ideology of industrialism – consumerism=wellbeing, technological expansion=progress, medicine=health, state=security etc. – they will probably make all efforts to sustain it and ignore, till the last moment, all warnings about unsustainability. If people believe that industrial society is something „advanced“ and part of the „progressive cultural evolution“ they will fight hardly to sustain it. But if we question this ideology and understand that history is *not* progressive and that industrial society is the most unnatural social order in human history, its collapse will appear as something not only inevitable but desirable. Crucial question is not: can we sustain this civilization (or civilization as such), but: should we even try? True, it will be mass die-off, many sufferings and destruction among humans, but collapse of industrial civilization will not be understood as tragedy or disaster. It will be opportunity for re-building small communities, better suitables for human animals and in touch with human nature.<sup>50</sup> Some human groups will be perhaps able to restore hunter-gatherer life, our natural evolutionary context.<sup>51</sup> Demographic and social collapse will save many eco-systems and species from man-made destruction. Collapse of industrial civilization will not be catastrophe or the end of the world or even human species, but just one case of collapse of

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<sup>48</sup> Typical for this approach is well-known book *The Long Emergency* by James Kunstler with his defense of „project of civilization“. Many other members of peak oil community also accept official ideology of industrial society, although, of course, not believing in its sustainability. „Salvation of civilization“ is a call in climate change theorists as well. But, there is also some ambiguity among many peak oil writers who believe in positive consequences of collapse of the industrial megastructure and restoration of small communities. Richard Heinberg writings are typical for this approach (Heinberg 2004a, 2005, 2007). Richard Heinberg, one of the most prominent peak oilers, was radical critic of not just industrialism, but civilization as a whole in 1990s (Heinberg 1995, 1996). But, in recent years, Heinberg significantly changed his mind and now he is ambivalent even about „benefits“ of industrial order, although there are many occasional „primitivist“ remarks in his recent articles and essays as well. For many peakers, principal questioning of civilization and „progress“ is completely out-of-question. Chuck Burr is exception in his problematizing of „historical progress“ and civilization in peak oil circles (Burr 2008). So, it is quite wrong labelling peakers as „neo-luddites“ or „anti-progress“ (Mills 2008).

<sup>49</sup> Markus 2006, 2009a, 2009b, 2009c.

<sup>50</sup> This point is very often emphasized in writings of Greer, Heinberg, Kunstler, Baker and other members of the humanistic „current“ in Peak Oil movement. There is certainly a positive aspect of future vision in their writings, not just doom-and-gloom.

<sup>51</sup> For millions years our ancestors were living not in „Stone Age“ (or R. Duncan's „Olduvai Gorge“), but in Green Age, or in wild natural world, clean and organic environment, not some kind of paradise, but in normal social and ecological circumstances for which we are genetically adapted. From the perspective of quality of human life (that is, satisfaction of fundamental needs: community, homeland, equality, clean and wild environment etc.) civilization looks as very bad experiment and always was Dark Age. So, reduction in social complexity is not so bad thing at all.

complex societies, often phenomenon in recent human history.<sup>52</sup> Collapse of civilization is not a fall in some kind of primordial chaos, but return to more typical/normal conditions of life in human history. Demographic and social collapse will relax mass human pressure on the wild habitats and species and make possible, in the long-term, restoration of many parts of the wild natural world, our true home. We have good chances to avoid restoring typical anthropogenic problems in traditional agrarian societies – petty local wars, contagious diseases, vast inequalities etc. – because restoration of agrarian civilizations will not be possible in near future. There is no favourable ecological conditions („frontier“ or empty space, possibility for intensive agriculture etc.) for rise of some other complex societies when industrial civilization will fall. Transition Towns movement can be one good start to our uncertain post-industrial future.

## LITERATURE:

- Aleklett, K. – Campbell, C. 2003. „Too Little Oil for Global Warming“  
([www.newscientist.com](http://www.newscientist.com))
- Aleklett, K. 2007. „Global Warming Exaggerated“ ([www.energybulletin.net](http://www.energybulletin.net))
- Aleklett, K. 2010. „The UN's Future Scenarios for Climate are Pure Fantasy“  
([aleklett.wordpress.com](http://aleklett.wordpress.com))
- Bardi, U. 2009. „Fire or Ice?“ ([www.energybulletin.net](http://www.energybulletin.net))
- Barry, J. 2007. *Environment and Social Theory*, London: Routledge
- Bodley, J. 2007. *Anthropology and Contemporary Human Problems*, W. Creek:  
Altamira Press
- Buell, F. 2004. *From Apocalypse to Way of Life*, London: Routledge
- Burr, Ch. 2008. *Culturequake*, Victoria: Trafford
- Caldararo, N. 2004. *Sustainability, Human Ecology and Collapse of the Complex Societies*, Ewanston: Edwin Mellen Press
- Catton, W. 1980. *Overshoot*, Urbana: University of Illinois Press
- Catton, W. 1998. „If Malthus Was So Wrong, Why Is Our World In Trouble?“  
([www.mnforsustain.org](http://www.mnforsustain.org))
- Catton, W. 2009. *Bottleneck*, Philadelphia: Xlibris Corp.
- Chefurka, P. 2009. „World Energy and Population“ ([www.paulchefurka.ca](http://www.paulchefurka.ca))

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<sup>52</sup> About earlier cases of collapse see: Caldararo 2004, Homer-Dixon 2006, Tainter 2007, Ponting 2007, Diamond 2008, McAnany-Yoffee 2009. This kind of literature often neglects specific position of industrial societies and their complete dependence on new (fossil fuels) energy sources. Overshoot and collapse – that is, reduction in population density and social complexity - was one possibility in agrarian world, but it is inevitability (or so it seems today) in industrial world due to its dependency on non-renewable energy source. This crucial fact was rightly emphasized by William Catton thirty years ago (Catton 1980). It means that collapse of industrial civilization will be much faster – several decades at most - than it was earlier.

- Chew, S. 2008. *Ecological Futures*, Walnut Creek: Altamira Press
- Cobb, K. 2006. „Apocalypse Always“ (www.energybulletin.net)
- Cohen, D. 2009. „2009 – A Year We Will Live to Regret“  
(www.energybulletin.net)
- Cocks, D. 2003. *Deep Futures*, Montreal: McGill-Queens U. P.
- Cooke, S. 2009. *In Mortal Hands*, London: Bloomsbury
- Crosby, A. 2006. *Children of the Sun*, New York: W. W. Norton
- Deffeyes, K. 2009. *Hubbert's Peak*, Princeton: Princeton U. P.
- Dekanić, I. 2007. *Nafta: blagoslov ili prokletstvo*, Zagreb: Metropres
- Diamond, J. 2008. *Slom*, Zagreb: Algoritam
- Dobson, A. 2007. *Green Political Thought*, London: Routledge
- Dodds, W. 2008. *Humanity's Footprint*, New York: Columbia U. P.
- Doyle, T. 2004. *Environmental Movements in Majority and Minority Worlds*,  
N. Brunswick: Transaction Publ.
- Dryzek, J. 2005. *Environmental Discourses*, Oxford: Oxford U. P.
- Duncan, R. 2006. „The Olduvai Theory“ (dieoff.org)
- Ehrlich, P. – Ehrlich, A. 2008. *Dominant Animal*, Washington: Island Press
- Engdahl, W. 2008. *Stoljeće nafte*, Zagreb: Detecta
- Frazier, W. 2004a. „Peak Oil, New Energy and the End of Scarcity“  
(www.ahealedplanet.net)
- Frazier, J. 2004b. „Hooked on Scarcity“ (www.ahealedplanet.net)
- Friedman, T. 2008. *Hot, Flat, and Crowded*, New York: Farrar, Straus & Giroux
- Goodchild, P. 2010. „Depletion of Key Resources“ (www.countercurrents.com)
- Goodstein, D. 2005. *Out of Gas*, New York: W. W. Norton
- Greer, J. M. 2008a. *The Long Descent*, G. Island: New Society Publ.
- Greer, J. M. 2008b. „Premature Triumphalism“ (www.energybulletin.net)
- Greer, J. M. 2009. *The Ecotechnic Future*, G. Island: New Society Publ.
- Hall, A. S. – Day, J. W. 2009. „Revisiting the Limits to Growth After Peak Oil“  
(sgentropy.blogspot.com)
- Hanson, J. 1999. „Energetic Limits to Growth“ (www.mnforsustain.org)
- Hardin, G. 1995. *Living within Limits*, Oxford: Oxford U. P.
- Hardin, G. 1999. *The Ostrich Factor*, Oxford: Oxford U. P.
- Hawken, P. 2007. *Blessed Unrest*, New York: Viking
- Hawken, P. 2008. *Natural Capitalism*, New York: Bay Back Books
- Hay, P. 2002. *Main Currents in Western Environmental Thought*, Bloomington:  
Indiana U. P.
- Heilbroner, R. 1991. *An Inquiry Into the Human Prospect*, New York: Norton
- Heinberg, R. 1995. „The Primitivist Critique of Civilization“  
(www.primitivism.com)
- Heinberg, R. 1996. *A New Covenant with Nature*, Wheaton: Quest Books
- Heinberg, R. 2004a. *Powerdown*, G. Island: New Society Publ.
- Heinberg, R. 2004b. „The Abiotic Oil Controversy“ (www.energybulletin.net)
- Heinberg, R. 2005. *The Party's Over*, G. Island: New Society Publ.

- Heinberg, R. 2007. *Peak Everything*, G. Island: New Society Publ.
- Heinberg, R. 2008. „Economists without a Clue“ (www.energybulletin.net)
- Heinberg, R. 2009a. *Blackout*, G. Island: New Society Publ.
- Heinberg, R. 2009b. „Temporary Recession or the End of Growth?“ (www.energybulletin.net)
- Heinberg, R. 2009c. *Searching for a Miracle* (www.postcarbon.org)
- Heinberg, R. 2010a. „The Meaning of Copenhagen“ (www.energybulletin.net)
- Heinberg, R. 2010b. „Life After Growth“ (www.energybulletin.net)
- Heinberg, R. 2010c. „Quacks Like a Duck“ (www.energybulletin.net)
- Hemenway, T. 2006a. „The Origins of Peak Oil Doomsterism“ (www.energybulletin.net)
- Hemenway, T. 2006b. „Apocalypse, not a Critical Look at Peak Oil Catastrophism“ (www.paternalliteracy.com)
- Holmgren, D. 2009. *Future Scenarios*, London: Chelsea Green
- Homer-Dixon, T. 2001. *Environment, Scarcity and Violence*, Princeton: Princeton U. P.
- Homer-Dixon, T. 2006. *The Upside of Down*, Washington: Island Press
- Homer-Dixon, T. ed. 2009. *Carbon Shift*, Toronto: Random House
- Hopkins, R. 2008. *The Transition Handbook*, London: Chelsea Green
- Hosseini-Zadeh, I. 2008. „The Recurring Myth of Peak Oil“ (www.counterpunch.com)
- Huber, J. 2004. *New Technological and Environmental Innovations*, Cheltenham: Edward Elgar
- Kharecha, P. – Hansen, J. 2008. „Implications of „peak oil“ for Atmospheric CO<sub>2</sub> and Climate“ (arxiv.org)
- Klare, M. 2005. *Krv i nafta*, Zagreb: Golden marketing
- Klare, M. 2006. „The Permanent Energy Crisis“ (www.countercurrents.com)
- Klare, M. 2009a. *Rising Powers, Shrinking Planet*, New York
- Klare, M. 2009b. „The Era of Xtreme Energy“ (www.countercurrents.com)
- Korpela, S. 2008. „Prediction of World Oil Production“ (Newman 2008:28-47)
- Kunstler, J. 2006. *The Long Emergency*, New York: Atlantic Monthly Press
- Kunstler, J. 2008. *World Made by Hand*, New York: Grove/Atlantic
- Lardelli, M. 2008. „To Save the World We May Have To Waste It“ (www.onlineopinion.com)
- Lardelli, M. 2009a. „The Population Problem“ (www.onlineopinion.com)
- Lardelli, M. 2009b. „The Oil-Economy Connection“ (www.onlineopinion.com)
- Lardelli, M. 2009c. „Energy Is Everything“ (www.onlineopinion.com)
- Leggett, J. 2006. *Half Gone*, London: Portobello Books
- Linner-Ola, B. 2004. *The Return of Malthus*, London: White Horse Press
- Lovins, A. 1979. *Soft Energy Path*, San Francisco: Harpercollins
- Lynas, M. 2008. *Six Degrees*, Washington: National Geographic Society
- Mahaffey, J. 2009. *Atomic Awakening*, New York: Pegasus Books
- Marks, R. 2007. *The Origins of the Modern World*, Lanham: Rowman &



- Littlefield
- Markus, T. 2006. *Dubinska ekologija i suvremena ekološka kriza*, Zagreb: Hrvatsko sociološko društvo
- Markus, T. 2009a. „Darwinizam i povijest“ ([www.isp.hr/~tmarkus/](http://www.isp.hr/~tmarkus/))
- Markus, T. 2009b. «Ekologija i povijest» ([www.isp.hr/~tmarkus/](http://www.isp.hr/~tmarkus/))
- Markus, T. 2009c. „Integral Theory“ ([www.isp.hr/~tmarkus/](http://www.isp.hr/~tmarkus/))
- Marshall, A. 2009a. „Entering the Greatest Depression in History“ ([www.globalresearch.ca](http://www.globalresearch.ca))
- Marshall, A. 2009b. „The Economic Recovery is an Illusion“ ([www.globalresearch.ca](http://www.globalresearch.ca))
- McAnany, P. – Yoffee, N. eds. 2009. *Questioning Collapse*, Cambridge: Cambridge U. P.
- McKee, J. 2005. *Sparing Nature*, New Brunswick: Rutgers U. P.
- McKillop, A. 2009. „ZPG2: Zero Population and Zero Oil Growth“ ([www.energybulletin.net](http://www.energybulletin.net))
- McMichael, T. 2003. *Human Frontiers, Environments and Disease*, Cambridge: Cambridge U. P.
- McNeill, J. 2000. *Something New Under the Sun*, New York: W. W. Norton
- McNeill, J. – McNeill, W. 2003. *The Human Web*, New York: W. W. Norton
- Meadows, D. – Randers, J. – Meadows, J. 2004. *Limits to Growth: The 30-Year Update*, London: Chelsea Green
- Mills, R. 2008. *The Myth of Oil Crisis*, Westport: Praeger
- Moran, E. 2006. *People and Nature*, Oxford: Blackwell
- Newman, Sh. ed. 2008. *The Final Energy Crisis*, London: Pluto Press
- Nolan, P. – Lenski, G. 2008. *Human Societies*, Boulder: Paradigm Publishers
- Nordhaus, T. – Shellenberg, M. 2009. *Breakthrough*, Boston: Houghton Mifflin
- Ophuls, W. – Boyan, A. 1992. *Ecology and the Politics of Scarcity Revisited*, New York: Freeman
- Pernick, R. – Wilder, C. 2008. *The Clean Tech Revolution*, S. Francisco: Harper
- Pimental, D. – Pimentel, M. 2008. *Food, Energy and Society*, Boca Raton: Taylor & Francis Group
- Pimental, D. 2008. „Population and Energy“ ([www.sciencemag.org](http://www.sciencemag.org))
- Ponting, C. 2007. *The New Green History of the World*, London: Penguin Group
- Price, D. 1995. „Energy and Human Evolution“ ([dieoff.org](http://dieoff.org))
- Radkau, J. 2008. *Nature and Power*, Cambridge: Cambridge U. P.
- Rawles, J. 2009. *How to Survive the End of the World as We Know It*, New York: Plume
- Rubin, J. 2009. *Why Your World Is About To Get a Whole Lot Smaller*, New York: Random House
- Ruddiman, W. 2007. *Plows, Plagues and Petroleum*, Princeton: Princeton U. P.
- Sanderson, S. 1999. *Social Transformations*, Lanham: Rowman & Littlefield
- Sanderson, S. – Alderson, A. 2005. *World Societies*, Boston: Allyn & Bacon

- Shearman, D. – Smith, J. 2007. *The Climate Change Challenge and the Failure of Democracy*, Westport: Praeger
- Smail, K. 2002. „Remembering Malthus“ ([www.scribd.com](http://www.scribd.com))
- Smail, K. 2008. „Confronting the Inevitable“ ([www.culturechange.com](http://www.culturechange.com))
- Smil, V. 1994. *Energy in World History*, Boulder: Westview Press
- Smil, V. 2003. *Energy at the Crossroads*, Cambridge Mass.: MIT Press
- Smil, V. 2008. *Global Catastrophes and Trends*, Cambridge Mass.: MIT Press
- Smith, J. – Lyons, G. – Moore, E. 2000. *Global Anarchy in the Third Millenium?*, London: Palgrave
- Smith, J. – Shearman, D. – Positano, S. 2008. *Climate Change as a Crisis in World Civilization*, Lewiston: E. Mellen Press
- Stanton, W. 2003. *The Rapid Growth of Human Populations*, Brentwood: Multi-Science Publishing
- Steffen, A. 2009. „Transition Towns or Bright Green Cities?“ ([www.worldchanging.com](http://www.worldchanging.com))
- Strahan, D. 2007. *The Last Oil Shock*, New York: Gardners Books
- Sunderlin, W. 2003. *Ideology, Social Theory and the Environment*, Lanham: Rowman and Littlefield
- Simlesa, D. 2008. *Kako potrositi svijet*, Zagreb: Sto citas?
- Tainter, J. 2007. *Kolaps kompleksnih drustava*, Zagreb: Jesenski i Turk
- Thompson, P. 2006. „The Twilight of the Modern World“ ([www.oilcrashmovie.com](http://www.oilcrashmovie.com))
- Trainer, T. 2007. *Renewable Energy Cannot Sustain a Consumer Society*, London: Springer
- Trainer, T. 2009a. „The Transition Towns Movement“ ([candobetter.org](http://candobetter.org))
- Trainer, T. 2009b. „Further Musings from Ted Trainer“ ([candobetter.org](http://candobetter.org))
- Trainer, T. 2009c. „Strengthening the Vital Transition Towns Movement“ ([www.pacificecologist.org](http://www.pacificecologist.org))
- Tverberg, G. 2009a. „Where We Are Headed: Peak Oil and the Financial Crisis“ ([www.energybulletin.net](http://www.energybulletin.net))
- Tverberg, G. 2009b. „There is a Plenty of Oil, But...“ ([www.energybulletin.net](http://www.energybulletin.net))
- Vanderheiden, S. ed. 2008. *Political Theory and Global Climate Change*, Cambridge Mass.: MIT Press
- Watson, P. J. – Jones, A. 2005. „The Myth of Peak Oil“ ([www.prisonplanet.com](http://www.prisonplanet.com))
- Zable, G. 2002. „Population and Energy“ ([www.mnforsustain.com](http://www.mnforsustain.com))
- Yergin, D. 2008. *The Prize*, New York: Simon and Schuster
- Youngquist, W. 1997. *GeoDestinies*, Portland: National Book Comp.
- Youngquist, W. 1999. „The Post-Petroleum Paradigm – and Population“ ([dieoff.org](http://dieoff.org))
- Youngquist, W. 2000. „Alternative Energy Sources“ ([www.hubbertpeak.com](http://www.hubbertpeak.com))

