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A POLICY-MAKING TOOL FOR POST-CARBON CITIES USING CO-CREATION AND LIVING LABS

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Title: A Policy-making tool for post-carbon cities using co-creation and living labs

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Abstract

Drastically reducing greenhouse gas emissions to reach a post carbon society by 2050 requires policy makers - and to an important extent city authorities - to take action to change the way by which our modern society uses energy. Key sectors of the economy will be affected, but policies will work only if stakeholders actively participate and change their way of living, moving, consuming and doing business. Today's climate objectives require policy-making tools which engage directly with citizens as co-creators of decisions. This paper discusses a living lab approach using visioning and backcasting with an example of results in stakeholder workshops in the cities of Barcelona and Malmö for the EU funded project POCACITO.

Key words:

cities, transition, post-carbon, living lab, co-creation

A POLICY-MAKING TOOL FOR POST-CARBON CITIES USING CO-CREATION AND LIVING LABS

1. POST-CARBON CITIES OF TOMORROW

Cities are home to over 50% of the global population and are expected to accommodate over 70% of the world's population by the year 2050 with most of this growth expected in Africa and Asia (United Nations, 2014). Already today, 70% of global greenhouse gas (GHG) emissions stem from urban agglomerations, a share very likely to increase exponentially in the coming decades (UN-HABITAT, 2011). Anthropogenic GHG emissions contribute significantly to climate change with an expected severe impact on human lives on the planet, ranging from sea-level rise, to rising temperatures, droughts and flash flooding (IPCC, 2014a). While the impacts affect urban and rural populations, most of the GHG emissions are attributed to city dwellers. Therefore, it is of paramount urgency to decarbonise cities and support the transition towards Post-Carbon Cities (Chatterton, 2013; McCormick et al., 2013). Cities not only are a large contributor to climate change, they also harbour significant potential for GHG emissions reductions (Erickson and Tempest, 2014).

The term "post-carbon" emphasises the transition process, a shift of paradigms, responding to the multiple challenges of climate change, ecosystem degradation, social equity, and economic pressures. Post-carbon cities transform the threat of climate change into "an opportunity to reduce vulnerability" (Ridgway et al., 2014). Therefore increasing resilience of cities is as much a need as reducing GHG emissions, i.e. the capacity of the urban metabolism to absorb external shocks and adapt to the new exogenous setting while remaining functionally active (Walker et al., 2004).

However, the transition of cities to a post-carbon urban metabolism (Kennedy et al., 2011) is fraught with significant uncertainty, hindering the rapid uptake of mitigating and adaptive action: uncertainty with regard to the pace and severity of climate change impacts, uncertainty with regard to the socio-economic background developments, uncertainty with regard to the efficiency and

effectiveness of mitigation and adaptation measures and uncertainty about technological progress, i.e. the evolution of the space of attainable outcomes (IPCC, 2014b). Thus, climate change adaptation and mitigation can be primed a 'wicked problem'; yet, as with every wicked problem, lack of certainty cannot be a cause for inaction (Lazarus, 2009).

Transition research is supporting decision makers with applied research results and policy recommendations and crossing disciplines in a systems thinking approach (Loorbach and Rotmans, 2006). Since transitions are fluid and refer to a change of the structural character of a society, their evolution follows non-determined pathways and can only partially be affected by policy making (Rotmans et al., 2001). Thus, transition management is as much about letting go as about controlling.

Transitions occur at all levels of society: from the individual or micro-level (i.e. individual preferences and resulting behaviour), to the meso-level (i.e. intangible infrastructure such as cultural norms, scientific knowledge, policies and markets), and the macro-level (i.e. physical infrastructure such as transport or energy systems) (Geels, 2011).

Micro-level transitions represent the individual and collective psychological processes of adapting to change (Bridges, 2004), including three phases of transition: 1) letting go of the old state or paradigm, 2) the transitional zone where the old has ended but the new not yet emerged or is not yet manifest and 3) the new state or paradigm. In this framework, four questions need to be answered in order to facilitate a successful transition: What is the goal or objective of the transition? What is the future vision one aims to attain? What are the potential pathways to reach the vision? What actions are required to be taken by whom and when?

If one accepts that transitions can only be steered to a certain extent, but also admits that these are quintessential for furthering progress in climate change mitigation and adaptation, then the fundamental question is how to stimulate and support the transition of today's cities at micro-, meso- and macro-level to become post-carbon cities of tomorrow.

The research project Post-Carbon Cities of Tomorrow (POCACITO) examined just how to facilitate the transition of cities to a post-carbon era. POCACITO followed the main concepts of transition research and applied a user-driven policy innovation approach (Eskelinen et al., 2015). The

resulting living lab environment of co-creation between stakeholders in selected European cities (see Section 3) led the way to city-level strategic transition papers. Key methods for the POCACITO living labs were participatory visioning and backcasting, adapted from Robinson (1990), using a desired end point vision as a starting point for a backtracking towards the current status quo (Breil et al., 2015).

This paper will discuss how to use a living lab and co-creation approach in policy design at the city level for accelerating the transition to a post-carbon economy, supporting at the same time climate change mitigation and adaptation. POCACITO shows that stakeholder participation needs to be considered from the onset of any transition strategy design and also needs to remain the focal point of the entire process. To make this case, the paper focuses on the two sectors that are common to all the visions of case study cities, transport/mobility and energy. In order to examine the transferability and reproducibility of lessons learned, it looks at experiences in Barcelona and Malmö and distils three key messages.

The following section 2, presents a literature review supporting the use of living labs approach and co-creation in cities. Section 3 presents the practical implementation of such approaches in the form of visioning and backcasting exercises with city stakeholders in in nine case studies based on a framework developed and tested in the POCACITO project. Section 4 discusses policy issues associated with transport/mobility and energy sectors, which have emerged from stakeholder participation processes in Barcelona and Malmö. Section 5 extracts key messages resulting from the case studies of the two cities, emphasising the importance of coordination between different governance levels such as local, national and the EU levels.

2. A FRAMEWORK FOR INTEGRATING LIVING LABS AND CO-CREATION

Given the difficult environmental and socio-economic challenges for our society, there is a pressing need to enhance our understanding of cities as drivers of - or locus for - post-carbon transitions. This requires in particular to explore the potential of cities as testing grounds for radical - albeit inclusive and sustainable - solutions. Cities play a key and critical role, due to the increasing share of the world's population located in them as mentioned earlier, their growing economic and political power, the large demand of resources, as well as innovation taking place in cities (McCormick et al., 2013). Diversity and heterogeneity add to the complexity of cities, but simultaneously provide wide opportunities to rethink current structures and practices and stimulate innovation.

The major challenges linked to the transition to post-carbon societies thus involve not only policy makers, business and technologies but also cities as complex socio-economic entities, which are driven by a large extent by citizens' complex behaviour and interactions (Bulkeley, 2010). This is why, while transition research often perceives technological innovation to be the push and starting point of major changes (e.g. Geels, 2011; Geels and Schot, 2007), this paper focuses on the changes that stem from the intersection of policies, society and citizenship by benefiting from the dynamic intersection of our research focus and the input and knowledge provided by participants (Metzger et al., forthcoming). i.e. those who experience urban contexts, possessing mundane knowledge of the urban contexts and those who will be affected by the transitions and live in the future cities.

In many research and development projects, the benefits of including users, citizens and/or stakeholders have been explored as a way to enhance innovative solutions to urban challenges. Integration of innovative solutions, developed in collaboration or coordination

with users and citizens, has spread within the area of technological innovation where testing and developing new user-based technologies in urban networks have provided creative elements to the innovative processes. This process of co-creation is widely recognized in the area of developing digital technologies (Leminen et al., 2012), and links closely to exploration of novel developments. Due to the uncertain nature of complex challenges such as mitigating climate change or sustainable urbanisation, developing solutions takes place in life-scale testing sites with real people using the technologies and forming co-creative networks in the daily environments and local communities of cities, coined in the notion of living labs (Baccarne et al., 2014; Pallot et al., 2011).

Taking this as point of departure, studies of post-carbon cities can use innovative processes as experimental policy and planning tools in actual urban settings and based on the inclusion of citizens and stakeholders perspectives, needs, interests and creative input. This transfers the insights from conceptual elaboration on living labs and co-creation processes from the area of largely technological innovations to a wider societal setting, more apt for fundamental transitions, and allows for inclusion of processes of policy and social learning in experimentation and creative co-creation processes.

Thus, in approaching selected cities as living labs we allow for experimental engagement with local policy makers, stakeholders and citizens. Moreover, the living lab approach provides an arena for creative engagement in settings that reflect the complexities and uncertainties of real cities, while the research expands to address uncertainties and complexity in novel ways through co-creation with stakeholders. This involves the participants in specific – and diverse – roles during the process of creating a pathway to sustainable future cities (Nystrøm et al., 2014), which stimulates learning among the participants and create ownership to shared futures. Moreover, through the experimental approach embedded in living

labs, insights, tacit knowledge and novel approaches can be integrated through feedback processes in urban policy making and planning, recognizing how 'governance and planning [are] critical to transformative change towards urban sustainability' (McCormick et al., 2013: 1).

3. THE IMPLEMENTATION OF CO-CREATION IN STAKEHOLDER PARTICIPATION PROCESSES IN THE NINE CASE STUDIES

The POCACITO project selected nine cities of various sizes, and geographical locations as case studies in order to cover a wide range of challenges and opportunities facing European cities. Those nine cities are Barcelona, Istanbul, Lisbon, Litoměřice (Czech Republic), Malmö, Milan/Turin, Rostock, and Zagreb. Table 1 below summarises the characteristics of individual cities.

Table 1: Case study cities in POCACITO

City/Region	Region typology	Location	Main aspects	Population in municipality (and region)	City challenges
Malmö (SW)	Coastal	Baltic Sea	Trans-boundary; regional capital; and Metropolis with Copenhagen	Malmö 303,873; Total of the region including Copenhagen 1,543,908	Integration (housing segregation); Social sustainability
Rostock (DE)			Regional centre	204,260	Networking with regions; Quality of life
Barcelona (ES)		Mediterranean	Regional capital; port city; strong economic centre	1,621,540 (3,218,071)	Developing real mobility, not only modes of transport; Preserving the local authenticity of the city (too much emphasis on tourism); Social integration; Effective reduction of emissions, including those outside the city area but affected by it; Airport (outside the city], Port (city)
Istanbul (TR)		Bosporus	Megacity; primate city	12,915,158	Ineffective and untimely usage of public resources; Conflicts in the region/terrorism/security problems; Migration/population growth; Lack of institutional coordination & cooperation
Lisbon (PT)		West Atlantic	Dominant regional capital; port city	547,733 (2,042,477)	Natural disaster (floods, earthquakes); Mobility (private car is the main transport mode used by population); Social inclusion (poverty, unemployment, ageing etc.)
Milan/Turin (IT)	Inland	Northern Italy	Regional cooperation; mega-metropolitan area	MLN 1,350,267 (3,202,947); TRN 905,352 (2,308,846); Total 5,511,793	Economic development (specialisation); Soil consultation; Accessible and compact city
Litoměřice (CZ)		Central Europe	Regional centre; small city	25,517	Air pollution from nearby chemical factory placed in another town; Financing of geothermal plant
Zabreb (HR)		Southeast Europe	Regional capital	790,000	Management issues (urban strategies, programs and plans; lack of long-term urban planning and strategy) - Non-active citizens (lack of awareness, non-proactive, lack of education on sustainable development)

Source: update on Table 1, Annex I: Description of Work to the grant agreement for POCACITO, using information available in Nuñez Ferrer and Stroia (2016) and at http://pocacito.eu/case-studies

The basic methodology for systematic generation of urban visions was developed in a common guidance document (Breil et al., 2015) and adapted by case study leaders to fit the profile of the stakeholders and design the most suitable approach, given local circumstances and attitudes of the stakeholders. The methodology was tested, altered according to local needs, and consequently customised by stakeholders participating in the consultation process, which can be interpreted as *a living lab*.

Each case study was implemented according to the following steps. By applying the common indicators reflecting environmental, economic, and social dimensions, i.e. the Key Performance Indicators (KPIs)(Silva et al., 2014),[1] case study leaders develop an initial assessment of each case study city. The assessment is sector-based: not only energy and transport but also green infrastructure, waste and water, as well as socio economic issues such as education, employment, gender equality and competitiveness indicators. Next, the case study city identifies key stakeholders and engages them in consultation at a series of workshops. Although case study leaders may manage to identify key stakeholders through their connections and networks, local authorities and city associations can help them to invite additional experts and minority groups, thereby improving the composition of participants. The city authorities should also be actively involved as key stakeholders, as their participation is quintessential. A transition strategy cannot have any realistic impact without the involvement of the public authorities. The diversity and heterogeneity of stakeholder representation, ranging from city authorities, urban planners, architects, to financial specialists, will allow for a more comprehensive vision, and a wider range of solutions. A sufficiently wide coverage of the interests of a majority of citizens is equally important. The diversity and coverage could increase the level of

[1] The Post-carbon City Index (PCI) is a mechanism to assess and monitor the post-carbon city transition process. The KPIs that compose the PCI aim to evaluate the performance of cities during the transition process (Silva et al., 2014).

citizens' acceptance of the vision, strategy and the proposed milestones and actions resulting from the process.

In a vision workshop stakeholders develop a common post-carbon vision for the year 2050, which is based on a sectoral assessment. This vision facilitates them to imagine how the city should be like in 2050. In addition to the common sectors and urban issues, stakeholders identify challenges that are specific to their contexts and define a strategy for achieving the vision. Stakeholder workshops are an effective tool to validate the initial assessment and receive feedback on visioning and scenario-building results (Breil, 2016). Moreover, visioning can motivate stakeholders to follow a path that is aligned with wider social and economic goals and identify their own roles in preparing transition to the distant future (Metzger et al., forthcoming).

In a backcasting workshop ideally supported with inputs from a quantitative analysis to validate the solutions proposed, stakeholders identify what is needed between now and the future to make the vision reality by setting milestones and proposing actions. When participating in the workshop, these stakeholders need to shape and design together the future of a city and agree together on the milestones and actions, which can be regarded as *co-creation*. Once the milestones are determined, backcasting encourages stakeholders to look at specific barriers and solutions in further detail. Guided by results of a quantitative analysis, stakeholders can assess whether the proposed milestones and actions specified in the quantitative analysis are sufficient to reach the long-term objectives.

It is backcasting that is considered decisive in enabling the process of strategy development as far as POCACITO case studies are concerned. This exercise allows participants to bring the distant future − the year 2050 − into the present and to develop a realistic pathway based on concrete actions to a desired future state. In this way, the urgent and immediate needs for action become clearer to stakeholders, and additional actions required can be determined with more confidence.

For this purpose, sectoral assessment is particularly useful to prioritise specific sectors that are strategically important to the targeted city. Among the 12 main sectors which are considered relevant to POCACITO case studies[2], not all cities placed the same importance on each sector.

Table 2: Sectors addressed in the 2050 post-carbon visions

CITY	TRANSPORT & MOBILITY	ENERGY	LAND USE & INFRASTRUCTURE	SOCIAL ISSUES	ECONOMY	BIODIVERSITY & CONSERVATION	TECHNOLOGY & INNOVATION	EDUCATION	TOURISM	GOVERNANCE	FOOD PRODUCTION	CONSUMPTION & WASTE
Barcelona	●	●	●	●	●		●	●	●	●		
Istanbul	●	●	●	●	●	●	●			●		●
Lisbon	●	●	●	●	●		●		●	●	●	
Litoměřice	●	●	●	●	●		●	●	●	●	●	●
Malmö	●	●	●	●	●		●				●	●
Milan	●	●	●	●	●	●	●	●		●		●
Rostock	●	●	●	●	●				●		●	●
Turin	●		●	●	●				●			
Zagreb	●	●	●		●	●		●		●	●	●

Source: Johnson and Breil (2015)

As the above table shows, transport and mobility, energy, land use and infrastructure, economy and social problems topped the concerns of stakeholders. Thus our discussion on policy issues will focus on the top two sectors.

[2] Transport and mobility, energy, land use and infrastructure, social issues, economy, biodiversity and conservation, technology and innovation, education, tourism, governance, food production, and consumption and waste.

4. DISCUSSION ON POLICY ISSUES

In order to understand how local contexts matter to development of cities strategies and the extent to which good practices could be transferable and reproducible, this section looks at two case study cities, Barcelona and Malmö. Based on Table 1, it is assumed that these cities can be grouped together due to common features such as being regional capital with total populations in the range of 1.5-3.2 million[3] and located in coastal cities.

Transport and mobility: A fully decarbonized transport system and better mobility

This policy objective reflects an important aspect of transition to a post-carbon future. The concept of 'mobility' goes well beyond just transport as a means of urban life but quality of life. The location of public services (e.g. city administration) or residential, leisure, transport and commercial areas have a huge impact on the lifestyle, opportunities and quality of life of the citizens. 20th century cities have been developed based on the existence of motorised transport - and in particular the private car, which result in a high level of greenhouse gas (GHG) emissions. Cities as a result were zoned in living, commercial and industrial areas. The zoning policy has led to a number of problems with mobility, not only due to traffic congestion, but also generating lifeless business areas after working hours and residential areas that lack proper services. Social problems include transport poverty, i.e. the exclusion of those that cannot pay or are unable to access transport due to e.g. a disability or old age.

Issues covered in the transport and mobility sector can be divided into five main categories: *quality of transport* with the implicit goal of changing the modal share in favour of public transport; *carbon-free transport* as a general goal for all types of transport; *public over private transport*; *integration, connection, and multimodality*; and *reduced impact* from traffic. Barcelona's vision focuses on *quality of transport as well as accessibility to goods and services at district level*. Another aspect, which the stakeholders found problematic, is the high emissions from the port, in particularly the large ships using diesel generators. Malmö covers *CO_2 free*, *public over private*, and *integration,*

[3] The total population of the region including Malmö and Copenhagen amounts to 1,543,908 (see Table 1).

connection, and multimodality (Johnson and Breil, 2015). Their transport strategies by the target year, milestones and actions to achieve them are summarised below.

Table 3: Examples of transport strategies

The target year	Milestones	Actions to achieve milestones
Barcelona		
Quality of transport		
2017	Public transport is not only designed radially but in the form of a net	Reform of transport planning; Coherence between national, regional and urban area transport authorities; infrastructure planning needs to be integrated
2020	Reduce emissions from shipping in the port – ships no longer with motors on.	Change rules and build energy connections to the ships
2030	Achieving "optimal" public transport	Fully electric with a transition period supported by fiscal incentives
2035	No more fossil fuel transport in city;	Law to ban fossil fuel transport and phasing in scheme;
	All private transport driverless	Phasing in driverless transport over 10 years
2050	A city with mobility at its core rather than transport	For easy access to the city services, more liveable districts with accessible shops and services
Malmö		
2030	Transport 40% electric	Offshore wind park inaugurated 2030; Carbon Rationing per person introduced 2040; Updated traffic programme for Malmö (current programme expires 2017)
2035	Fossil fuelled transport reduced to 50%	Large biogas plant inaugurated 2020
2050	Fossil fuelled transport reduced to 10% within outer city and 0% in city centre	Trams, subway and Malmö ring inaugurated 2020-2025, or probably later e.g. 2030; Residents use car pools/ mobility pools more.

Source: Authors, compiling information in Harris and Ljungkvist (2016); Nuñez Ferrer and Stroia (2016)

The process of strategy development is completed by assessment of needs for policy intervention at different governance levels, i.e. local authorities, national authorities, and the EU. Stakeholders in Barcelona call for national authorities to ensure clear coordination of national - regional transport systems. The city should focus on 'mobility' or 'accessibility', not transport. By 'mobility' the stakeholders understand the ability of all citizens to access goods, services and leisure,

not in terms of ability for long distance travelling. They question the consequences of zoning policy and district structures. Stakeholders in Malmö urge city administration to act on the following issues. First, as public transport is guided by the local traffic- and mobility plan, it is important to define how transport efficiency should be measured, for example, in fuel per person km or in other indicators. Measurement of goods transport is also important with the aim to develop more efficient logistic solutions. The goods transport plan is an important document for defining the method of measurement (Harris and Ljungkvist, 2016).

Energy: Energy efficiency in buildings with zero or negative emissions and developing green energy system

Issues covered in the energy sector can be divided into four categories: *reform of energy generation and distribution*; *new concepts, plans, and performances*; *the reduction of energy consumption*; and *increases in energy efficiency of buildings* and *the capacity of buildings to generate energy*. Barcelona, focuses on *reform of energy generation and distribution*, an area of action which is seen as crucial by seven of the cities, and *new concepts, plans, and performances*. Malmö includes only the former (Johnson and Breil, 2015). Their energy strategies by the target year, milestones and actions to achieve them are summarised below.

Table 4: Examples of energy strategies

The target year	Milestones	Actions to achieve milestones
Barcelona		
Developing green energy system		
2025	Smart grid	Legal reforms to allow RES integration and independent entities
		Smart grid with 80% renewables
Energy efficiency in buildings with zero or negative emissions		
2030	**All public** buildings renovated and energy efficient	The city authorities should draft and implement a plan.
	75% of all buildings renovated and energy efficient	*Fiscal and legal reforms* to incentivise to building renovation, intermediate milestone.
2045	**All** buildings renovated and energy efficient	
Malmö		
Energy, carbon and transport		
2025	Malmo City Municipality operations carbon neutral	Updated energy strategy/action plan for Malmö
	Fossil free district heating system	
		Shift to biofuels?
2035	Average building energy reduced to 50 kWh/m^2	Energy consumption tax is introduced per m^2 of living space and person; Reduce the amount of bought energy.

Source: Authors, compiling information in Harris and Ljungkvist (2016); Nuñez Ferrer and Stroia (2016)

The process of strategy development is completed by assessment of needs for policy intervention at different governance levels, i.e. local authorities, national authorities, and the EU. Stakeholders in Barcelona suggest that the national authorities should reform the division of powers between the national and subnational authorities including local city authorities, taking into account the need to have an effective functional power distribution, in line with the energy, environmental and social needs for post-carbon transition. According to the stakeholders, the EU should ensure that national energy rules stay in line with the renewable energy targets and provide incentives for decarbonisation, and that improvements in building regulations accelerate the adoption of energy efficiency solutions. Stakeholders in Malmö urge city administration to act on the following issues. The

national authorities need to provide clear, consistent and long-term economic incentives to promote post-carbon activities. Examples of incentives include tax shifts and higher energy prices. While the EU guides much of national legislations today, there is a need for the member states to operationalize and implement the legislations that lead to a more circular and less carbon intensive economy. Examples of such legislations include incentives to compensate high costs to investments in energy efficiency and higher prices for carbon under the ETS (Emissions Trading System). Lastly, the stakeholders call the industry to act as front-runners and make investments in renewables wherever possible. These early adapters can act as inspiration and show strong cases for the rest of society on how to progress towards a sustainable society (Harris and Ljungkvist, 2016).

5. CONCLUSIONS

The POCACITO case cities have contributed to a better understanding of policy-making and the challenges presented by climate change. However, the depth and quality of the result and the level of acceptance by local authorities differs from city to city. This is partly the reflection of the experimental and innovative nature of the project, but also of the cultural and institutional realities in the cities, which may facilitate or hamper such participatory approaches to some degree.

In response to the challenges of transferability and reproducibility, the above experiences of two case study cities in development of local strategies lead to the following findings. First, as the example of Barcelona shows, the stakeholders are open and able to contest the established concept of policy area such as transport, stretch its boundary and explore a new concept such as mobility. The latter can be overarching multiple policy areas (urban planning, transport, social, community development) and supported by Key Performance Indicators with environmental, economic, and social dimensions. Second, the examples of both cities reiterate that the stakeholders can be strategic, should they be appropriately informed. Once the target year is determined, they can jointly set milestones, identify actions to achieve the milestones, and assess specific needs for the city administrations, national authorities, and the EU. Third, as the examples of Barcelona and Malmö show, some

stakeholders may know exactly what works and what does not work on the ground, thereby helping the overall exercise of strategy planning, as they can identify the barriers and solutions to institutional challenges. These stakeholders can also highlight the coordination problems involving different governance levels revealing needs for national and supranational policy reform. Particularly the last two findings make a strong case for more substantial participation of city representatives in the living labs and co-creation processes. Results of consultations should also influence the policy-making and implementation processes of higher authorities such as the EU and member states. Future policy making for post-carbon cities will need to embrace co-creation and living labs for stakeholder participation in order to overcome outdated governance approaches and respond to the complexity and uncertainty of current and future challenges in the fields of economic, social and environmental sustainability.

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