

# Managing the Escalating Risks of Natural Catastrophes in the United States

Lloyd's of London

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## Introduction

Since the early 1990s, total economic losses from natural catastrophes in the U.S. have averaged tens of billions of dollars per year. These disasters cause death and injury, damage property and the natural environment, interrupt business activities, and disrupt society generally. Furthermore, owing to trade and other commercial activities, the impact of these natural catastrophes often extends well beyond the immediate disaster area to other regions within the U.S. and even to other nations.

Damages from natural catastrophes in the U.S. are rising and are expected to continue to grow in the future. Increases in population and economic activity coupled with development in riskier and more environmentally vulnerable areas, will expose more property, infrastructure and other assets to damage from natural catastrophes. Inflation, recovering property values and increasing individual wealth may further amplify the potential costs of damages. Whatever the cause, it is evident that we are experiencing more frequent extreme weather events.

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*This article is adapted with permission from the report "Managing the escalating risks of natural catastrophes in the United States" produced by the International Regulatory Affairs and Exposure Management departments at Lloyd's of London. The report can be read in its entirety at [www.lloyds.com](http://www.lloyds.com).*

Many individuals and organizations have a vested interest in managing natural catastrophe risks. Property owners (both private and real estate interests), the insurance industry and the government all have a role to play. Property owners have an interest in managing risks to their property and/or investments. The business of the insurance industry is to help property owners manage risk by transferring it from an individual policyholder to a larger risk

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sharing community with premiums set to represent an insured's contribution to the overall risk. Government participates through its regulation of the insurance industry and when its involvement is necessary to correct environmental externalities, support risk mitigation or subsidize damage claims for the common good of society.

The increasing vulnerability arising from more people, economic activity and infrastructure in high risk areas, coupled with increasing evidence that climate change is leading to more frequent and severe weather events, points to continuing increased natural catastro-

phe risk on a scale not experienced before. Because of the scope and long-term nature of the problem, collaboration and cooperation among the key stakeholders identified above will be essential.

Often the private natural catastrophe insurance market is unable to function properly where, for public policy reasons, government-run insurance programs or pools offer insurance that does not reflect the true price of the risk. Insurance is not sustainable if it is offered at rates below what is required by sound, risk-based actuarial practices. When insurance is not risk-based, the wrong price signals are sent and there is little or no incentive to mitigate risk. In turn, this leads to wider adverse impacts on society, such as degradation of vulnerable environments and a reliance on emergency funds to help rebuild communities after catastrophic events.

In this paper Lloyd's sets out a set of principles for addressing the challenge of managing natural catastrophe risks in the U.S. Within these principles and the accompanying report, we examine ways that the insurance industry, government and property owners can work together to manage increasing natural catastrophe risks and make insurance in catastrophe-exposed areas more available and affordable for U.S. policyholders.

1. The first step in protecting U.S. property owners from natural catastrophe losses is ensuring there is a healthy, private insurance market

The insurance industry should be allowed to perform its natural role, in particular, the risk-based pricing of premiums, the diversification of risk across differing classes of business and the spreading of risk through global (re) insurance markets. We want to work towards future solutions that do not negatively impact the proper functioning of the private insurance market.

Risk management is necessary for individuals and legal entities in the U.S. and insurance performs a vital role in managing the cost of natural catastrophe risks.

Data from the Census Bureau shows that 35.7 million people were seriously threatened by Atlantic hurricanes in 2008, compared with 10.2 million in 1950. These twin problems of growing urbanization in coastal areas and increasing populations in high-risk areas have been reflected in an increase in insured and economic losses during that time.

The insurance and reinsurance market has shown its ability to provide capacity and financial strength to manage the financial impact of natural catastrophes. Through reinsurance and other risk transfer mechanisms, the impact of disasters is spread manageably through the global financial system.

The healthy functioning of the private insurance market relies on the true pricing of risk. Like any company, insurers need to factor in the cost of the risk to their capital in doing business. In calculating the cost of insurance coverage accurately, the insurance industry encourages a responsible attitude to risk by reflecting the nature and cost of behavior, location, build quality and many other rating factors.

2. Government intervention in private insurance markets should be kept to a minimum

The government should only act as the insurer of last resort where insurance is unavailable or unaffordable in the private market. Government involvement can increase the potential burden on the taxpayer after a loss and create hidden subsidies. It can also limit the effectiveness of the insurance industry by distorting competition and reducing rates to uneconomical levels.

As risks of natural catastrophes escalate, both the government and the private insurance industry need to respond. These responses must be collaborative

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to maintain and strengthen the viability of the private insurance sector and to support measures to mitigate natural catastrophe risks. Allowing the private insurance industry to perform its natural role of providing insurance using risk-based pricing is vital in minimizing the potential liabilities for the taxpayer.

In the past, these state and federal programs created residual market 'insurers of last resort,' offering insurance at above market rates to those who could not otherwise obtain it, either because of their risk-profile or for socioeconomic reasons. Residual insurance programs such as these can have a clear public policy benefit where they stick to their initial policy goal or tightly define their targeted policyholders.

Government has a vital part to play in conjunction with private insurers and

reinsurers in addressing and managing the costs of natural disasters. However, in doing so, it must avoid compromising the private market's ability to function to maximum effect.

#### *How Problems of Intervention Emerge*

In some instances government involvement in providing insurance has become extensive. In intervening in private insurance markets, the government must take care not to restrict the market's ability to offer suitable alternative insurance products. Undercutting private markets can result in a vicious circle of knock-on effects that can prove counter-productive.

Taking the threat of catastrophic losses as our starting point, problems of availability and affordability of insurance may emerge in some markets. In some areas, these problems of availability and affordability in the face of catastrophes may become so severe as to grow into a major political issue. Public pressure may then build on politicians in the wake of natural disasters and the resulting hardship. This in turn may lead to the search for a public policy solution.

An easy, though mistaken, course of action is to depress the costs of insurance. One means of doing this is through the regulation of rates, which is of course the case for many admitted markets. Another is the establishment of publicly-funded residual market programs. Both may result in a tension between actuarially sound pricing and offering the customer "affordable" but unsustainable insurance (i.e. insurance which does not reflect the risk).

Furthermore, residual markets such as these may expand beyond their original remit and experience has shown several examples of programs growing rapidly while offering underpriced coverage. The combined effect is to create large liabilities for the taxpayer, both by expanding the number of policyholders and by increasing the implicit subsidy awarded to each policyholder. Examples of expanding residual market programs

include the Fair Access to Insurance Requirements and the Beach and Wind-storm Plans.

Despite the growth in state plans, many homeowners are still either uninsured or under-insured, either because they feel the coverage offered is too expensive to be affordable or too cheap to be adequate. Often those without insurance end up with compensation from the government after a disaster, which can undermine the incentive to be properly insured. Since Hurricane Katrina in 2005, the Federal Emergency Management Agency (FEMA) has paid over \$7 billion in disaster assistance through its Individuals and Households Program alone.<sup>i,iii</sup> An increasing reliance on private insurance and greater targeting of assistance would reduce the reliance on government emergency aid.

#### *Reconciling the Private Industry's Role*

The private insurance industry is at the forefront of natural catastrophe risk management. Insurers and reinsurers monitor changes in weather patterns as part of their underwriting and risk evaluation process and use increasingly sophisticated catastrophe models to estimate expected losses from weather-related catastrophes.

Historically, the insurance industry has developed risk solutions that enable insurance to be made affordable to as many potential policyholders as possible and supported government and private action to mitigate risks.

- i. 61% of claims by value from Hurricane Katrina, Rita and Wilma were paid by the global reinsurance industry. RAA Press Release, March 18, 2011.
- ii. Total disaster assistance paid is current as of initial publication of the Lloyd's of London report. This amount does not include disaster assistance paid following Hurricane Sandy.

Some government programs were created following a major disaster or sequence of disasters or in other circumstances where the private market was not offering sufficient natural catastrophe insurance cover. The availability of capacity in the private insurance market is dynamic and in theory residual market demand will fluctuate as a result. Policymakers should reflect this and work to keep the scale of any such programs within manageable limits. Treating the need for government support as constant is highly damaging as government programs come to eclipse the role the insurance industry needs to play.

### 3. Risk-based pricing is the fairest and most sustainable solution

Risk-based pricing is a way of providing incentives for risk mitigation. While risk mitigation should be rewarded, insurers should be free to determine premium levels. Material cross subsidies should be avoided where possible. Residual markets should avoid restricting the use of private insurance markets, and avoid the risk falling on taxpayers.

Risk-based pricing allows insurers to rate their premiums based on the actual risk insured and the insured's risk of future losses. It is based on the insured's exposure to particular risks and the loss history of the insured. An insurer can also hedge individual risks against the

diversifying effect of how its overall portfolio of business performs.

By contrast with private insurers who must maintain regulated solvency margins, government programs are often not satisfactorily funded. The rates charged are often depressed below the cost of the risk insured. Thus, public finances are exposed to the risk of having to carry a debt for future years. This tends to produce a reliance on post-loss funding mechanisms to cover catastrophic losses. Unlike private insurers, these programs often result in hidden premium subsidies owing to political pressure and can also encourage a reliance on emergency disaster relief.<sup>2</sup> Consequently, these programs incur large deficits after a disaster. In addition, these programs can also suffer from adverse selection, where homeowners who are at the most risk are those most likely to buy catastrophe insurance.

Risk-based pricing is the fairest and most efficient way to rate insurance risks, cover the cost of losses and protect policyholders against their future losses. Moreover, risk-based pricing encourages risk mitigation by policyholders and, in turn, allows insurers to provide incentives in this regard.

A failure to price on the basis of risk is unfair to those insuring better or 'safer' risks, particularly where they have taken steps to mitigate risk. If subsidies are to be used, it should be in a way that is

## National Flood Insurance Program

Most flood insurance in the U.S. is offered by the National Flood Insurance Program (NFIP). According to a March 2011 report by the U.S. General Accounting Office (GAO), the NFIP owed the Treasury \$17.8 billion and was in serious need of financial reform.<sup>3</sup>

The NFIP is restricted by law in its ability to adjust existing rates and to offer risk based pricing. It also does not hold capital and is therefore not required to service this capital. The effect over time, therefore, is that it effectively subsidizes many of its policyholders' rates in a way that is not transparent. It provides overall flood insurance at one-third of the true risk cost in higher risk areas.<sup>4</sup> Proposals are before Congress at the moment to reform many aspects of its operations and to extend the program for a further five years.

open and that allows the real cost of risk to be understood.

4. Specialist international insurers and reinsurers add value to the U.S. natural catastrophe market through additional capacity and expertise

International (re)insurers are fundamental to the U.S. market, paying around 60% of catastrophe losses in the US. Global insurance markets benefit the U.S. economy and American policyholders by diversifying U.S. natural catastrophe risks out of the country. International (re)insurers also provide new perspectives from different regions and offer specialist underwriting expertise. They offer alternative potential solutions to U.S. markets through their appetite for natural catastrophe risk, such as hurricane, flood and earthquake.

By accessing international markets, U.S. policy holders are spreading some of the risk away from domestic markets and sharing the burden with overseas insurance markets. This means that even in the face of significant natural catastrophe losses, both the domestic private market and international reinsurers are more likely to remain healthy and robust and able to meet future claims. Furthermore, by holding capital collectively against a number of different risks, insurers are potentially able to offer policyholders lower premiums.

There is no single solution to assessing and managing natural catastrophe risks but international markets and insurers can bring different perspectives and ideas from their own domestic markets which may help in the U.S. market. Examples include flood insurance in the UK and the Norwegian Natural Perils Pool.

5. Government and insurers must respond to changing trends in the frequency and severity of losses

Changes in climate and demographics, in particular increasing population concentrations and development in catastrophe-exposed areas and rising wealth and property values, are increasing loss severity. These are the result of a diverse set of causes and are evidenced in larger loss costs and more extreme event patterns. Acknowledging and responding to these are vital steps in mitigating the social, economic and environmental impacts of these changes.

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The average inflation-adjusted damages from U.S. natural disasters have increased over the past decades as both population and economic activity have grown in coastal regions that are prone to hurricanes and winter storms, as well as in areas vulnerable to wildfires, river flooding, earthquakes, droughts and other natural disasters.

#### *Population*

The entire U.S. population grew by 70%, or 125 million people, during the 48-year period from 1960 to 2008, reaching 304 million in 2008. The coastal population increased 84% during that time period and the economy grew almost five fold, from around \$2.5 trillion to more than \$12 trillion (real GDP in 2000 U.S. dollars).

#### *Property*

The value of insured coastal properties has grown significantly between 1960 and today. According to a 2008 study by AIR Worldwide,<sup>5</sup> from December 2004 through to December 2007, the insured value of properties in coastal areas of the United States continued to grow at a compound annual growth rate of just over 7%. The insured value—or the cost to rebuild properties—has maintained an annual growth rate that will lead to a doubling of the total value every decade. In total, the value of insured coastal properties in all 18 coastal states rose to \$8.9 trillion in 2007 from \$6.9 trillion in 2004.

#### *Economic Development*

The way economic development has occurred and is occurring in the U.S. has resulted in more natural catastrophe risk. Environmentally important and sensitive areas are being weakened as a result of development. These include the ecosystems that border U.S. coasts and rivers and protect water supplies and prevent erosion. Consequently, they have less ability to reduce or withstand the impacts of natural catastrophes.

Development has also occurred, and is occurring, in high-risk areas. This is often because of government insurance programs offering rates that do not reflect risk, inadequate information about risks and the non-enforcement or lack of regulations around risk mitigation. Policies intended to mitigate risks, or compensate for development in high-risk areas, sometimes fail to help. For example, most of the damage from Hurricane Katrina resulted from the breakdown of the levee system, a man-made construct designed to protect low-lying property.

#### *Climate Change*

The earth's average global land surface, sea surface and lower atmospheric temperatures, as well as the heat content of the oceans, have all risen since the late 1800s, with accelerating increases



over the most recent decades. When the temperature increases so does the water-holding capacity of the atmosphere. It is argued that increased moisture content of the atmosphere favors stronger rainfall events, and therefore increases the risk of flooding.<sup>6</sup>

A report by the U.S. Climate Change Science Program cites heat waves, heavy precipitation events, increase in areas affected by drought and more intense hurricanes as climate change impacts that are already occurring and that can be expected to increase in the future.<sup>7</sup> Sea level rise is likely to continue and it will affect storm surge resulting from hurricanes and tropical storms as happened with Hurricane Katrina in 2005.

Actions to reduce greenhouse gas emissions and build resilience are necessary to lessen the potential impacts of future extreme weather events.

## 6. Government has an important role to play in helping develop risk mitigation measures and rewarding adaptation to reduce the overall costs to the economy

Government entities at the federal, state and local level have a critical role to play in planning and implementing risk mitigation and adaptation measures. Policymakers have a duty to protect and mitigate risks to civil infrastructure. Insurers should work with government to administer policies aimed, for example, at improving construction standards or discouraging building in inappropriate areas. Better risk management leads to lower pricing reducing the overall costs to the economy.

One of the key elements in managing escalating natural catastrophe risks is direct risk mitigation measures that render communities and ecosystems more resilient to the impacts of weather related and other natural catastrophes. The government has a critically important role to play in providing incentives for and/or requiring risk mitigation measures.

Achieving resilience to withstand natural disasters involves protecting buildings and civil infrastructure, adopting safer building codes and zoning practices and strengthening ecosystems. Planning to implement these measures in an effective way requires improvements in current data collection, mapping, models and other tools.

In helping develop risk mitigation measures and rewarding adaptation, we propose that government should focus on the following:

### *Building Codes and Retrofits*

All buildings should comply with current codes to be eligible for rate-regulated insurance. Current codes should be evaluated by national and local officials and stakeholders with an eye to strengthening new construction and developing retrofit plans. The lifetime of the structure and future climate change scenarios should be considered when specifying new codes.

In the U.S., the model building code is set by the National Institute of Building Scientists (NIBS) and updated every three years. The code is still backward-looking and the NIBS standard does not include climate change considerations. However, states and localities may modify the code to make it more stringent and to fit their specific circumstances.

### *Strengthen Ecosystems and Improve Agricultural Practices*

Forests and wetlands help the ground absorb more water and provide buffers to break up wind force. Water from precipitation flows more slowly into rivers and streams if trees are present, thereby reducing the risk of flooding in many cases. Protecting, expanding, and strengthening ecosystems can accomplish goals of both resiliency and reduction of carbon dioxide in the atmosphere.

### *Zoning Changes*

It is important to develop and enforce land use policies that restrain growth

in high-risk areas. Flood plains by rivers and coastal areas and forested areas prone to wildfire are two areas of concern. Policies might include “no build” in the highest risk areas and only allowing new building with “code plus” standards in other designated areas.

Data and tools to determine the risks in a given location are essential. FEMA flood zone maps are required for insurance purposes, but these are largely inadequate and out-of-date. There are ongoing discussions to update FEMA maps, but it appears that the new maps will not consider climate change impacts and forecasts, nor will they be based on data collected by LIDAR, an advanced tool that may serve better for planning purposes.

Erosion set backs and rolling easements are two ways to set zoning requirements that take into account increased natural catastrophe risks in coastal areas. Once a property is placed under a rolling easement, the landowner is allowed to develop it as they see fit, but is not allowed to put up barriers or otherwise protect the property from the ocean, or to collect damages in the case of flooding. Rolling easements can be bought by the government or by a private group from the landowner. This gives the property owner a financial motive to create the easement. If the property is sold, the easement goes with it, thereby discouraging further development.

### *Protection of Civil Infrastructure*

Potential vulnerabilities to natural catastrophes for public transportation (including roads and bridges), communications, power production and the grid, water supply, and sewage and waste, must be identified by municipalities and by relevant utility infrastructure owners. Both short and long-term measures to protect civil infrastructure from hazards should be specified. Examples of activities that might be undertaken in urban areas include: power back-up systems for neighborhoods or homes; placing power lines underground; us-

ing more resilient building materials; measures to enhance water absorption; and retrofitting of buildings with wind resistant windows. These measures could be funded, mandated or partially subsidized by the city, state or federal government.

#### *Costs of Risk Mitigation*

Risk mitigation measures will require significant expenditures, which will be difficult to fund in today's political and economic climate, but which may complement insurance or make insurance more affordable. Potentially very large costs will be incurred from retrofitting buildings and large infrastructure.

#### *Reward Adaptation*

Financial incentives or subsidies will be important to encourage property owners to implement natural catastrophe risk mitigation measures. Incentives can be provided through direct government subsidies, or tax benefits, and through risk-based insurance pricing whereby insurance premiums may change to reflect any reduction in risk.

The state or federal government might consider subsidizing risk-based insurance premiums for low or moderate income households that have adopted risk mitigation measures. This would provide a double incentive - with one based on a potentially lower, risk adjusted insurance premium from the insurance company and an additional government subsidy to help defray the insurance cost.

Tax-exempt adaptation savings accounts would provide incentives for homeowners to save money to cover risk mitigation expenses, which could improve the risk profile of their properties.

### 7. The insurance industry has a key role to play in helping build more resilient communities

The insurance industry should partner with policymakers to encourage customers to adopt risk mitigating measures such as "code plus" standards for new

building and retrofits. It should incentivize policyholders to take risk mitigation measures through reduced premiums and other incentives.

It is in the interest of the insurance industry, as well as the policyholder and the government, to implement risk mitigation measures, thereby potentially reducing both the cost of insurance and the damages from natural catastrophes.

One way for the insurance industry to incentivize policyholders to take risk mitigation measures is through offering reduced premiums for implementing appropriate mitigating actions. Another option is for insurers to encourage policyholders to share a greater proportion of the risk through offering policies

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with higher deductibles. This provides a financial incentive for the policyholder to implement cost effective risk mitigation measures in order to keep losses as low as possible below the full deductible amount. The incentive is also provided in part through savings in insurance premium.

Insurance companies can communicate to customers on the advantages of retrofits in hazard prone areas and consider offering home inspections and retrofit recommendations. Insurance companies can offer risk-based premiums to property owners who have mitigated risk and in some cases even make this a condition for insurance.

The insurance industry can provide expertise and tools to help assess natural catastrophe risks. It can support risk mitigation and adaptation efforts by applying its catastrophe models to assess the loss scenarios of increasing natural catastrophe risks in the future.

### 8. Good quality data and hazard mapping is critical to robust underwriting

The insurance industry requires better and more up-to-date mapping of natural hazards and improved data collection. Government and insurers should work together to improve hazard mapping and the quality and availability of data.

The insurance industry needs improved data collection, hazard mapping and other tools to manage increasing natural catastrophe risks in its underwriting processes. These overlap to some extent with what local and regional adaptation planners require to plan and make recommendations for government funded or mandated risk mitigation and adaptation measures. Additional data collection, tools and research are important to identify future trends and anticipate future risks of natural catastrophes, as well as to better understand current risks.

The government and the insurance industry can find ways to collaborate on collecting data, monitoring climate variables, developing and using risk assessment and valuation tools and designing research that will improve forecasts and increase understanding of the impact of increasing natural catastrophes.

Observational data collected both remotely by satellites and on the ground is necessary to provide information on weather patterns and changes in the climate system. Adequate and up-to-date flood plain and coastal maps are needed to better determine current risk levels. They are essential for risk mitigation and adaptation plans.

Better quantification of the probability and impact of future climate change

requires the advancement of scientific understanding and the refinement of climate model forecasts. Specifically, the output of the climate models needs to be shorter term, to be focused on smaller geographic regions and to have less uncertainty surrounding the forecasts.

## 9. We believe in encouraging a responsible approach to risk in society

Public and policymaker understanding of risk is critical. Governments, insurers and other stakeholders should work together to ensure there is a greater understanding of the economic and social consequences of poor risk management and to develop appropriate solutions.

The complexities and difficulties of managing natural catastrophe risks and the increasing impacts of climate change will require the cooperation of the insurance industry, government, property owners at risk and other stakeholders. The insurance industry can take a leading role in involving a wider group of participants in today's risk management challenges by educating policyholders, the government and other concerned parties.

Real estate investors and mortgage lenders can play an important role by considering likely future natural catastrophe risks in lending and investment decisions and by promoting risk mitigation measures and more resilient buildings. They can require that the buildings they invest in or develop be built in low risk areas and to higher standards to withstand natural disasters.

Private property owners have a responsibility and vested interest in taking actions to protect their property or investments. Risk mitigation measures could be required by the government or by an insurance company that makes the issuance of the insurance policy conditional on these measures. However, some property owners might also take action independently to protect their

property or livelihood and choose a policy with a higher deductible. Utility companies (including gas, water and electric companies) might also provide incentives for adaptation by offering preferential rates or grants in exchange for the protection of equipment, or infrastructure on the homeowner's property.

In order to tackle the problem of managing increasing natural catastrophe risks in the U.S., cooperation among key stakeholders is essential. One way to enable this will be to form coalitions between insurance companies, NGOs and other stakeholders focused on major issues relating to natural catastrophe risks. Such coalitions will be important in tackling the sheer scale and complexity of the issue of escalating natural catastrophe risks in the U.S. and furthering public understanding of the subject.

## Conclusion

When natural catastrophes strike, the impact on individuals, communities and wider society can be devastating. Insurance has an important role to play in helping people and businesses recover from these catastrophic events. Therefore it is vital that insurance should be available and affordable to those that need it. This paper does not provide an instant solution to current problems, but rather it aims to highlight the key issues and themes that we all need to work together to address.

Perhaps two overriding themes emerge from the report:

The scale of the challenges requires significant cooperation between government, insurers and planners. In particular, government efforts to assist must be focused in a way that allows the insurance industry to continue to function efficiently and effectively. Subsidies can be effective, and even essential in certain circumstances, in addressing some of the challenges of natural catastrophe insurance, but they must be deployed in a targeted way that allows insurers to continue to accept risks.

Society needs to foster a responsible attitude to risk and an understanding of the potential costs of natural disasters to both those affected and the wider economy. A greater understanding of how individuals and communities can take steps to mitigate the potential consequences of catastrophes and adapt to the future impacts of climate change before disaster strikes could significantly reduce the impact and costs of natural disasters.

Finally the extent of the challenge facing us, is perhaps best highlighted by the unprecedented series of natural disasters that have occurred in the U.S. this year. Never has it been more timely or necessary to manage the escalating risk of natural catastrophes in the U.S.

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