# Hungarian energy law as an example of using complex system viewpoints for the public sector

*Dr. Máté Tóth LL.M. (mate.toth@ratkynet.hu)*
*Attorney-at-Law, Rátky and Partner Attorneys; Chairman, Hungarian Energy Association Interdisciplinary Division; PhD student, Széchenyi István University*

## Abstract

Complex systems theories come from hard sciences. The question arises whether these viewpoints can add anything to the understanding of the operation and failures of continental normativity governing the public sector.
Via certain industry-specific examples, we may observe that Hungarian energy law, one of the absolute extremes of continental law is complex. These lead to the identification of such issues like emergence and "robust yet fragile" dilemma. Identification of the proliferation of norms may also let us closer to the failures of the system. These approaches can also assist identifying systemic risk, whilst also helping to understand country risk issues of the regulation and quality concerns of public administration.

**Keywords:** Public administration, Energy law, Systemic risk

**Complex systems and law**

There is still a significant gap between 'hard sciences' and 'human sciences', the latters being in the bootstrap of ontological-political motifs and expectations that are mainly egalitarian-behaviourist in nature. This approach in legal thinking is well-criticized by a minority of scholars, underlining the speculative (Kekes 2004), arbitrary (Ross 1958, 259) and politically governed (Wesel 1984, 72) motifs resulting in the expressed omission of the findings of modern natural sciences (Szmodits 2011, 15), however, these voices cannot be considered as well-recognized. A stunning experiment to strike this unscientific hegemony in legal thinking is the extension of *complex systems* theories to law. Complex systems theories come from hard sciences, especially from physics, mathematics and biology; partially deriving from chaos theory in deterministic systems, game theory (very apparent in nature), dynamical systems of nonlinearity, non-equilibrium thermodynamics and so on. Common examples of complex systems are the human brain, the internet, cancer, the entire universe and so on; however, complex system-related approaches are recently getting closer to sociology (Miller and Page 2007) and economics (Sawyer 2005) as well. Such social constructs as the financial system are also well-connected to these approaches in scientific debates (Anabtawi and Schwarcz 2011). Some contemporary legal thinkers outlined the relevance of complex system theories concerning *law* (Ruhl, 2008), especially complex adaptive systems, "*in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution*" (Mitchell 2009, 13). However, to the extent one can be acquainted with the available literature, there is still a significant resistance to the application of complex system and complex adaptive system approaches, methods and theories in legal thinking (e.g. Vermeule 2010). It is indeed hard to realize that similar methodology to be used to the 'sacrosanct' humanity and to the gliding of vast flocks of English starling gathering

over the roost at dusk in a spatial coherence (Jones 2012) or that complex systems' development and evolution can be described as an ecosystem (Yu 2005). Thus, one have to admit that in case legal systems are complex systems, their archetype *should be* the ecosystem.

Law, whether being a complex system is not, is unique in a sense that it aims, in a normative way, to regulate *other* social (complex) systems. As such, one would presume that the law should therefore take into account the very (complex) nature of those systems regulated by it. This means that, arguably, in order to regulate a complex social system, the law should act as a complex system as well, however, given the *sui generis* (Katsuhito 2016) nature of law, this might lead to certain pre-conceptual fallacy. However, if legal systems are complex systems, such frank confessions may also occur like that regulation does not just *not always work*, many times it is part of what causes a failure cascade within and beyond the legal system (Ruhl 2014).

Just putting aside these general remarks for the time being, we can make one further observation in connection with the available scientific publications concerning law as complex system in this topic. Namely, that these publications surprisingly deal *almost exclusively* with common law (e.g. Bommarito, 2009). Complex systems theories concerning common law advanced even to map the emergent federal judicial social structure with graphs as well (Ruhl 2015). It is beyond doubt that common law systems and continental law systems are very distinct in nature, and these differences may extend to the criteria of complex system classification. Complex systems symptoms are relatively easily identifiable in case of legal systems based on common law, where the complex, multi-level case-law and legal theories are in a complex and clearly non-linear interaction with each other and where social structures of judges and courts matter (see the above graph as an example taken from Ruhl). Compared to this, *the continental law systems are still endeavour linear normative chains in a binary, reductionist logic*. In continental law, cases, judges, law schools, and law review are less relevant, especially in public law: i.e. those features are marginal based on which complex systems criteria are ordinarily demonstrated in common law. Thus, the question is still open and seems unanswered whether recent academic findings on the nature of (common) law as complex system are valid and applicable in a similar extent to continental law as well.

**The nature of Hungarian energy law and public administration in charge**

In order to answer this question, as well as to determine whether continental law systems are worth to be considered as complex systems like their common law counterparts overseas, I have chosen a very rigid and proudly linear continental law system, the law of Hungary for the purpose of analysis. To be consequent, I have obviously chosen public (administrative) law, and within the realm of public law, the over-regulated energy law, one of the absolute extremes of rigid continental law still in force as a field on investigation. Perhaps not surprisingly, though the energy law of Hungary tries to be linear, the market it regulates is full of different level participants (all of them are highly regulated as well as licensed apart from the consumer) being highly interconnected to each other. The *types* of market players are:

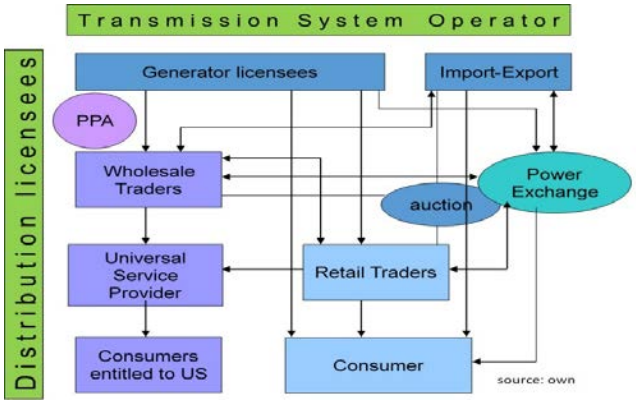


*Figure 1 – types of market players*

Hungarian public administrative law, and within this, energy law as a typical semi-autonomous industry-specific public law field regulates the relationships of these players and is indeed complicated. But is it complex as well? According to Watkins, complicated system is when the various elements that comprise the system still maintain a certain independence from each another, meaning that the removal of one element will not fundamentally change the system's behaviour all in all. Compared to this, in case of complexity the clear dependencies among the elements are unavoidable where removing one element will alter the system behaviour "*to an extent that goes well beyond what is embodied by the particular element that is removed*" (Watkins, Nicholas W. and Freeman, Mervyn P. 2008, 324).

**Heterogeneity and removing elements**

In order to assess this, we should consider *heterogeneity and agents* in Hungarian energy law. Consider the following example. When two gas traders in the wholesale scene agree the prices in a contract (thus under private law), first they do so in compliance with their licenses (thus public law, issued by the deconcentrated public administrative body in charge), incorporating general provisions of Act XL of 2008 on natural gas and its implementation decree (Government Decree no. 19/2009. (I.30)). Then they incorporate into the agreed contractual (!) prices system usage fees set by a decree of the Hungarian Energy and Public Utility Regulatory Authority ("HEA") (Decree 13/2016 (XII.20.) MEKH) also taking into account of pricing principles under Decree 14/2016 (XII.20.) MEKH, i.e. instruments of public law. If any of these elements, i.e. compliance with licenses, system usage price, any of the provisions of the listed laws and bylaws above, is removed, *it will fundamentally alter the system behaviour.* In legal terms, this would definitely render the agreed price, therefore the whole contract between the gas traders in our example *null and void.*

Let us consider another example of issuing license for electricity production exceeding 0.5MW in-build capacity. The Act LXXXVI of 2007 on electricity (a law) as well as Government Decree no. 273/2007 (X.19) on its implementation (a bylaw) specify the HEA as a public administrative body whose task is to issue the licence. Doing such, the law prescribes that the HEA should consider all elements of a taxative list when making a decision to issue such license, including business plans, certain technical and company law documents and so on. This might of course be a complicated decision-making process, however, removing one element from the list and thus making the licensing process less complicated *would not result in the less complex nature of the system.* What would affect the complexity and not (only) complicatedness in such a process? If the Hungarian electricity act or its implementation decree prescribed that the HEA must consider all relevant factors and discretionally balance them in order to grant a license to an electricity producer, then the elements and factors would no longer be independent

from each other, and removing one could significantly alter the result (Ruhl and Salzman, 2003, 796-806). Though the above is an unlikely example in energy law (licensing requirements are generally taxative), such complex nature is identifiable from a bird-eye view. Licensing of a power plant would imply environmental and building licensing processes as well in parallel with energy regulatory licensing. The cross-reference provisions internally and from other laws and bylaws (also in the electricity act and vis-à-vis environmental and building regulation) as well as the assignment of responsibilities to multiple public administrative agencies (environmental, building, energy) will result in the express interconnectedness of the whole licensing system.
What is more, agencies and public administrative bodies involved in the licensing will also further involve special authorities for special professional queries such as fire protection, public defence etc. These latter professional bodies do not connect directly vis-à-vis the power plant as a client in the production licensing process, only through the process of the leading licensing authority, e.g. the fire protection authority or the public defence special authority is contacted only through the licensing procedure of the building authority. What is more, the decision of the special authorities, either positive or negative, cannot be appealed directly, only through an appeal against the decision of the leading licensing authority. Thus, we are now entering a complex system with *different levels* between the nodes.
It is also worth mentioning the different chain of legal remedies available:

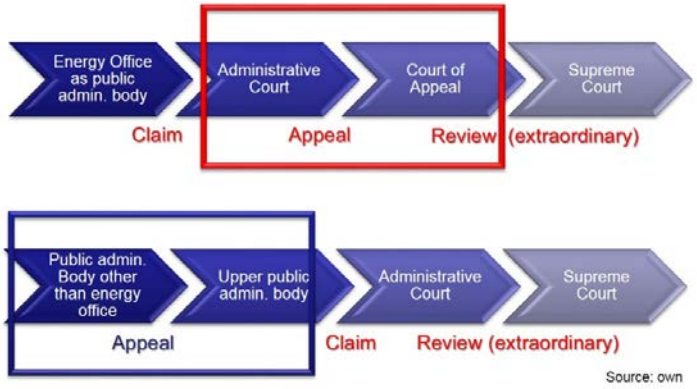


*Figure 2 – Remedy chains*

Obviously, these legal remedy-chains are also interconnected and be further complicated with the involvement of the special authorities mentioned above, whose decisions cannot be appealed directly. These patterns of legal remedies introduce the unpredicted, interconnected deterministic rules into the system as upper public administration bodies (agents) interpret or overrule both legislative acts and the acts of the lower public administrative bodies (agents) or courts *creating connections and feedbacks in a multiple level*.

**Non-linear relationships**

Furthermore and contrary to the declared intention of continental law, the *relationships between the above investigated particles are non-linear*. First, in the above examples of energy law relationships, contractual connections of gas traders or licensing procedures of the parallel authorities (HEA, environmental authority, building authority as leading authorities, accompanied by the lower level special authorities) are neither providing proportionate relationships and patterns nor are constant in time. Second, the nonlinear relationships are further sophisticated by the often changing legislature, having the highest relevance in continental law countries. Just continuing the example of electricity licensing, the licensing rules have been amended more than 100 (!) times during the last 25 years. There are voices saying that legal systems exhibit properties that make them

behave more like weather and less like tides (Ruhl and Katz, 2015, 225), and, in light of the above examples, they are likely right when considering Hungarian energy law as well.

**Evolvability, "RYF" and systemic risk**

These above questions lead to another essential feature of complex systems that is *emergence and evolvability*. Neither legal systems, nor public administrations are static phenomena. Even a robust complex adaptive system is not something immune to emergence, thus emergence is not a judgment nor a quality issue. Emergence is commonly defined as "*a process that leads to the appearance of structure not directly described by the defining constraints and instantaneous forces that control a system*" (Crutchfield, 1994, 515) or in more technical terms, as "*complicated global patterns emerging from local or individual interaction rules between parts of a system*" (Binder 2008, 322). Though the expectedly more robust complex legal systems, the continental law systems are less transparent in their emergence behaviour, the above should be true for them as well, being complex systems like common law or the ecosystem. Emergence is inherent, Hungarian energy law evolves: the laws and bylaws are amended and repealed, the "nodes": the licensees and even the agents change as well. Just to the latter, public authorities are dissolved, created or re-defined: the HEA was re-designed in 2013 so thoroughly that it became even a legislator concerning price setting besides its public administrative tasks. This emergence happened due to the Hungarian Government's so-called "rezsicsökkentés" (overhead reduction) campaign, expecting to keep end-consumer energy prices in an artificially low level in Hungary, not only regulating the potential profit of certain market players (the distribution system operators), because it was already around zero, but also their justified costs as well. In order to avoid successful judicial reviews of the public administrative resolutions of HEA with the artificial and arbitrary price reduction, the Parliament passed a law even changing the Constitution. This amendment prescribed that HEA should carry out its price settings not in the form of individual public administrative resolutions, against which judicial review is open, but through decrees, i.e. bylaws instead with erga omnes binding force, against which no judicial control is available.

It seems scholars do consider emergence only as a positive characteristic of complex legal systems (e.g. Ruhl, 2014). The emergence in legislation and legal execution (public administration) may represent useful flexibility as adaption indeed, but also risk. Concerning the latter, emergence may also be associated with country risk (i.e. a country changing its legal norms too often producing less stability) and public administration operation (i.e. quality of public administration). In our latter example, i.e. the changing rule of HEA as a public administrative body in Hungarian energy law, even becoming a legislator thus making law, is clearly a self-explanatory case study of legal emergence both being in connection with the increase of country risk and the decrease of quality expectations towards (i.e. trust in) public administration. A public administrative body becoming a lawmaker for price setting out of blue is indeed a thing affecting investment and regulatory stability and thus country risk (and trust) in the energy sector in general, whilst quality expectations and trust in public administration is also being affected by narrowing available legal remedies against decisions of the public administration. This is not just a theory. I have seen dozen of big energy investors increasing the used country risk factor in their future investment decisions due to the arbitral and unpredictable change of the price setting back in 2013 whilst decreasing their reliance on public administration in the same time, by clearly avoiding further possible contact with public administrative bodies.

As seen above, even the legislation governing Hungarian energy law has changed several times, turning all the above to a more normative (and de lege ferenda) viewpoint, i.e. to

the “robust yet fragile” (RYF) dilemma. Emergence in the legal system like the change of the HEA role may add to the robustness of the legal system (strengthening legal position of official price setting and defending “rezsicsökkentés” from judicial review) and the fragility of it (increasing country risk, decreasing trust in quality of public administration) in the same time. The RYF dilemma is generally about the phenomenon that a legal system is both robust and fragile in the same time, and any effort to reduce fragility by reducing organization would also reduce robustness, but increasing organization to increase robustness also increases fragility. According to Alderson and Doyle, the core criterion for the RYF dilemma model is “*large and/or diverse number of components, the complexity of their interconnections and interactions, and the complexity of the behaviors that result*,” (Alderson and Doyle, 2010, 840) i.e. the very essence we identified.

Understanding the complex system nature of our very rigid continental law example, namely the Hungarian energy sector regulation and the involved public administration should necessarily draw our attention to this RYF dilemma in understanding *systemic risks*. Whilst legal scholars have written about systemic risk occurring in financial systems as early as in the 1980s (Gruson 1987, 303), identifying systemic risk within the legal system is a quite recent field of investigation (Ruhl 2014). Risks cannot only be caused *in other complex social systems* by the law, like it happened with the changing rule of the HEA causing the increasing country risk and decreasing trust in public administration quality. A certain degree of systemic risk is without doubt inherent *within* the legal system itself as in case of any other complex adaptive systems. Systemic risk is the risk of having not just statistically independent failures, but “*connections between risks (‘networked risks’)*” (Helbing, 2013). It is exactly the potential for cascading that is so dangerous in case systemic risk is high. The RYF dilemma and the emergence of systemic risk are closely related, therefore, whilst investigating the common law system of the United States, Ruhl comes to the fundamental question that if we cannot effectively manage systemic risk within the legal system, how can we expect the legal system to manage systemic risk elsewhere? (Ruhl, 2014, 563.)

**Identifying complex constraints and systemic risk**

Where and how can we identify the systemic risks of emergence, i.e. the frontline of the RYF dilemma in law being a complex system? Though different types of constraints and risks may arise on the level of components, the most important ones are complex constraints. The reason is simple: constraints that occur on the component level can be realised much easier. A constraint is complex on the system as a whole that is not a consequence of those on the components (Alderson & Doyle, 2010, 841). It means that it is much harder to realise them then constraints occurring on the component level, as they do not exist on the component level. Those procedural norms creating an environment for the operation, e.g. licensing rules in Hungarian energy law could be relevant to such complex constraints for example. Different constraints may combine in their effect and interact with each other, creating emergent situations that might not have arisen in lack of this combination, i.e. would not occur in component level. Let me take another example, the issue of licensing wind power plants in Hungary. Following Hungary’s accession to the European Union, the green energy goals of the EU became goals of Hungary as well. In order to comply with these goals, the Hungarian energy law regulation intended to solve the issue of promoting power plant investments producing electricity from renewable energy sources (RES) by introducing a so-called mandatory off-take system accompanied by a feed-in tariff. In this off-take system the wholesale electricity trader, then later the transmission system operator was obliged to off-take the electricity produced from RES. The expected return of investments was inbuilt in the

tariffs of electricity produced that were officially set by law, whilst eligibility to participate in the mandatory off-take system was checked and criteria (e.g. amount of electricity to be sold, time of eligibility for the off-take) were set by HEA in resolutions. Risks or apparent constraints were not present on the component level, the logic was clear and straight-forward, and tasks were well-balanced between the legislator, the affected market players (producer, off-taker) and the public administration (HEA). However, in 2006, given that the guaranteed return (mandatory off-take and feed-in tariffs) made RES investments a very attractive business with guaranteed return, applications for licenses were submitted to the HEA exceeding 1,000 MW new wind capacity in total, more than three times higher than what the electricity system could manage. The problem was simple. Given the volatility of wind energy (the wind is not always blowing, not always from the same direction etc.), each megawatt electricity produced from wind requires a certain amount of electricity as a "back up" in case the production of the wind park stops (storage possibilities were almost null). These "back up" is provided through so-called system-level services provided by old gas-fuelled power plants in the system. That time, the maximum amount of wind energy that could be handled by system-level services was around 300 MW, whilst the total requested new wind capacity in the submitted license requests were the said 1,000 MW. A cascade of failures occurred. As Alderson and Doyle argues, when system organization becomes more complex, even slight perturbations could have cascading and ultimately catastrophic consequences through the tightly interconnected system (Alderson and Doyle, 2010, 843). Here the complexity increased with the introduction of the green energy subsidy, i.e. with the mandatory off-take and feed-in tariffs. This new element brought in the perturbation event to the complex system – new wind energy production licence applications of a total 1,000 MW the electricity system was physically unable to handle – and even the originally well-functioning particles failed in an unforeseen way. As Alderson and Doyle explain: the emergence of complexity can often be seen as a spiral of new challenges and opportunities that organisms and/or technologies exploit, but "*which also lead to new fragilities, often from novel perturbations. When successful, fragilities are met with increasing complexity and robustness, which, in turn, creates not only new opportunities but also new fragilities, and so on*" (Alderson and Doyle, 2010, 843). What happened in the wind power plant licensing issue then is worth considering to understand the RYF dilemma and the cascade of failures. Given that the Hungarian electricity system was physically incapable to handle 1,000 MW wind power plant capacity, HEA arbitrarily decided which license application to accept and which to reject, though legally (concerning criteria set by law) all had to be accepted. HEA thus manifestly violated the law. HEA issued a so-called "prospectus" with the arbitrarily set criteria – the problem with this doubtful paper was that as "prospectus" did n ot appear in law concerning legislation, thus it could not have binding force at all. In terms of normativity, it was simply not law, but the HEA considered it necessary in order to defend the robustness of law. The investors whose license applications were rejected turned to the courts in a form of public administrative litigation. Thus, the perturbation manifesting in the HEA's dilemma was passed to a different branch of power: the judiciary. The court, measuring the interest of formal legality (stability) and the interest of the electricity system as a whole (though not manifested in law), decided in favour of the latter. The consequence was that dozens of investors left the country. The legislator also reacted in its slow way: the electricity act was amended saying that licensing of wind power parks should be subject to special rules in the future. However, the special law regulating such was enacted only one and a half year later, causing an unconstitutional omission. So far, the cascade of legal failures included the failure of the existing regulation, then the failure of the public administration (HEA), the failure of the courts, the failure of the legislation.

Handling this RYF complexity spiral in law as a complex system should indeed be a central issue for de lege ferenda thinking. Some scholars suggest fail-safe strategies, improving the quality of the system components, redundancy of components, building in sensors and feedback (Alderson and Doyle, 2010, 841-42, Ruhl 2014, 579).
Improving the quality of the system components in order to strengthen robustness of the legal system is again closely connected to the issue of quality in public administration concerning the executive branch of power and to the issue of country risk through stability and reliability of legislation, whilst also being a rational response to the issue of systemic risk within the law. Such quality improvement may address institutions, procedures, people, technology (digitalization) and so on. The *quality excellence models* used nowadays originally elaborated for the private (business) sector are capable as a tool to grab the issue for the public administration. National quality awards in Western European public service organizations under both models do operate with the following criteria: leadership, policy and strategy, people, resources, processes and finally different categories of "objective" and "subjective" results, with obvious differences in weightings form country to country (Löffler 2001, 25-47). These are mainly indirectly forced by law from a client perspective, as these should be applied (and often self-assessed, especially in case of the European Excellence Model) by public administrative organs, not necessarily (though in some cases still) forming part of classical public administrative codes. It is also worth noting that the Common Assessment Framework ("CAF") (Bouckhaert and Pollit 2001). *The ISO 9000 series* are also good-old standards (often refreshed) for quality assurance purposes (Russel 2010). Concepts go so far that legislative and judicial branches of power are also affected by the promotion of quasi-legislative and quasi-judicial tools and instruments are encouraged. Quasi-legislative processes are deliberative democracy, e-democracy, public conversations, participatory budgeting, citizen juries, study circles, collaborative policy making, and other forms of deliberation and dialogue among groups of stakeholders or citizens. Quasi-judicial processes include alternative dispute resolution such as mediation, facilitation, early neutral assessment, and arbitration (Bingham, Nabatchi and O'Leary 2005, 547-558).

**Proliferation of norms**

As seen above, evolvability, RYF and systemic risk are clearly aspects of complex system investigations adding a lot to understand normativity *per se*.
Given that the very essence of normativity is the norm itself, it is worth looking for the systemic risk of potential failures there as well. In this sense there are justified grounds recognizing the proliferation of norms through the operation of *power-law event distribution*, a typical effect of the existence of complex systems as well. It is considered as a complex system feature that overall behaviour characterized by mathematical "power laws" that do not follow "familiar bell-curve" statistical distributions (Farber 2003, 152). Power-law distribution identified in areas such as the populations of cities, the intensities of earthquakes, and the sizes of power outages. In energy law, the effective use of the different levels of legislation in operation would be an apparent field to recognize the operation of power law. On the top of the legislative hierarchy the industrial codes are present (the electricity act and the gas act), followed by a huge amount of governmental decrees, even more ministerial decrees and decrees of the HEA (something like a hundred), and then with tens of thousands resolutions, either of individual or wider industrial effect, by the public administration authorities. In case we enumerate among an x axis the relevant laws and bylaws according to their hierarchy from the left to the right and then we collect references to the provisions (norms) of them in certain cases (e.g. total of HEA issued resolutions) we would likely get a power law graph.

The analysis of the "proliferation of norms" would follow the recipe for analysing power-law distributed data:
(1) Estimation of the parameters x-min and α of the power-law model.
(2) Calculation of the K-S value (goodness-of-fit) between the data and the power law using the method. Bootstrapping procedure can be used to calculate the p-value from a K-S value. Based on Clauset, Shalizi, and Newman (2009) if the resulting p-value is greater than 0.1, the power law is a plausible hypothesis for the data, otherwise it is rejected.
(3) To confirm the results of the comparison of the power law with alternative hypotheses carried out via a likelihood ratio test. Based on Clauset, Shalizi, and Newman (2009): for each alternative, if the calculated likelihood ratio is significantly different from zero, then its sign indicates whether the alternative is favoured over the power-law model or not.

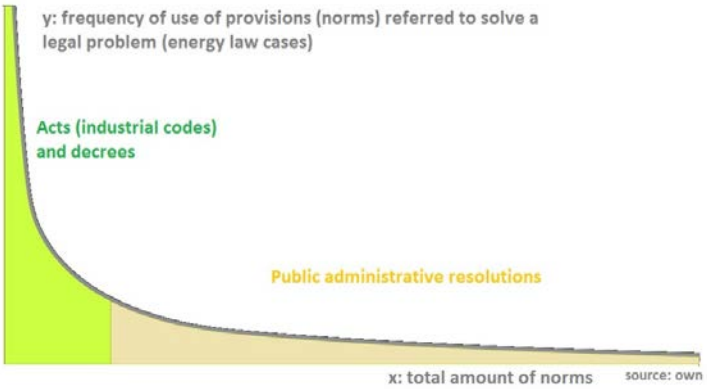


*Figure 3 – The proliferation of norms*

Such measurements would require some time-consuming data collection, but the result would likely be very impressive – and, based on my 10-year personal experience as a lawyer – something like the above presumed graph, on the right with a long tail, and on the left with the most cited (and likely the most higher-ranked) limited number of pieces of legislation. Such a graph may also be very informative on the proliferation of legislation as well as on frequency of certain types of norms specified, compared to the total. Whilst certain provisions of the energy act will be highly referred in the HEA resolutions, certain bylaws will have less frequency, whilst other public administrative resolutions, even including those having wide industrial affects (e.g. network codes) will be referred on very rare occasions or even never. Just excluding public administrative resolutions referring to each other, the remainder of the long tail still contain legislation seldom used by public administrative bodies during their activities vis-à-vis market players as clients. I used sampling of random 100 electricity-related resolutions of the HEA issued in 2018 available at the HEA webpage and collected the references from these (x axis), and whilst there were acts and bylaws being referred in more than 90 (the maximum was 97), there are complete government decrees never referred at all. Such measurement may also take place in other regulatory fields as well, providing useful data on such “sleeping norms” that, like so-called inactive (sleeping) genes in our DNS not coding nucleotide, may not have any real significance, but still carry an imminent systemic risk instead.

**Conclusion**

As it can be seen from the examples of one of most rigid written continental public law regimes, the Hungarian energy (public administrative) law, there are valid grounds to investigate complex system approaches of understanding continental laws as complex systems even though there are significant differences between common law and

continental legal systems. It is therefore beyond doubt that evolvability, RYF and systemic risk are clearly aspects of complex system investigations adding a lot to understand normativity per se. There are still a lot to be said in these fields, such as based on the identification of the proliferation of norms. Complex system approaches could therefore assist identifying and handling systemic risk within the law, also helping to understand and hopefully to mitigate country risk issues of the regulation and quality concerns of public administration. It is therefore a promising new field for interdisciplinary experiences to use complex system approaches to understand normativity governing the public sector as a complex system.

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