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Annabelle Workman<sup>1,2</sup>, Grant Blashki<sup>3</sup>, Kathryn J Bowen<sup>2,4,5</sup>, David J Karoly<sup>1,2</sup> and John Wiseman<sup>2,6</sup>

<sup>1</sup> School of Earth Sciences, Faculty of Science, The University of Melbourne, Parkville, Australia

<sup>2</sup> The Australian-German Climate and Energy College, The University of Melbourne, Parkville, Australia

<sup>3</sup> The Nossal Institute for Global Health, The University of Melbourne, Parkville, Australia

<sup>4</sup> Institute for Advanced Sustainability Studies, Potsdam, Germany

<sup>5</sup> Fenner School of Environment and Society, Australian National University, Canberra, Australia

<sup>6</sup> Energy Transition Hub, The University of Melbourne, Parkville, Australia

E-mail: [workmana@unimelb.edu.au](mailto:workmana@unimelb.edu.au)

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## Abstract

Urgent and ambitious climate action is required to avoid catastrophic climate change and consequent health impacts. Political will is a critical component of the ambitious climate action equation. The current level of political will observed for many national governments is considered inadequate, with numerous political leaders yet to commit to climate action commensurate with the projected risks and responsibilities for their respective jurisdictions. Under the leadership of the Obama administration, however, the United States of America arguably provided an example to the contrary. Strategically utilising an available legislative lever, the Obama administration pursued comparatively ambitious climate change mitigation policies, with health as a core motivation. Analysis of Obama-led climate policies and policy-making strategies provides valuable insight into the utility of health as a motivator for climate action. It also reaffirms that strong political leadership constitutes an essential element in the pursuit of increasingly ambitious climate change policies, particularly in the face of strong opposition.

## 1. Introduction

Recent scientific assessments emphasise that the risk of threats to human and ecosystem health are projected to increase with rising global temperatures [1]. Despite this, a majority of governments have failed to commit to measures commensurate with the threats that current and projected climate change pose. Recent estimates indicate that global temperatures are on a pathway considered well above a 'safe' threshold for planetary health under current policy trajectories [2]. Technological and economic barriers are no longer considered insurmountable, with delayed action now primarily a matter of political will [3].

Committing to ambitious climate action appears a formidable challenge; searching for opportunities to overcome climate action inertia is imperative. While it is unlikely to be a panacea, the consideration of positive health outcomes that result from the implementation of climate change emissions reduction (mitigation) policies may provide the

impetus that some national governments require to enhance climate mitigation policy ambition. Shorter-term positive health outcomes—often termed 'health co-benefits'—can result from environmental changes such as improved air quality, and can assist governments to reframe climate change from a longer-term, global issue to a shorter-term, local issue [4], providing 'a powerful incentive to accelerate policy change' [5, p 1156]. Longer-term positive health outcomes—termed 'health benefits' in this paper—result from a reduction in health impacts associated with climate-related events [6].

Yet limited research examines the role of shorter- or longer-term health benefits in mitigation policy development. The existing literature on health co-benefits [e.g. 7–9] contends that they have not greatly influenced policies and concludes that a number of factors inhibit their political traction in the mitigation policy development process.

To contribute to this literature, we investigated the role of health in the development of climate change mitigation policies in the United States of America

(U.S.). While health appears to have a limited influence on the development of climate change mitigation policies in Australia and the EU [10, 11], analysis of the U.S. under the Obama administration suggests that health was a major motivation for comparatively ambitious climate action.

Such an example of the utility of health in motivating comparatively ambitious climate action may offer strategies for other jurisdictions to consider in justifying increasingly ambitious climate change mitigation policies in future.

This paper first provides a brief historical overview of climate change policy in the U.S. After describing the methodological approach used, the paper thematically reports results from analysis of key Obama era policy documents. The paper then discusses the implications of our results in the context of recent changes in U.S. climate policy, before concluding with opportunities for future research.

### 1.1. Background

The U.S. is not immune to the impacts of climate change, nor the associated economic costs. In 2016, the U.S. Global Change Research Program (USGCRP) released a scientific assessment of the impacts of climate change on human health in the U.S. The assessment noted that between 2004 and 2013, approximately 3300 fatalities were attributable to heat waves, tornadoes and hurricanes, with cumulative economic and health costs of more than USD\$500 billion [12]. Further, climate change in the U.S. is likely to exacerbate domestic inequality as a result of economic impacts. Under business-as-usual emissions, economy-wide direct damages are projected to cost approximately 1.2% of gross domestic product for every additional degree Celsius of global average surface temperature increase [13].

In the face of profoundly polarized positions on climate change across government, industry and society, any meaningful national action on climate change in the U.S. is easily thwarted [14]. Evidence suggests, however, that sub-national levels of the U.S. government can—and do—forge ahead irrespective of national leadership on climate change. For example, in 2009, nine states formed a Regional Greenhouse Gas (GHG) Initiative, committing to a cap-and-trade scheme for carbon emissions from their power plants with intentions to reduce emissions longer-term. The cap has been strengthened three times already and additional states have expressed an interest in joining the initiative [15].

Despite challenging circumstances, since 2009 the U.S. experienced a shift in the direction of national climate change mitigation policy development. While political action on climate change dates back to 1987 when the U.S. government first introduced the *Global Climate Protection Act*, climate change mitigation policy development from the late 1980s through to 2008 was relatively homogenous, with

GHG emissions reduction largely pursued through non-interventionist, ‘no regrets’ policies that focused on industry-supported efforts, such as investments in research and development, and voluntary reductions [16].

While a detailed examination of legislation is out of scope here, it is pertinent to discuss *An Act to Improve, Strengthen, and Accelerate Programs for the Prevention and Abatement of Air Pollution (1963)* (Clean Air Act; CAA) and related amendments given its pivotal role in the development of mitigation measures for both GHG and non-GHG emissions under the Obama administration. The CAA was initially introduced to support the development of programs to monitor and control air pollution by the federal government agency, the U.S. Environmental Protection Agency (EPA). Section 202 of the CAA provides that if, based on the U.S. EPA Administrator’s judgement, any air pollutant is endangering public health, the U.S. EPA can regulate the emission of the air pollutant from any class of new motor vehicle.

A critical turning point in the development of U.S. climate change policy came with the Supreme Court’s ruling in April 2007 on *Massachusetts et al vs Environmental Protection Agency*. The Supreme Court overturned a decision made by the District of Columbia Circuit Court of Appeals based on a 1999 petition brought to the U.S. EPA to regulate GHGs based on Section 202 of the CAA. The U.S. EPA Administrator published her finding in December 2009 that compelling scientific evidence existed to define six GHGs as air pollutants for the purposes of regulation under Section 202 of the CAA. The U.S. EPA Administrator published her finding in December 2009 that compelling scientific evidence existed to define six GHGs as air pollutants for the purposes of regulation under Section 202 of the CAA [17]. This finding paved the way for the U.S. EPA to develop regulatory rules to support the reduction of GHG emissions in the U.S.

The following year, the U.S. EPA began using the social cost of carbon (SCC or SC-CO<sub>2</sub>) methodology to account for the health and welfare benefits of GHG emissions reduction. The SCC method estimates the monetised value of impacts associated with changes to carbon dioxide emissions on agriculture, human health and ecosystem services for any given year [18]. The development of a standardised method for the purposes of incorporating benefits consistently into benefit-cost analyses further entrenched a commitment to a more holistic consideration of climate change policy options.

### 1.2. A brief overview of climate change mitigation policy development during the Obama administration

Following his election as President in 2008, Barack Obama introduced directives that affirmed a commitment to develop a low-carbon economy. This included a directive requiring all federal agencies to lead by example and reduce GHG emissions through a variety of measures [19]. Further, the Obama administration committed to pursuing a

GHG emissions reduction target of 17% compared with 2005 levels by 2020 [20].

With GHGs classified as air pollutants, the U.S. EPA and other federal agencies developed a suite of emissions and fuel efficiency standards for both existing and new stationary and mobile sources of fossil fuel emissions [21]. Specifically, the U.S. introduced increasingly stringent GHG emissions performance standards for light-, medium- and heavy-duty engines across successive years from 2010 to 2016.

The President's 2013 Climate Action Plan set the overarching framework for U.S. climate change policy development. The Plan outlined three key pillars for action: (1) a reduction in domestic carbon pollution; (2) domestic preparation for climate change impacts; and (3) leadership at the international level [20].

In 2014, the U.S. released its intended Nationally Determined Contribution (NDC) for the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21) held in Paris, committing to an economy-wide GHG emissions reduction target of 26%–28% below 2005 levels by 2025. The centrepiece of the U.S. NDC—carbon pollution standards for fossil fuel-powered plants—were finalised by the U.S. EPA in 2015. The standards were introduced to reduce carbon emissions from power plants by 32% by 2030 compared with 2005 levels. The regulation was heralded for its prioritisation of health, given 'the effects on human wellbeing form the basis of the rationale behind the plan, with economic and more general environmental reasons taking a back seat' [22, p 661].

## 2. Methods

### 2.1. Selection criteria for documents

Policy documents published by U.S. government bodies between 2007 and 2017 with a focus on national climate-related mitigation efforts or health-related mitigation activities that were publicly accessible online were considered for analysis.

### 2.2. Selection of policy documents

Based on the selection criteria above, we searched U.S. government websites as well as the UNFCCC website in order to identify as many applicable policy documents as possible. 34 documents were ultimately identified for analysis [49].

### 2.3. Analysis

We employed directed qualitative content analysis as our analytical approach, a research method used to systematically classify and code large amounts of text through the identification of categories or themes. We analysed policy documents according to six pre-defined themes: (i) the policy-making process; (ii) factors influencing the prioritisation of multiple considerations; (iii) enablers and barriers to

the consideration of health in mitigation policy; (iv) the evidence base for policy development; (v) the role of external actors and stakeholders; and (vi) the communication of policy decisions. The qualitative analysis software NVivo [23] was used to support data analysis. We uploaded all 34 documents into NVivo and coded the text in each document based on our pre-defined themes. This process facilitated the investigation of U.S. climate mitigation policies and supported us to interrogate the role of health and other factors in the policy development process. One additional sub-theme, 'government actions', emerged during coding. This sub-theme is distinct from the policy-making process and captured statements on specific existing and proposed climate-related policies and regulations as opposed to the policy-making process more broadly. Data relating to this additional sub-theme were incorporated into section 1.2 above.

## 3. Results

Under the Obama administration's leadership from 2009 until 2016, the consideration of health constituted a core component of the development of climate change mitigation policies. Led by the U.S. EPA, in collaboration with other agencies, the U.S. pursued integrated emissions reduction policy development for stationary and mobile sources of GHG emissions. Further, recognition of the health impacts of a changing climate and the health benefits that result from mitigation was explicit in messaging around the rationale for climate action. Results are presented below by theme.

### 3.1. The role of impact analyses in the policy-making process

The policy-making process in the U.S. is similar to those we investigated in other case studies [10, 11]. Regulatory impact analyses are a standard component of the U.S. policy development process, which are undertaken to assess the potential costs and benefits associated with any proposed regulation. Our analysis found that there was explicit acknowledgement that mitigation policy development is underpinned by economic modelling. As part of the modelling and impact analysis process, an estimation of the economic and human benefits that result from mitigation measures was explicitly integrated and considered in the policy development process both quantitatively and qualitatively:

'The U.S. government analyzes the anticipated economic effects of its proposed standards and policies. A key element of these analyses has been the estimation of the

potential economic and human welfare benefits of reduced GHGs. Specifically, federal agencies use a metric known as the social cost of carbon (SCC) to estimate the dollar value of the benefits of regulatory actions that affect CO<sub>2</sub> emissions.' [18, p 99].

### 3.2. Factors influencing the prioritization of multiple considerations in the development of climate mitigation policies

Our analysis identified economic costs as an influential priority in policy development, particularly given the propensity for regulations to be challenged through judicial proceedings in the U.S.:

'in several cases the DC Circuit has elaborated on this cost factor and formulated the cost standard in various ways, stating that the EPA may not adopt a standard the cost of which would be "exorbitant," "greater than the industry could bear and survive," "excessive," or "unreasonable" [24, p 35829].

However, additional factors appear to have been influential priorities in Obama-era climate policies. Intra- and inter-generational equity recurred as issues motivating climate change mitigation policies between 2009 and 2016:

'...the [U.S. EPA] Administrator places weight on the fact that certain groups, including children, the elderly, and the poor, are most vulnerable to these climate-related health effects [17, p 66498].

'We have an obligation to current and future generations to take action to meet this challenge [18, p 7].

'...the EPA considered a variety of potential impacts that its action might have on the environment, on businesses, particularly in the energy sector, and on the reliability of the electrical grid. The agency gave extensive consideration to impacts on vulnerable communities, particularly low-income communities, communities of color, and indigenous communities [25, p 64969].

Employment impacts of regulations—notably, in the aftermath of the global financial crisis—comprised another recurring priority:

'Although a stand-alone analysis of employment impacts is not included in a standard cost-benefit analysis, the

current economic climate has led to heightened concerns about potential job impacts' [26, p 48318].

### 3.3. Enablers and barriers to the consideration of health in mitigation policy

Numerous factors enabled the consideration of health in the development of U.S. mitigation policies. Firstly, the Obama administration utilised credible individuals to communicate the health implications of a changing climate to the broader public—the U.S. Surgeon General and the U.S. EPA Administrator, an environmental health and air quality expert, as noted in the U.S. Government Accountability Office report below:

'In April 2015, the Surgeon General spoke publicly about climate change impacts to health following a roundtable discussion on the topic with the President, the EPA Administrator, and others, and also used social media to solicit and respond to questions about health impacts from climate change. The U.S. EPA Administrator has also communicated about these risks to a variety of audiences, citing climate change as a major Department of Energy the most significant threats to public health' [27, p 26].

Secondly, the U.S. EPA's determination that GHG emissions negatively impacted human health was vital to support the consideration of health in future climate change and air pollution mitigation policies:

'In the Endangerment Finding, which focused on public health and public welfare impacts within the United States, the [U.S. EPA] Administrator found that elevated concentrations of GHG emissions in the atmosphere may reasonably be anticipated to endanger public health and welfare of current and future generations' [28, p 73486].

Thirdly, by taking a holistic approach in the assessment of the potential benefits and costs associated with U.S. emissions reduction policies, the U.S. EPA was able to demonstrate that the economic benefits of implementing mitigation measures far outweighed the costs when health was a consideration:

'...the annual dollar value of benefits of air quality improvements will be very large, and will grow over time as emissions control programs take their full effect, reaching a level of approximately \$2.0 trillion in 2020. ...Most of these benefits (about 85

percent) are attributable to reductions in premature mortality associated with reductions in ambient particulate matter... Our central benefits estimate exceeds costs by a factor of more than 30 to one... [29, abstract].

In relation to barriers, quantifying and monetising the costs is considered an easier process with fewer uncertainties around the robustness of the final values. Limitations in models, current knowledge of health-emission exposure pathways as well as access to reliable data are often acknowledged as barriers that impede fully accounting for health benefits:

‘The monetized benefits used in the net benefit calculations reflect only a portion of the total benefits due to limitations in analytical resources, available data and models, and the state of the science... [29, p 10].

An additional issue that likely exacerbates the first barrier relates to the comparatively minimal amount of funding historically dedicated to climate change and health research:

‘...NIH, which awards financial assistance for research, reports that it awarded about \$6 million to support research on the health impacts of climate change in fiscal year 2014. This amount comprised a relatively small portion—about 0.025 percent—of the approximately \$24 billion that NIH awarded for research that year’ [27, p 19].

### 3.4. Building the health impacts evidence base

While funding specifically for climate change and health research was arguably insufficient, inter-departmental collaboration supporting climate change science more broadly has been a feature of U.S. climate-related architecture for three decades. The USGCRP has been responsible for the development of four National Climate Assessments that facilitate the translation of climate change research into policy:

‘The essential capacities for research and observations are widely distributed across U.S. government agencies, and are brought together into a single interagency program through the USGCRP. Growing out of interagency activities and planning that began in 1988, the creation of the USGCRP energized cooperative interagency activities, with each agency bringing its strengths to the collaborative effort. The FY 2010 budget

provides over \$2 billion for programs under the USGCRP—an increase of \$46 million, or about 3 percent, over the 2009 level... [30, p 8].

The aforementioned endangerment finding that proved a pivotal decision in enabling health to drive the development of mitigation policies was primarily justified on the basis of a robust scientific evidence base:

‘The [U.S. EPA] Administrator has determined that the body of scientific evidence compellingly supports this finding. The major assessments by the U.S. Global Climate Research Program (USGCRP), the Intergovernmental Panel on Climate Change (IPCC), and the National Research Council (NRC) serve as the primary scientific basis supporting the Administrator’s endangerment finding’ [17, p 66497].

Further, the established scientific basis constituted one of the chief motivations in the U.S. EPA’s denial of petitions to reconsider the endangerment finding:

‘The science supporting the [U.S. EPA] Administrator’s finding that elevated concentrations of greenhouse gases in the atmosphere may reasonably be anticipated to endanger the public health and welfare of *current and future* U.S. generations is robust, voluminous, and compelling, and has been strongly affirmed by the recent science assessment of the U.S. National Academy of Sciences’ [31, p 49556; emphasis added].

### 3.5. The role of external actors and stakeholders

Both targeted and general stakeholder consultation processes were considered core components of the policy development process:

‘This rule builds on our commitment to robust collaboration with stakeholders and the public. It follows an expansive and thorough outreach effort in which the agencies gathered input, data and views from many interested stakeholders, involving over 400 meetings with heavy-duty vehicle and engine manufacturers, technology suppliers, trucking fleets, truck drivers, dealerships, environmental organizations, and state agencies’ [28, p 73480].

Unsurprisingly, major stakeholders for climate change mitigation policies include affected industries and states. In relation to vehicle emission and fuel standards, concerted efforts appear to have been made to accommodate affected industries, particularly in the face of cross-jurisdictional policy discrepancies:

‘We received more than 200,000 public comments. A broad range of stakeholders provided comments, including state and local governments, auto manufacturers, emissions control suppliers, refiners, fuel distributors and others in the petroleum industry, renewable fuels providers, environmental organizations, consumer groups, labor groups, private citizens, and others...Auto manufacturers have stressed the importance of being able to design, produce, and sell a single fleet of vehicles in all 50 states...’ [32, p 23418].

There was also explicit acknowledgement that consultation takes place at the international level:

‘The agencies also met with regulatory counterparts from several other nations who either have already or are considering establishing fuel consumption or GHG requirements, including outreach with representatives from the governments of Canada, the European Commission, Japan, and China’ [28, p 73484].

### 3.6. The use of health in communicating policy priorities

The use of health as a communications frame is evident in key messaging disseminated by the Obama administration that employed a multiple benefits approach to justify the pursuit of comparatively ambitious climate change mitigation policies:

‘The transition will benefit the U.S. economy in multiple ways...Improved air quality will mean a healthier and more productive workforce. Developing alternative transportation fuels will diversify our energy portfolio, helping to shield the U.S. economy from adverse economic consequences of oil market volatility. Finally, the Paris Agreement signals a sustained shift in the global economy towards low carbon investment, which creates economic opportunity for American businesses’ [33, p 38].

Despite efforts to incorporate health into key messaging for climate change mitigation policies, there was recognition from health officials that for the public, the relationship between climate change and health remains tenuous:

‘...health officials told us that stakeholders and the public have limited awareness about climate change as a public health issue, in part because climate change has historically been framed as an environmental issue’ [27, p 37].

To address this issue, analysis suggests that GHG emissions were strategically referred to as carbon pollution:

‘Before President Obama entered office, forecasts projected that U.S. emissions would grow indefinitely. Instead, *carbon pollution* from energy is down 9 percent since 2008. The economy has grown by 10 percent over this period, proving that emissions reductions can co-exist with a strongly growing economy’ [33, p 6; emphasis added].

Finally, the Obama administration not only discussed the benefits and opportunities of action, it was also explicit about the adverse impacts of delayed action and the role of environmental justice and equity as motivations for climate change action:

‘...a do-nothing approach will disproportionately harm the most vulnerable Americans, including children, the sick, the poor, and the elderly.. Existing health disparities and other inequities increase vulnerability to climate health impacts like heat waves, degraded air quality, and extreme weather. Low-income families are the most vulnerable to disruptive events that cause the household breadwinners to miss work’ [33, p 38].

## 4. Discussion

Our results indicate that the consideration of human health-related evidence and arguments facilitated the introduction of comparatively ambitious mitigation policies in the U.S. under the Obama administration. This was achieved through an integrated approach to regulating GHGs and air pollutants, enabling the Obama administration to highlight both the shorter-term and longer-term health benefits mitigation efforts afford.

It also involved reframing climate action as presenting the U.S. economy and citizens with benefits and opportunities, as opposed to costs and burdens. Importantly, the introduction of increasingly ambitious climate mitigation policies was achieved in the face of strong political and industry opposition. Mitigation policies were predominantly pursued through executive and existing statutory authorities; no substantive climate legislation has passed through the U.S. Congress since 2011 [34, 35]. Our findings support the contention that where the political will exists, health benefits can be utilised to justify comparatively ambitious climate change mitigation policies. This position aligns with evidence elsewhere that political leadership is critical for the integration of health into other policy agendas [36–38].

It is important to note that this positive finding is tempered by seemingly incongruent objectives in other domestic policy areas. Of note, energy policy under the Obama administration has come under scrutiny, particularly given the implications of Obama Administration's 'all of the above' strategy toward U.S. energy security and independence, which in practice facilitated the expansion of oil and gas production in the U.S [39]. Moreover, despite early attempts to demonstrate leadership on both domestic and international fossil fuel subsidy reform [39, 40], significant domestic fossil fuel subsidies continue to be exploited by the U.S. extractive industry, at a cost of USD\$2 billion annually [41].

Further, positive findings in this case study are tempered by the reality of subsequent U.S. climate change mitigation policy development. Since its election in 2016, the Trump administration has drastically shifted the trajectory of national climate change mitigation policy, returning to a traditional framing of climate action as an excessive domestic cost. In March 2017, for example, a presidential directive required federal agencies to immediately review existing regulations that potentially *burden* the development of any domestically produced energy source [42; emphasis added].

The substantial changes to national climate change mitigation policy under the current U.S. administration emphasise the pivotal role of political will in the pursuit (or lack thereof) of climate action and demonstrates the malleability of climate change mitigation policy development, especially when policies and processes rely on the use of non-legislative means and methods based on normative assumptions. The SCC represents a case in point for the latter issue. The current U.S. administration has withdrawn all SCC technical guidance developed under the Obama administration, given its consideration of the global impacts of carbon as opposed to solely domestic impacts. Further, the U.S. EPA has recalculated the SCC based on criticisms from the federal Department of Energy that SCC calculation ranges were too high, given the values

used to discount future utility were too low [43]. The U.S. EPA's most recent determination that co-benefits should no longer be a consideration in cost-benefit analyses that underpin regulatory impact assessments effectively signals the death knell for the role of health in the development of mitigation policies at the federal level [44].

While there is cautious optimism that the judicial process will preserve at least part of the Obama administration's climate policy legacy [35] and sub-national commitments will compensate for the policy vacuum at the national level [45], there are legitimate concerns that regression in the ambition of national climate change mitigation policies and the lack of U.S. political leadership will fundamentally undermine international climate change politics and architecture, specifically the Paris Agreement [46, 47].

## 5. Future research

This paper contributes to a burgeoning area of research situated at the nexus of climate change, health and policy development. While our results reaffirm the importance of political will in the pursuit of ambitious climate action, particularly in the face of partisan positions on climate change, there are opportunities to bolster our findings through future research. It is important to acknowledge the limitations of our research. Most notably, our analysis focuses narrowly on the development of climate change mitigation policy and the role of health, with no meaningful scrutiny of other, potentially relevant domestic policy goals or the socioeconomic implications of implementing mitigation policies [48]. We recommend these shortcomings be addressed and explored in future research. Further, the triangulation of our findings with alternative data sources, such as interviews with key actors during the Obama era, would strengthen the conclusions presented in this paper. Beyond the U.S., investigating the role of health in the development of national climate change policies for other major emitters, particularly countries with developing economies and expanding populations, would be invaluable as the first review of Nationally Determined Contributions approaches. Finally, consideration of health co-benefits as a motivation for climate action at the sub-national level presents a timely opportunity for addressing research gaps in our understanding of the role of health co-benefits as a driver of ambitious climate action.

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## Data availability statement

The data that support the findings of this study will be openly available following a delay.

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