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**To:** Department of Energy, Research and Technology and Investment Committee  
**Re:** Request for Information: Energy Storage Grand Challenge (85 Fed. Reg. 43,223; Docket no. DOE-FRDOC-0001): Section 4: Policy & Valuation

The Institute for Policy Integrity (“Policy Integrity”) at New York University School of Law<sup>1</sup> respectfully submits comments on the Department of Energy (“DOE”)’s recent request for information (“RFI”) on the Energy Storage Grand Challenge.<sup>2</sup> Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy. Policy Integrity has particular expertise on the valuation of energy storage.

DOE’s Energy Storage Grand Challenge, announced in January 2020, is program designed to expand the technological development and proliferation of energy storage systems in the U.S. electric power system.<sup>3</sup> The RFI is meant to gather information to be used in internal DOE decisionmaking and planning “to ensure that future activities maximize public benefit while advancing the Administration’s goals for leading the world in building a competitive, clean energy economy; securing America’s energy future; reducing carbon pollution; and creating domestic jobs.”<sup>4</sup>

### RFI Section 4 - Policy & Valuation

These comments respond specifically to Section 4 of the RFI, Policy and Valuation. DOE seeks to “ensure that storage is properly valued, effectively sited, optimally operated, and cost-effectively used to improve grid and end-user reliability and resilience,” by “providing stakeholders with the necessary information and capabilities.”<sup>5</sup> To achieve this vision, there must be efficient investment in energy storage systems, which requires that energy storage systems are accurately valued and

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<sup>1</sup> This document does not purport to present New York University School of Law’s view, if any.

<sup>2</sup> Dep’t of Energy, Request for Information: Energy Storage Grand Challenge, 85 Fed. Reg. 43,223 (Jul. 16, 2020).

<sup>3</sup> *Id.*

<sup>4</sup> *Id.*

<sup>5</sup> *Id.* at 43,224.

can participate fully in the market. Specifically, there are three conditions that can ensure energy storage is optimally deployed.<sup>6</sup>

1. All attributes of energy storage systems, including their capability to reduce greenhouse gas emissions, must be properly valued;
2. Barriers to entry into the market for energy storage systems must be reduced or eliminated;
3. Energy storage systems must have access to multiple value streams.

Even though fully implementing policies that can satisfy all three conditions require coordination and collaboration among state and other federal regulators, DOE has an important role to play to achieve these goals. Relying on its authority under the Department of Energy Organization Act,<sup>7</sup> DOE can wield agenda-setting authority and propose rules, regulations, and statements of policy related to energy storage. And DOE can also provide funding incentives, guidance documents, and technical support for improving energy regulation, both at the federal and the state levels. Accordingly, these comments make recommendations for specific actions DOE can take in the context of how to value energy storage and support the policies that are necessary to ensure efficient investment.

Below, we explain tools and policies necessary to accurately value energy storage systems, regardless of where they are located on the grid, and to efficiently deploy them wherever they can be most beneficial to the nation. DOE should use its capacity and resources to help develop the tools necessary for proper valuation, and facilitate coordination efforts through technical guidance and funding opportunities.

## Valuation

Energy storage has many benefits, like renewables integration or reserve capacity.<sup>8</sup> Deploying it in a manner that brings the most value to society is necessary to achieve the Administration's goals of "maximizing public benefit" while "leading the world in building a competitive, clean energy economy," and "reducing carbon emissions."<sup>9</sup> To enable optimal deployment of energy storage systems, all benefits they provide must be accurately valued. If some benefits are not valued and compensated, energy storage may not get deployed even when it would be socially beneficial because the upfront costs are so high.

Accurately valuing energy storage is important to ensure that there are optimal investments in storage and that energy storage policies maximize social benefits. There can be high upfront costs with battery storage, so sufficient investment is necessary to bring them online.<sup>10</sup> If decisionmakers do not assign value to energy storage based on all the services it provides, there will be underinvestment and underutilization of battery storage because value is "left on the table." In addition, if energy storage systems are not valued for all of the services they provide, they may be

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<sup>6</sup> See Richard L. Revesz & Burcin Unel, *Managing The Future Of The Electricity Grid: Energy Storage And Greenhouse Gas Emissions*, 42 HARV. ENVTL. L. REV. 139 (2018); see also MADISON CONDON ET AL., INST. FOR POL'Y INTEGRITY, MANAGING THE FUTURE OF ENERGY STORAGE (2018),

[https://policyintegrity.org/files/publications/Managing\\_the\\_Future\\_of\\_Energy\\_Storage.pdf](https://policyintegrity.org/files/publications/Managing_the_Future_of_Energy_Storage.pdf).

<sup>7</sup> 42 U.S.C. § 7173-7175 ; 16 U.S.C. § 824a. See also Michael Gergen *DOE as a Catalyst for Innovative and Transformative Economic Regulation of the Bulk Power System?*, New U.S. Leadership, Next Steps on Climate Change 87-92 (Oct. 2016).

<sup>8</sup> Revesz & Unel, *supra* note 6, at 142, 146.

<sup>9</sup> 85 Fed. Reg. at 43,223.

<sup>10</sup> Revesz & Unel, *supra* note 6, at 189 ("Because the revenue potential based on only one category of benefits does not justify the current high upfront investment that is needed, one value stream is not enough to give sufficient incentives for large scale deployment.").



calculations. Similarly, calculating the environmental and public health benefits that energy storage systems can provide to the public require more easy-to-use tools regulators can have access to.<sup>17</sup>

## Energy Storage and Greenhouse Gas Emissions

One of the stated goals of the Energy Storage Grand Challenge is “reducing carbon pollution.”<sup>18</sup>

Greenhouse gas consequences of energy storage deployment and operation depend on many factors, and energy storage systems can increase emissions under certain circumstances.<sup>19</sup> If storage is charged during off-peak times by polluting generators, and then discharged during peak times as a competitor to more expensive, and less polluting or nonpolluting, energy sources, the net effect will be an increase in emissions. Additionally, when energy storage demands more total energy generation to compensate for energy lost during charging and discharging, there could be greater emissions, if the battery has been charged with emitting resources.

Understanding the emissions consequences of energy storage systems requires knowing the marginal emission rates during charging and discharging periods. These rates depend on the type of the generator that responds to a change in demand for electricity during those times, i.e. the marginal generator, adjusting its production to match the marginal change in demand. In other words, having real-time marginal emissions data is critical for efficient energy storage deployment. However, many policymakers do not have access to this kind of data.

DOE can play an important role in ensuring energy storage systems are properly valued by developing or supporting tools for providing real-time marginal emissions data. This information is critical for determining whether the operation of energy storage is actually reducing emissions. For example, DOE can provide the funding for making such data openly available, or collaborate with Federal Energy Regulatory Commission (“FERC”) to have ISO/RTOs release the data.

Energy storage systems can also bring other environmental and public health benefits by displacing local pollutants. The monetized value of these benefits also depends on many factors such as weather patterns and population data,<sup>20</sup> which are not readily available for policymakers.

For a detailed explanation of data and modeling needs to calculate these values, see Policy Integrity’s 2018 report, *Valuing Pollution Reductions*.<sup>21</sup>

## Resilience

Resilience is another benefit that energy storage can provide to various stakeholders, as well as society at large, but is difficult to quantify. In the RFI, DOE expressed a particular interest in understanding the value of the resilience that battery energy storage can contribute. DOE also stated that one of its goals is “to improve grid and end-user reliability and resilience” based on information gathered under section 4 of the RFI. Energy storage can improve electricity system resilience to disruptions, such as from storms and wildfires that are expected to increase in frequency and severity as the climate changes.<sup>22</sup> Storage can also help facilitate predictable and

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<sup>17</sup> CONDON ET AL., *supra* note 6, at 8-10; *see also* GUNDLACH & UNEL, *supra* note 14, at 21-23 (Discussing the environmental and resilience attributes of DERs generally.).

<sup>18</sup> 85 Fed. Reg. at 43,223.

<sup>19</sup> *See* CONDON ET AL., *supra* note 6, at 8-10.

<sup>20</sup> *See* JEFFREY SHRADER ET AL., INST. FOR POL’Y INTEGRITY, VALUING POLLUTION REDUCTIONS: HOW TO MONETIZE GREENHOUSE GAS AND LOCAL AIR POLLUTANT REDUCTIONS FROM DISTRIBUTED ENERGY RESOURCES 22-25 (2018), [https://policyintegrity.org/files/publications/Valuing\\_Pollution\\_Reductions.pdf](https://policyintegrity.org/files/publications/Valuing_Pollution_Reductions.pdf).

<sup>21</sup> *Id.*

<sup>22</sup> NAT’L ACAD. SCIS., ENG. & MED., ENHANCING THE RESILIENCE OF THE NATION’S ELECTRICITY SYSTEM 9 (2017), <https://doi.org/10.17226/24836>.

secure electricity access for low-income individuals and communities.<sup>23</sup> Therefore, DOE should support work that helps quantify both “electricity system resilience” and “community resilience.”

### Electricity System Resilience

“Electricity System Resilience” refers to the electric grid’s ability to resist, absorb, recover from, and adapt to high-impact, low-probability external shocks.<sup>24</sup> As explained in Policy Integrity’s 2018 report, *Toward Resilience: Defining, Measuring, and Monetizing Resilience in the Electricity System*, this definition is consistent with those put forward by both policymakers at the state and federal levels and academic researchers.<sup>25</sup>

Several publicly available methodologies are available to value energy storage’s potential contribution to improved resilience.<sup>26</sup> Sandia National Laboratory, which is funded by DOE, has developed metrics for evaluating the resilience of DERs.<sup>27</sup> Policy Integrity’s report, *Towards Resilience*, draws from the work of Sandia National Laboratory and lays out a general methodology for valuing resilience. However, regulators need easy-to-use tools to apply existing metrics and methodologies to their decisionmaking. Without such tools, regulators may avoid trying to value the resilience benefits provided by of DERs at all.<sup>28</sup>

DOE could build upon the work of Policy Integrity and others by developing or supporting a ready-to-use tool for calculating the value of the electricity system resilience provided by battery storage.

### Community Resilience

“Community Resilience,” measures a community’s capabilities to prepare and plan for, absorb, recover from, and adapt to low-probability, high-impact, adverse events.<sup>29</sup> Community resilience

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<sup>23</sup> GRIDWORKS ET AL., THE ROLE OF DISTRIBUTED ENERGY RESOURCES IN NEW JERSEY’S CLEAN ENERGY TRANSITION 4, 9 (2019), <https://perma.cc/7MMU-7Y6Z>.

<sup>24</sup> BURCIN UNEL & AVI ZEVIN, INST. FOR POL’Y INTEGRITY, TOWARD RESILIENCE: DEFINING, MEASURING, AND MONETIZING RESILIENCE IN THE ELECTRICITY SYSTEM 1 (2018), [https://policyintegrity.org/files/publications/Toward\\_Resilience.pdf](https://policyintegrity.org/files/publications/Toward_Resilience.pdf).

<sup>25</sup> *Id.* at 4, fn 14 & 15.; see also NYSERDA, Strategic Outlook 2019-2022, at 21; Grid Reliability and Resilience Pricing, Order Terminating Rulemaking Proceeding, Initiating New Proceeding, and Establishing Additional Procedures, 162 FERC ¶ 61,012, P 23 (Jan. 8, 2018); NAT’L ACAD. OF SCI., ENG’G & MED., ENHANCING THE RESILIENCE OF THE NATION’S ELECTRICITY SYSTEM, at vii (2017), <https://www.nap.edu/catalog/24836>; Dep’t of Energy, Transforming the Nation’s Electricity System: the Second Installment of the Quadrennial Energy Review 4–3 (2017), <https://perma.cc/FHE6-NUT2>; A. Stankovic, IEEE Power & Energy Soc’y, The Definition and Quantification of Resilience (Apr. 2018); Mathaios Panteli & Pierluigi Mancarella, *The Grid: Stronger, Bigger, Smarter?*, IEEE Power Energy Mag., May–June 2015, at 58, <https://perma.cc/NSB6-PN7X>.

<sup>26</sup> See generally NAT’L ASS’N OF REGUL. UTIL. COMM’R, THE VALUE OF RESILIENCE FOR DISTRIBUTED ENERGY RESOURCES: AN OVERVIEW OF CURRENT ANALYTICAL PRACTICES (2019).

<sup>27</sup> ERIC VUGRIN ET AL., SANDIA NAT’L LAB., RESILIENCE METRICS FOR THE ELECTRIC POWER SYSTEM: A PERFORMANCE-BASED APPROACH (2017), <https://perma.cc/Z6CB-DK4J>.

<sup>28</sup> E.g. CONN. DEP’T OF ENVI. & ENERGY PROTECT. AND CONN. PUB. UTILITIES & REG. AUTH’Y, VALUE OF DISTRIBUTED RESOURCES IN CONNECTICUT (Jul. 2020) 65-66 (Saying that “a standardized approach for the calculation of resilience value,” and “[n]o model reviewed...for the Study meets all of the steps outlines” by Policy Integrity, and therefore, DEEP and PURA were not able to quantify the resilience value provided by DERs.).

<sup>29</sup> NAT’L ACAD. SCIS., ENG. & MED., BUILDING AND MEASURING COMMUNITY RESILIENCE: ACTIONS FOR COMMUNITIES AND THE GULF RESEARCH PROGRAM 12-13 (2019); NAT’L INST. SCI. & TECH (NIST), COMMUNITY RESILIENCE PLANNING GUIDE FOR BUILDINGS AND INFRASTRUCTURE SYSTEMS, vol. 1, at 13 (2016), <https://perma.cc/68TB-5B98>; K.B. Wells et al., *Applying community engagement to disaster planning: Developing the vision and design for the Los Angeles County Community Disaster Resilience initiative*, 103 AM. J. PUB. HEALTH 1172, 1172 (2013), doi 10.2105/AJPH.2013.301407 (describing community resilience as “community capabilities that buffer it from or support effective responses to disasters”); National Research Council, Disaster Resilience: A National

overlaps with but is decidedly broader than electricity system resilience.<sup>30</sup> One of the important reasons for investing in electricity system resilience is to ensure that vulnerable populations can endure the aftermath of a disruptive event,<sup>31</sup> in part by ensuring that local critical facilities that rely on electricity remain operational (or quickly return to operation). Measuring community resilience in addition to electricity system resilience ensures that important indicators and outcomes are not missed, such as the availability and performance of cooling centers during heat waves, shelters during severe storms or floods, solar- or battery-powered mini-fridges used for storing medications, or support networks for the disabled.

Several tools and published analyses measure the ability of DERs, including energy storage, to improve community resilience.<sup>32</sup> However, there is not one comprehensive tool that decisionmakers can use to determine the monetary value of community resilience that energy storage systems can provide. DOE could engage stakeholders to develop a methodology for calculating the value of community resilience.

## Policy

The current regulatory and policy framework provides insufficient incentives for developing economically efficient energy storage deployment. This framework is also insufficient for deploying and operating energy storage where and when it can bring the most benefits to the grid.<sup>33</sup> Therefore, the current framework inhibits DOE's ability to achieve the goals it discussed in the RFI. Procurement mandates and direct investment incentives encourage the deployment of storage indiscriminately, without considering potential negative emissions effects, or which type of energy storage could bring the most benefit to which level of the grid.<sup>34</sup> Some policies are targeted to provide incentives for energy storage only when paired with renewable generators.<sup>35</sup> While these types of targeted incentive reduces the potential negative emissions consequences, they fail to provide incentives for the many other types of services storage systems can provide.

There are three main reasons why the current landscape lacks the proper signals for maximizing the benefits of energy storage systems. First, because prices do not take into account the external costs of electricity provision, such as the damages from greenhouse gas emissions, energy storage investment based on electricity arbitrage revenues does not lead to socially efficient deployment of energy storage. Second, barriers to entry prevent energy storage systems from fully participating in all the markets in which they could provide value. And, finally, energy storage systems cannot earn multiple revenue streams for various benefits they provide at different levels of the grid, so their current earnings do not accurately reflect their true value.

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Imperative 1 (2012) (defining resilience as “the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events”).

<sup>30</sup> For a discussion of the distinction and overlap, see Justin Gundlach, *Microgrids and Resilience to Climate-Driven Impacts on Public Health*, 18 HOUSTON J. HEALTH POL'Y & L. 77, 86-100 (2018).

<sup>31</sup> See, e.g., Eric Williams et al., Assoc. for Neighborhood & Housing Development, Inc., *Social Resiliency and Superstorm Sandy: Lessons from New York City Community Organizations* 5 (2014), <https://perma.cc/77E3-EJ7Q> (describing effects of extended power outages on elderly and medically compromised individuals).

<sup>32</sup> See Policy Integrity comments to State of Connecticut Public Utilities Regulatory Authority on the Value of Distributed Energy Resources (August 21, 2019), available at: <https://policyintegrity.org/projects/update/comments-on-connecticuts-study-of-the-value-of-distributed-energy-resources>.

<sup>33</sup> Revesz & Unel, *supra* note 6, at 169-170.

<sup>34</sup> *Id.*

<sup>35</sup> *Id.*

Achieving efficiency requires solving all three of these shortcomings. Therefore, policymakers should:

1. Put in place a regulatory and policy framework that takes all of the services energy storage systems can provide, including emissions reductions, into account;<sup>36</sup>
2. Eliminate any uncertainties and barriers to entry;<sup>37</sup> and
3. Ensure that energy storage systems can be compensated for all the benefits they provide to the grid.<sup>38</sup>

DOE can play a role in addressing all three of these policy improvements.

## Full Stream of Values

Energy storage provides different services to different stakeholders at different levels of the electricity system. In order to achieve economically efficient outcomes, all of these services need to be valued, even those that are difficult to quantify. For example, the emissions reduction benefits that storage can provide are not captured in the market, creating a type of market failure known as an externality. In other words, without valuing emission benefits of energy storage, outcomes will not be efficient.

As explained in the section on valuation, other services provided by energy storage systems are also not easily quantified. For example, the ability of battery storage to mitigate power outages, which happens at the distribution level, or its contribution to voltage maintenance at the transmission level are not readily monetized. Though regulators and stakeholders can follow a basic methodology to value the effect of a specific battery storage system in comparison to a baseline scenario (i.e., a scenario where the storage does not exist or is not deployed), they do not have the capability to calculate the benefits of a particular service any given storage system provides. Any tools that enable these calculations would need to identify and value the services at each level of the system, generation, transmission, and distribution.

DOE can help ensure optimal investment in and deployment of energy storage by supporting or funding the research and the development of models that allow regulators to accurately value these services. DOE can also develop guidance documents that explain the methodologies for valuing energy storage, including for quantifying difficult to monetize attributes. These tools would allow policymakers to consistently and accurately value energy storage, which they can apply to cost-benefit analysis or compensation schemes.

## Barriers to Entry

ISOs and RTOs integrate energy storage systems into their organized wholesale markets in different ways. Some markets already allow certain storage technologies to provide ancillary services. However, these rules were designed with traditional generators in mind and lack the flexibility to recognize unique characteristics of energy storage systems.<sup>39</sup> Some aspects of these market rules, such as performance penalties that penalize storage systems for not providing certain services while charging, create disincentives for energy storage systems.

Redesigning market rules to ensure participation of energy storage systems fully in electricity markets to the extent of their unique technical capabilities will increase the efficiency of these

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<sup>36</sup> See Revesz & Unel, *supra* note 6, at 180-184; see also CONDON ET AL. *supra* note 6, at 11-13.

<sup>37</sup> See Revesz & Unel, *supra* note 6, at 184-186; see also CONDON ET AL. *supra* note 6, at 13-14.

<sup>38</sup> See Revesz & Unel, *supra* note 6, at 186-191; see also CONDON ET AL. *supra* note 6, at 14-17.

<sup>39</sup> Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, Order No. 841, 83 Fed. Reg. 9580, 9582 (March 6, 2018), 162 FERC ¶ 61,127.

markets. In February 2018, FERC released a rule on energy storage, Order 841, which has made progress towards this goal by aiming to remove some of the barriers currently hindering electric storage resources.<sup>40</sup>

In this rule, FERC recognized that energy storage systems have the ability to provide a variety of services such as energy, capacity, and regulation, yet are restricted by compensation schemes that were designed for other resources.<sup>41</sup> However, much work still needs to be done. Under the order, ISO/RTOs must propose their own rules to open the markets under their jurisdictions to energy storage resources. However, the proposals of some ISO/RTOs are in conflict with others. For example, PJM will require batteries storage systems to have 10-hours of capability, while other ISO/RTOs, like those in New England and New York, have much shorter duration requirements.<sup>42</sup> There is also no consensus on how to integrate hybrid-resources, like solar plus storage, because ISO/RTOs have not harmonized the participation models of distributed generation resources with energy storage.<sup>43</sup>

DOE can help achieve by developing and provide guidance documents that help address such barriers to entry, and providing funding for research on how best to integrate new types of energy storage systems, such as hybrid systems, into the markets efficiently.

### Barriers to multiple value streams

Accurate price signals show the true value of a good or service to the society, and therefore lead to economically efficient investment signals. Therefore, maximizing the benefits of energy storage requires investors to be able to receive compensation for the wide range of services that energy storage can provide to every level of the energy grid.

Because the revenue potential based on only one category of benefits does not justify the current high upfront investment that is needed, one value stream is not enough to give enough incentives for large scale storage deployment.<sup>44</sup> A new framework that allows compensation for different value streams should be developed, even if those value streams are based on benefits that accrue to different parts of the market and, thus, have to rely on different compensation mechanisms under different jurisdiction. Ensuring accurate price signals requires unbundling the different services that energy storage systems can provide and ensuring that they are able to be compensated for each service.

Further, because energy storage can provide benefits to both wholesale markets, which are under FERC jurisdiction, and retail markets, which are under state jurisdiction, coordination between the federal authorities and state regulators is needed. FERC and state regulators must coordinate to explicitly lay out the categories of benefits of energy storage systems and how to compensate for each benefit.

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<sup>40</sup> *See id.*

<sup>41</sup> *See id.*

<sup>42</sup> Peter Maloney, *As grid operators file FERC Order 841 plans, storage floodgates open slowly*, UTILITY DIVE (Dec. 11, 2018), <https://perma.cc/3TQP-E2VT>.

<sup>43</sup> Tom Kleckner, *FERC, RTOs Need to Set Hybrid Rules, Experts Say*, RTO INSIDER (Jun. 23, 2020), <https://perma.cc/ZH8K-FSGV>.

<sup>44</sup> See JUDY CHANG ET AL., THE BRATTLE GRP., RENEWABLES AND STORAGE: DOES SIZE MATTER? (2010), <https://perma.cc/VC2U-3GCE>; JUDY CHANG ET AL., THE BRATTLE GRP., THE VALUE OF DISTRIBUTED ELECTRICITY STORAGE IN TEXAS (2014), <https://perma.cc/D37XDFTM>.



DOE can aid this necessary coordination by enabling all stakeholders to use the consistent tools to compensate energy storage systems. DOE can also help develop valuation methodologies and tools so all value streams of energy storage can be compensated.

## Conclusion

In conclusion, DOE can play a critical role in the future of energy storage to achieve the aims of the Energy Storage Grand Challenge, like making the United States a leader in the clean energy economy and reducing carbon emissions. DOE can use its technical expertise to improve methodologies for calculating difficult to monetize attributes of energy storage systems. It can also improve access to information, like real-time marginal emissions rates, that factor into the value of energy storage. DOE can also create or support the development of easy-to-use tools for regulators and utilities that calculates the full value an energy storage system is providing at any particular point in time. Finally, DOE can make policy recommendations that build on FERC's energy storage rule to eliminate barrier to entry for energy storage. DOE can either work on these tasks itself or create targeted funding opportunities for other experts. These efforts are critical to the necessary state and FERC coordination that is required to ensure optimal investment in and deployment of energy storage.

Sincerely,

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