

# The Envision Rating System for Sustainable Infrastructure: Development, Applications, and the Potential for Lebanon

Guest Author: Dr. Andreas Georgoulas

*Professor, Harvard University Graduate School of Design  
Director, Zofnass Program for sustainable Infrastructure*



## 1 Introduction

The private sector has a crucial role in sustainable development internationally. Private investments and public-private partnerships that are sustainable in environmental, social, and economic terms facilitate socially inclusive growth creating jobs and innovation necessary to raise the quality of life. This is especially important in developing countries, where the private sector provides up to 90 percent of jobs. As such, it has the critical potential to facilitate initiatives that ensure a positive impact on local communities. Private sector engagement in sustainable infrastructure and energy can effectively stimulate a huge potential in much-needed growth and at the same time add resiliency against long-term physical, environmental and economic risks.

Lebanon is no exception; plagued by historic failures to reform its electricity sector, the need

for modernization in Lebanon's infrastructure sector is eminent (MEW, 2010). The approximate estimation of \$2.5 billion of losses stemming from various system inefficiencies on the national economy annually makes the change to a new sustainable infrastructure energy system a national necessity (MEW, 2010). The Policy Paper for the Electricity Sector by the Ministry of Energy and Water gives a brief description of the main reasons behind this daunting crisis. It shortlists lack of sustainable investments, high fuel bills, old, and inefficient infrastructure, significant transmission and distribution losses, as well as complex legal and organizational configurations among the most important priorities that require a simultaneous and comprehensive solution framework (MEW, 2010).

Considering expected climate variations, the



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generating capacity requirements to fill current gaps, demand forecasts, and necessary infrastructure to facilitate electricity distribution in a sustainable manner exacerbates the problem (MEW, 2010). The Policy Paper divides actions into three strategic areas, infrastructure, supply & demand, and legal framework, and ten initiatives with an over-arching goal of achieving 12% of total energy needs, excluding transportation, in the country from renewable energy sources by 2020 (MEW, 2010 and Ghajar, R. , 2010). In order to streamline the process of achieving this ambitious goal, Lebanon is striving to facilitate comprehensive collaboration and public sector initiatives. A special financing mechanism, the National Energy Efficiency and Renewable Energy Action, has been created to provide private sector entities with subsidized loans for sustainable energy projects (El Khoury, P. 2013). The plan will be implemented in three distinct phases, encompassing both short and long- term goals (Ghajar, R. 2010). This, however, needs to be accompanied by a framework that will evaluate the transparent delivery of these actions and their continuous refinement to account for changes in the technological and built environment (MEW, 2010). Otherwise, in the midst of growing environmental and social pressures, the plan risks to overlook serious threats and miss significant opportunities.

## **The Need for an Infrastructure Sustainability Assessment Framework**

Even though the need for modernization and sustainable infrastructure in Lebanon and abroad is unequivocal, historically, the lack of political and other guidance significantly halts private sector sustainability endeavors. Sustainability guidelines, collection of best practices, and assessment methodologies on sustainability performance could help overcome this problem. A clear example of how all the above have been successfully applied in the building sector in the United States is the LEED rating system from the United States Green Building Council (USGBC). A rating system provides an easy-to-use methodology that includes several recommendations for best practices.

However, most of existing sustainability rating systems are focused on and designed for buildings, not infrastructure projects. Even if both buildings and infrastructures require concrete and steel to be constructed, their differences are many: buildings are confined, infrastructures are typically networks spanning many areas and geographies, affecting several communities and environments; buildings are typically much smaller in scale in comparison to infrastructure projects; buildings typically provide enclosed spaces that people spend a lot of their time inside, whereas infrastructures may not have enclosed spaces that are designed for frequent people stay; and finally, ownership and governance for most buildings is much simpler and single-owner focused, compared to infrastructure that is affected by multiple stakeholders and its ownership structures are much more deep and multi-layered.

It then becomes evident that a sustainability rating system that is designed for buildings is not fully capable to capture the fundamental differences between infrastructure and buildings, as well as their specific contextual factors with regard to time, scale and life-cycle differentials. And unfortunately, until recently the vast majority of available rating systems were focused on and designed for buildings. The lack of a comprehensive sustainability rating system within the infrastructure project domain has been evident for a long time.

Recognizing this lack, and the urgent need to better understand and promote sustainable infrastructure, the Zofnass Program (Zofnass) for Sustainable Infrastructure at Harvard University's Graduate School of Design has been working to fill these gaps. The Zofnass program embarked on 2008 to develop a sustainability rating system for infrastructure, able to provide a robust method to quantify sustainability for all infrastructure projects and promote their sustainable practices and actions. As the Program's founder and principal donor, Paul Zofnass, would say: "If we can come up with a set of metrics that people can agree to and that has the credibility . . . to measure and evaluate these projects I think we're going to have a very meaningful impact, a critically important impact, on preserving our environment." (Envision v2, 2010).

To deliver on its mission and achieve its goals, the Zofnass Program established a strategic partnership with the Institute for Sustainable Infrastructure (ISI) (Sustainable infrastructure), a not-for-profit organization headquartered in Washington, DC and

founded by the American Society of Civil Engineers, the American Council of Engineering Companies, and the American Public Works Association. The partnership between ISI and the Zofnass Program at Harvard aimed to create a unique, interdisciplinary approach and incorporate the different perspectives of infrastructure’s diverse stakeholders. Through this joint collaboration, a unique rating system to assess the sustainability of infrastructure projects was created: the Envision Rating System for Sustainable Infrastructure.

## The Envision Rating System

Envision is much more than a simple rating tool. It is a framework of criteria that can be used by all major infrastructure stakeholders for decision-making. It incorporates sustainable infrastructure design guidance, and integrates resources and libraries for education and best practices. It provides an overarching, comprehensive assessment framework that evaluates and quantifies sustainability for all infrastructure projects. The vision behind its creation is to facilitate a systemic change and advance the industry from a passive, business-as-usual thinking to higher innovative solutions; to promote sustainable

infrastructure and create a set of specific, scalable sustainability principles as a robust reference for all future infrastructure projects with an emphasis on economic, social, and environmental dimensions.

Envision, unlike other sustainability rating systems, focuses on the contribution of infrastructure to the many other systems it is part of, such as urban and natural systems and grids. It provides guidance to pursue holistic solutions by using a lifecycle approach evaluated against the needs of surrounding communities, as well as rewards restorative efforts that exceed traditional sustainability performance.

## Key Features

Envision is organized around five distinct categories, and fourteen subcategories. The five Envision categories, Resource Allocation, Natural World, Climate, Change, Quality of Life, and Leadership, correspond to principal areas of impact. Categories were selected considering that they could be applied to all types of infrastructure. Each category has its own credit list. Credits encompass evaluation criteria such as “reducing carbon emissions” and award



Figure 1: The Envision Categories, Subcategories, and credits. Image courtesy of Zofnass Program at Harvard University and Institute of Sustainable Infrastructure

points depending on the implementation of the evaluation criteria and the project’s expected performance. The submission is then verified and projects are certified based on their total awarded points. Envision expands the potential for sustainability action into two distinct areas: performance and pathway. The first addresses all actions taken by the project teams to improve a project’s sustainability characteristics with regard to performance, such as energy efficiency and water consumption. The latter considers whether the project requirements address community needs, and if the project team seeks to improve the community’s quality of life by integrating their project with existing systems. Therefore, Envision expands the traditional considerations with regard to sustainability. It motivates project teams to identify the community needs that result in a new project and not only ask “Will we do the project right?” but also, “Will we do the right project?” Regardless of how efficient a new infrastructure might be, it is not really sustainable if it is not necessary.

long-term risks that stem from traps and vulnerabilities. These are divided into distinct categories that relate to over-dependence on scarce and expensive resources such as fossil fuels, designs leading to projects vulnerable to climate variations, natural disasters and economic conditions, as well as conceptual plans that do not consider the urgent requirements for sustainable development and how these conditions might adjust in the future.

### Envision Categories of Assessment

Sustainability is often complex with overlapping objectives. For this reason, Envision organizes credits into five categories and fourteen subcategories based on their main area of impact. It guides project teams to assess their projects against broad areas of impact as well as identify complex synergies among credits and evaluation criteria.

### Resource Allocation

Envision also guides project teams to avoid significant

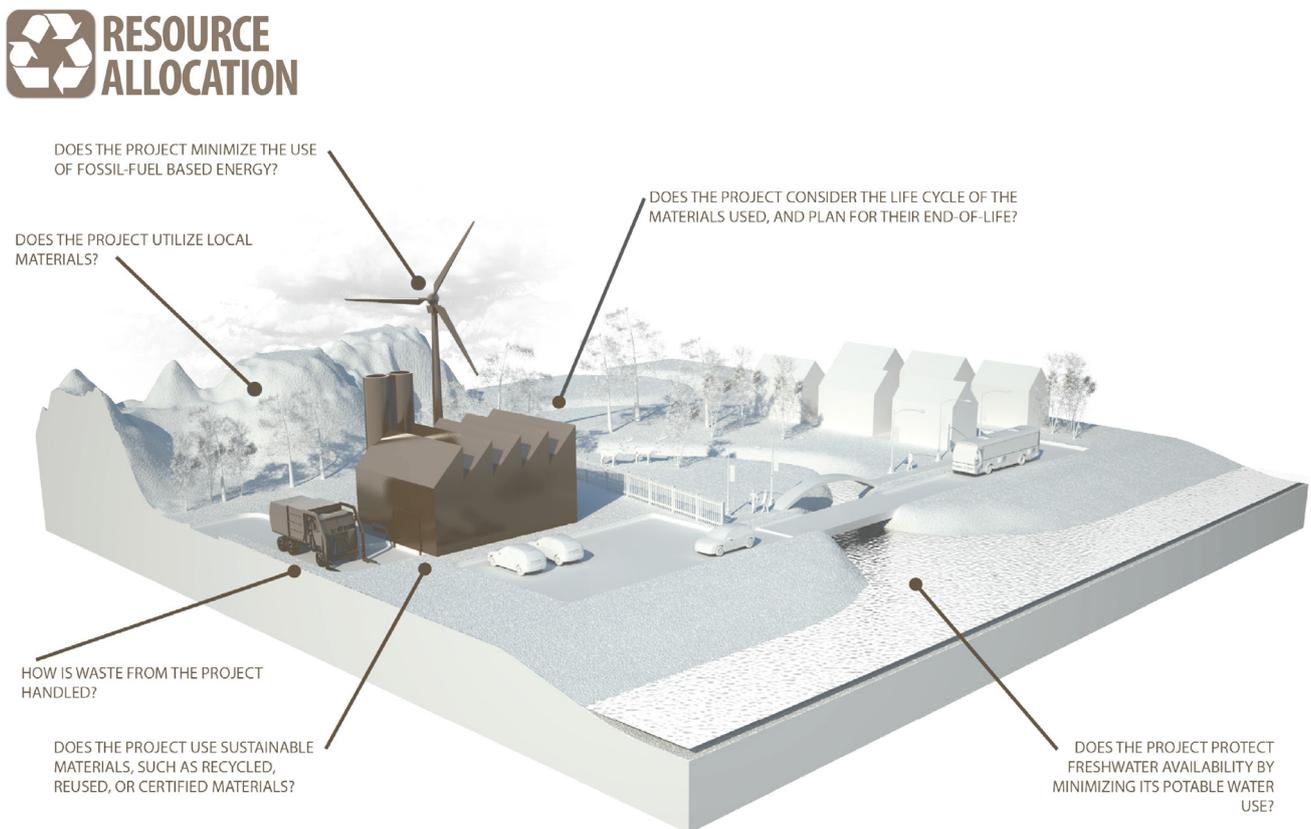


Figure 2: the Resource Allocation Category. Image courtesy of Zofnass Program at Harvard University & Institute of Sustainable Infrastructure

*Envision aims for the optimal allocation of resources, which has the least impact on the current environment and maximizes the potential of future generations to have access to the resources they will need.*

Resource allocation covers the required use of resources and energy to build and manage infrastructure projects. Envision investigates the amount, source, and characteristics of these elements, as well as their influence on project sustainability. Project teams are guided to choose materials that are less toxic to the environment and human health, and pursue efficiency from renewable resources. This category falls into three sub-categories: Materials, Energy, and Water.

**Materials**

Envision introduces the total amount of materials used as a prime consideration for infrastructure projects, incorporating issues of safety, stability, and durability. Similarly, considering the source of materials is also imperative. Materials originating from distant sources should be avoided in case the same type and quality can be found locally. Envision guides project teams to consider the full life-cycle of materials, as well as important characteristics that help to minimize the total amount of resource consumption.

**Energy**

Envision facilitates projects that aim to reduce overall energy use and avoid using non-renewable fossil-fueled power sources. It awards projects that strive to cover energy requirements through renewable sources when possible.

**Water**

Future water scarcity implications are imperative for long-term project planning. As such, Envision guides project teams to reduce overall water use and seek alternative water sources, such as stormwater runoff reuse. Water monitoring and studying is encouraged to identify optimal community water consumption.

**Natural World**

*Envision aims to preserve and enhance the ecological systems that sustain life. The design of built infrastructure should minimize ecosystem fragmentation and disruptions to land that provides habitat and supports biodiversity, promote the rejuvenation of degraded systems, and employ strategies of conservation which engage hazard avoidance/mitigation.*

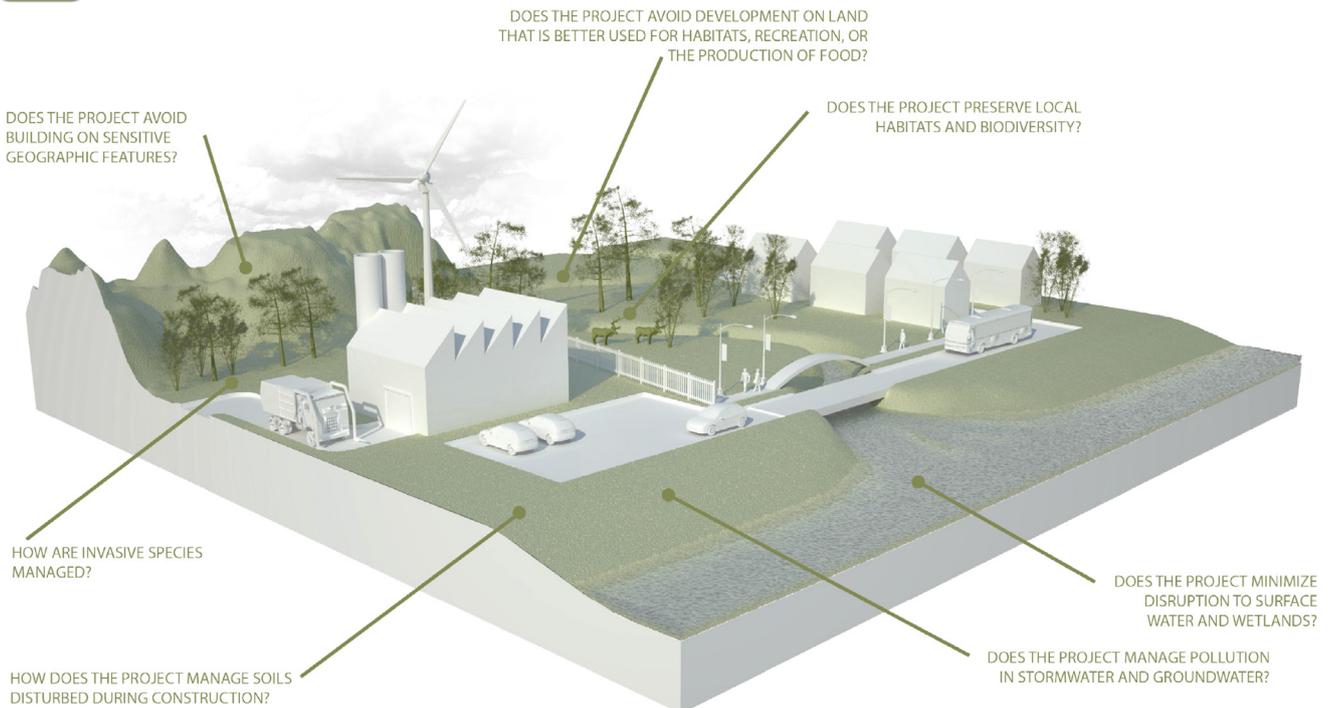


Figure 3: The Natural World Category. Image courtesy of Zofnass Program at Harvard University & Institute of Sustainable Infrastructure

Natural world focuses on the habitats, species, and non-living natural systems that exist around infrastructure projects. Infrastructure may unwillingly affect the systems it is located within and introduce unforeseen perturbations. Natural World examines the potential effects of infrastructure projects and strives to identify potential synergies with natural systems. Envision allocates these effects into three sub-categories: Siting, Land and Water, and Biodiversity.

### Siting

Site selection is imperative for infrastructure projects, and they should be sited to avoid disturbing sensitive ecological areas that perform important ecosystem services and provide critical habitat for many plant and animal species. Envision specifically recognizes projects that understand that impacts may extend beyond a project's physical boundaries, seek to preserve areas of geologic or hydrologic value and avoid interrupting natural cycles. It also recognizes that many times avoiding sensitive sites might not be practical. In such cases, sufficient mitigation measures should be incorporated. These new features need to match the quality of those that were perturbed. Furthermore, Envision rewards projects that utilize previously developed or contaminated land to rejuvenate surrounding ecosystems and improve land value.

### Land and Water

Envision highlights the importance of hydrologic and nutrient cycles to support resilient ecosystems. Therefore, it rewards projects that take steps to improve these qualities, or introduce minimal perturbations. Avoiding contamination through stormwater runoff or pesticides and fertilizers is considered imperative, since their impact is multi-layered and adversely impacts the quality of larger ecosystems. Water withdrawals from critical surface or groundwater sources should also not decrease water levels substantially.

### Biodiversity

Envision guides Infrastructure projects to minimize negative ramifications on local species and respective habitats. It places particular attention on avoiding the introduction of invasive species, as well as recognizing threatened, endangered, or other imperiled plants and animals that have a substantial role in maintaining local ecosystem functions. Furthermore, special care is also taken to avoid habitat fragmentation, as well as to promote connectivity and planning for various natural flows and crossings. Biodiversity considerations also include protecting surface water quality of local watersheds, controlling respective water withdrawals and mitigating stormwater runoff.

## Climate and Risk



DOES THE PROJECT MINIMIZE GREENHOUSE GAS EMISSIONS?

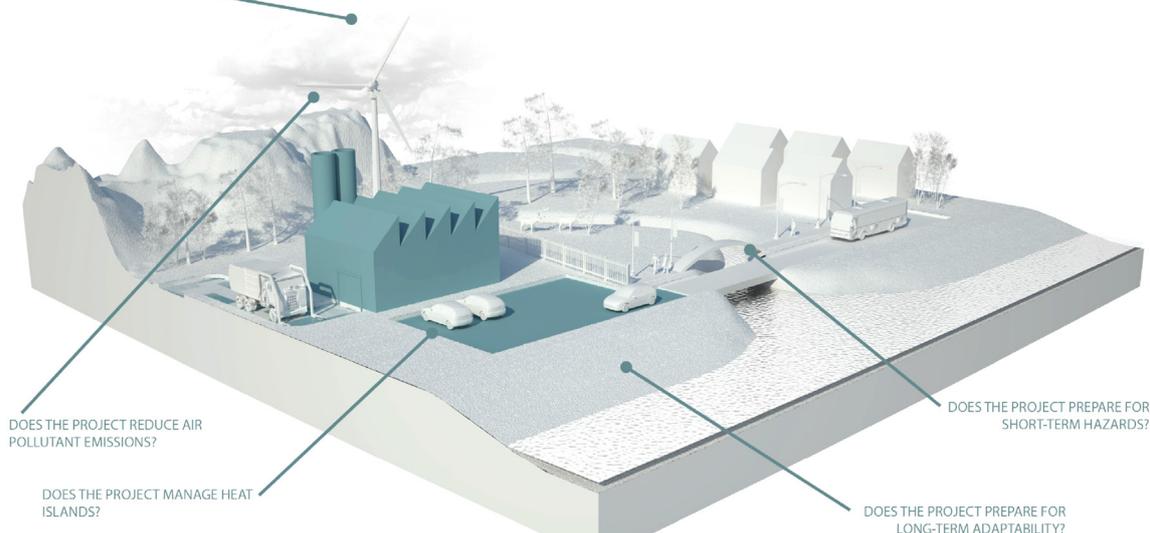


Figure 4: The Climate and Risk category. Image courtesy of Zofnass Program at Harvard University & Institute of Sustainable Infrastructure

*Envision aims to minimize long-term climate change caused by infrastructure works and operations and to promote infrastructure projects that are adaptable and resilient to future conditions that may result from climate change.*

Climate and Risk focuses on controlling emissions that might facilitate short and long term perturbations as well as promoting resilient infrastructure projects that are able to mitigate both short-term hazards and long-term variations. Climate and Risk falls into two sub-categories: Emissions and Resilience.

### *Emissions*

Infrastructure is responsible for a large portion of greenhouse gas emissions. For instance, electricity can be produced through fossil-fuel combustion and certain transportation networks facilitate automobile use. Envision identifies infrastructure gas emissions from various sources, such as energy consumption, transportation, embodied carbon in materials, and waste products. The focus is on understanding and controlling these emissions during all stages of a projects' life-cycle. Envision measures emissions in carbon dioxide equivalent values for simplification, while it also considers additional means of carbon

reduction, such as carbon sequestration and offsets.

### *Resilience*

Infrastructure resilience is imperative for efficient long-term planning. Envision supports project teams to deliver informed project design that anticipates and adapts to risks, minimizing overall vulnerability. Credits with regard to resilience deal with withstanding short-term risks, such as flooding, as well as changes in long-term conditions, such as sea level rise and climate variations. The overall objective is to support longer project life-cycles as well as the needs of the communities, for this and the next generations to come.

## Quality of Life

*Envision aims to maximize the quality of life of those who are affected by infrastructure projects, both now and in the future. Within this framework, the Zofnass Program views infrastructure as having a dual function: first to provide the required service, and second to provide this service at an acceptable quality level.*

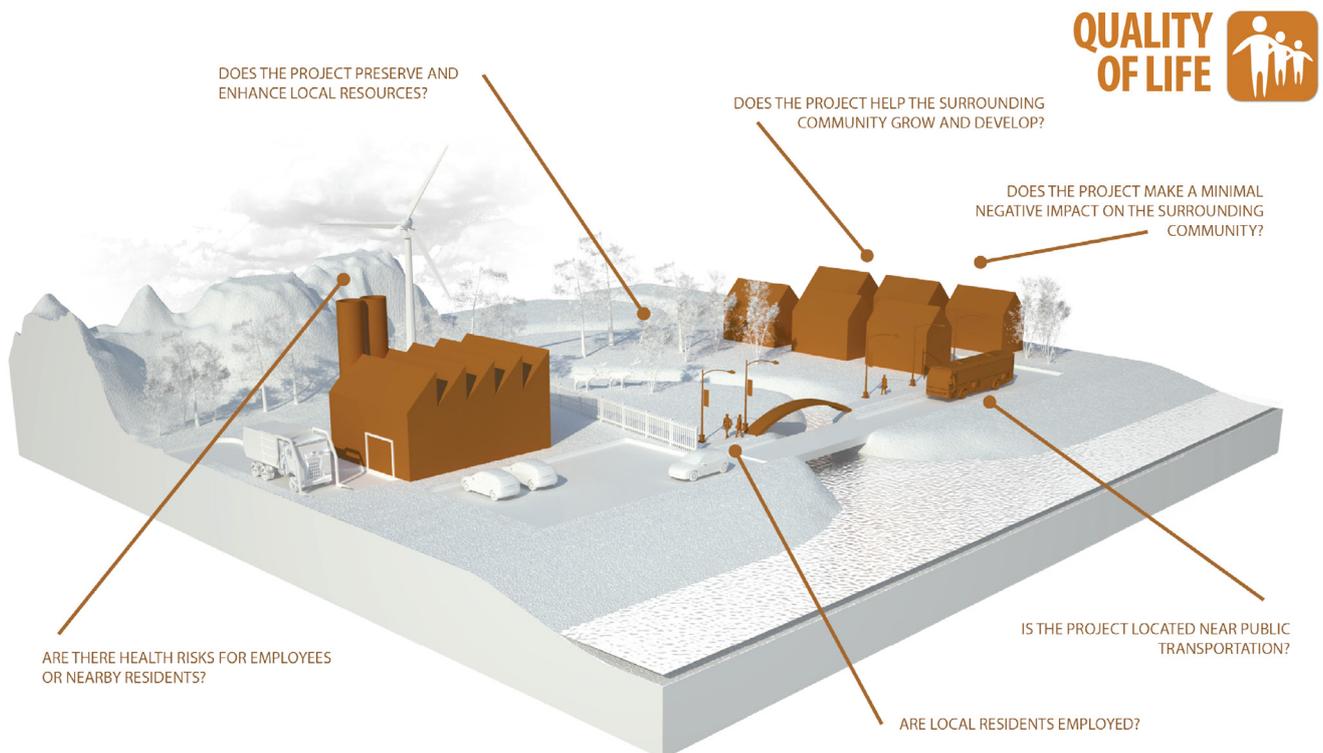


Figure 5: The Quality of Life category. Image courtesy of Zofnass Program at Harvard University & Institute of Sustainable Infrastructure

Quality of Life deals with the impacts that infrastructure projects might have on surrounding communities, encompassing individual, as well as community at large, health and wellbeing considerations. Impacts can be physical, economic, or social. Envision focuses its guidance on facilitating infrastructure projects that consider community aspirations, and are thoroughly planned and established as a part of existing networks. As such, Envision incorporates objectives that support community education, outreach, knowledge creation, and capacity building. It promotes community involvement, and strives to include community members and infrastructure users as crucial stakeholders and part of the decision making process. The category is divided into three sub-categories: Purpose, Wellbeing, and Community.

*Purpose*

Envision addresses fundamental functions of communities such as sustainable growth development, efficient job creation, and general life improvements. Ultimately, during every step of the project, it facilitates the critical consideration whether “This is the right project”. Infrastructure projects can always result in positive impacts, from providing information on their unique sustainable characteristics to disseminating the message about the sustainable development imperative and its impacts.

*Wellbeing*

Envision gives particular attention to addressing individual comfort, health, and mobility. It establishes safety of workers and local residents as an integral part of the project planning process and encourages the incorporation of alternative modes of transportation into surrounding transport networks.

*Community*

Local surroundings and context oftentimes remain in the sidelines during the planning and design stages of infrastructure projects. Envision promotes infrastructure project designs that maintain or improve its surroundings and consider its visual and functional impacts. Both rural and urban setting considerations are incorporated through context-specific objectives to preserve views and natural features as well as the local character of specific built environments. Envision rewards projects that with the help of sustainable procedures incorporate new ways of thinking with regard to their integration into their surrounding communities.

**Leadership**

Leadership deals with how project teams could establish effective communication and collaboration frameworks early in the planning phase to incorporate

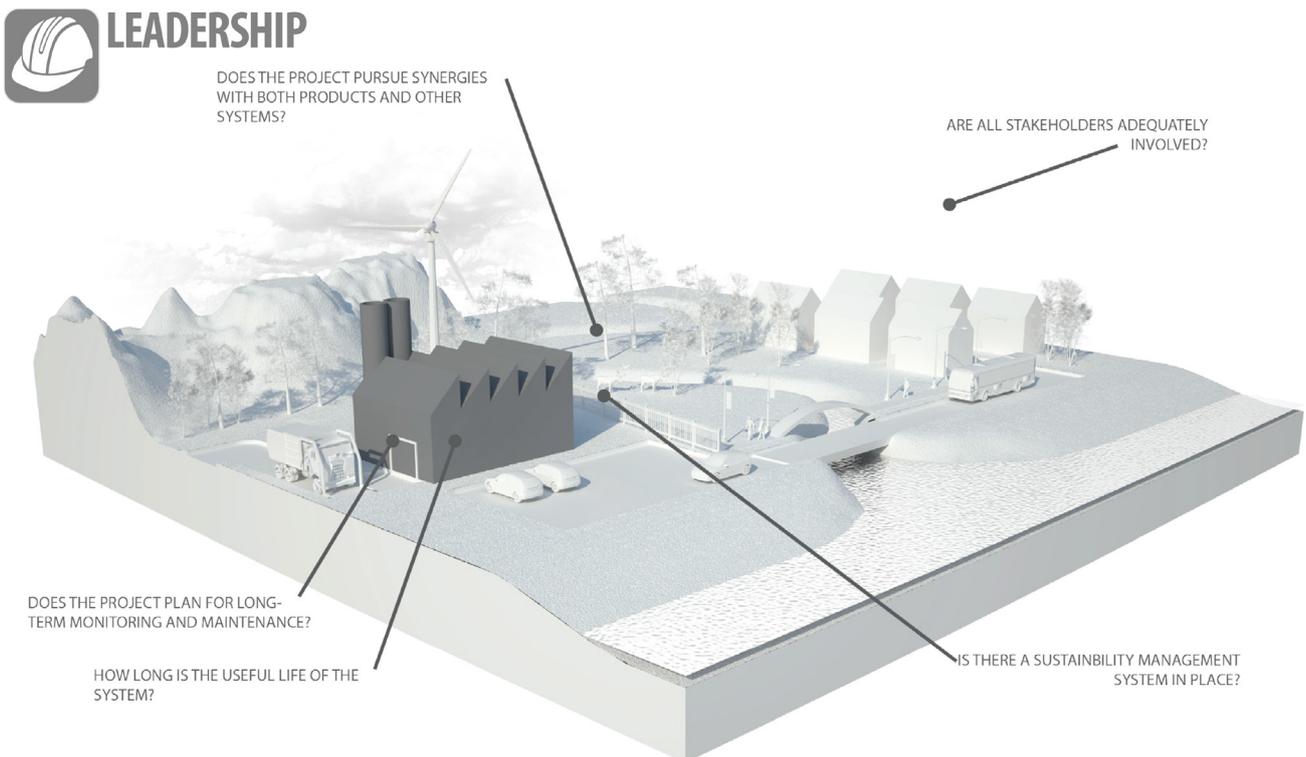


Figure 6: The Leadership category. Image courtesy of Zofnass Program at Harvard University & Institute of Sustainable Infrastructure

new innovative solutions regarding how projects are approached to truly achieve sustainable performance. Envision rewards engaging with different stakeholders to have a diverse overview of the project, as well as encompassing a more long-term, holistic consideration of the project's life-cycle. This section is divided into three sub-sections: Collaboration, Management, and Planning.

### *Collaboration*

Envision explores innovative leadership and commitment from project teams, and encourages effective management practices. Sustainable projects should allow for non-traditional stakeholder input and different perspectives in order to identify diverse innovation prospects.

### *Management*

Envision rewards projects that aim to identify synergies within the project or among larger infrastructure systems. Innovative management practices will maximize sustainability prospects, durability against long-term risks, as well as expand the life-cycle of the project.

### *Planning*

This section encompasses planning and regulatory environment considerations in order to facilitate a long-term view of the project with regard to sustainability. Specific objectives guide project teams to efficient project processes, avoid pitfalls and plan effectively for long-term risks.

## **How the Envision System Works**

### *Point Allocation*

Envision has sixty credits in total, divided into three types: qualitative, quantitative, and yes/no. Each credit corresponds to a specific sustainability indicator, and awards a varying number of points depending on its type. Credits are graded on a five-point scale identified as the levels of achievement: improved, enhanced, superior, conserving, and restorative. For every credit, a point value is earned with each level of achievement. As such, Envision is able to assess the full spectrum of efforts of infrastructure projects, allowing for increased flexibility and requirements tailored for a wide variety of project specifics. *“Levels of achievement always build upon one another. It is not possible to meet the*

*requirements for the conserving level without also meeting the requirements for improved, enhanced or superior.” (Envision v2)*

While simple and basic sustainability improvements consist the required first step, long-term actions need to consider restorative performance implications.

Envision aims to promote projects that do more than simply incorporate incremental sustainability improvements that have minimal environmental consequences. It makes restoration its highest goal and awards the last points to projects that restore and enhance communities, their economy, and their immediate surroundings. This also reserves the advantage of following relative long-term industry performance innovations. Projects that want to attain full points are required to progressively adjust their performance. Infrastructure planning and performance ultimately controls the award, as sustainable decisions award more points.

### *Evaluation Criteria*

Envision sets a step-by-step guideline of how to meet each credits' specific requirements, or evaluation criteria. Project teams are required to submit the requested documentation to be assessed by verifiers. If the objectives are met, then sufficient levels of achievement are specified. Qualitative credits involve submitting documentation or detailed descriptions of the actions the project team took to meet the requirements. Quantitative credits require calculations and supporting evidence.

### *Innovation*

Innovative new methods that facilitate sustainable infrastructure and push project performance beyond the expectations of credit requirements are specifically sought and awarded by Envision. For this reason, Envision includes a special Innovate or Exceed Credit Requirements credit, which aims to provide bonus accreditation to projects that push the traditional boundaries and achieve extraordinary sustainable performance.

### *Weights*

Several factors are used to precisely weight awarded points. Primarily, the local – regional context is used as the main weight, since sustainability impacts differ significantly among locations and regions. As such, it is critical for Envision to be adaptable. Consider potable water consumption, for instance. Areas experiencing substantial droughts will

TABLE OF POINT VALUES

			Improved	Enhanced	Superior	Conserving	Restorative	
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
2			QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
3			QL1.3 Develop local skills and capabilities	1	2	5	12	15
4		COMMUNITY	QL2.1 Enhance public health and safety	2			16	
5			QL2.2 Minimize noise and vibration	1			8	11
6			QL2.3 Minimize light pollution	1	2	4	8	11
7			QL2.4 Improve community mobility and access	1	4	7	14	
8			QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
9			QL2.6 Improve site accessibility, safety and wayfinding		3	6	12	15
10		WELLBEING	QL3.1 Preserve historic and cultural resources	1		7	13	16
11			QL3.2 Preserve views and local character	1	3	6	11	14
12			QL3.3 Enhance public space	1	3	6	11	13
			<b>13</b>	<b>27</b>	<b>62</b>	<b>150</b>	<b>151</b>	
13	LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
14			LD1.2 Establish a sustainability management system	1	4	7	14	
15			LD1.3 Foster collaboration and teamwork	1	4	8	15	
16			LD1.4 Provide for stakeholder involvement	1	5	9	14	
17		MNGMT.	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
18			LD2.2 Improve infrastructure integration	1	3	7	13	16
19		PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3		10	
20			LD3.2 Address conflicting regulations and policies	1	2	4	8	
21			LD3.3 Extend useful life	1	3	6	12	
			<b>10</b>	<b>31</b>	<b>56</b>	<b>115</b>	<b>31</b>	
22	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
23			RA1.2 Support sustainable procurement practices	2	3	6	9	
24			RA1.3 Use recycled materials	2	5	11	14	
25			RA1.4 Use regional materials	3	6	9	10	
26			RA1.5 Divert waste from landfills	3	6	8	11	
27			RA1.6 Reduce excavated materials taken off site	2	4	5	6	
28			RA1.7 Provide for deconstruction and recycling	1	4	8	12	
29		ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
30			RA2.2 Use renewable energy	4	6	13	16	20
31			RA2.3 Commission and monitor energy systems		3		11	
32		WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
33			RA3.2 Reduce potable water consumption	4	9	13	17	21
34	RA3.3 Monitor water systems		1	3	6	11		
			<b>29</b>	<b>66</b>	<b>112</b>	<b>170</b>	<b>62</b>	
35	NATURAL WORLD	SITING	NW1.1 Preserve prime habitat			9	14	18
36			NW1.2 Protect wetlands and surface water	1	4	9	14	18
37			NW1.3 Preserve prime farmland			6	12	15
38			NW1.4 Avoid adverse geology	1	2	3	5	
39			NW1.5 Preserve floodplain functions	2	5	8	14	
40			NW1.6 Avoid unsuitable development on steep slopes	1		4	6	
41			NW1.7 Preserve greenfields	3	6	10	15	23
42		L&W	NW2.1 Manage stormwater		4	9	17	21
43			NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
44			NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
45		BIODIVERSITY	NW3.1 Preserve species biodiversity	2			13	16
46			NW3.2 Control invasive species			5	9	11
47	NW3.3 Restore disturbed soils					8	10	
48	NW3.4 Maintain wetland and surface water functions		3	6	9	15	19	
			<b>15</b>	<b>33</b>	<b>86</b>	<b>165</b>	<b>169</b>	
49	CLIMATE	Emission	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
50			CR1.2 Reduce air pollutant emissions	2	6		12	15
51		Resilience	CR2.1 Assess climate threat				15	
52			CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
53			CR2.3 Prepare for long-term adaptability				16	20
54			CR2.4 Prepare for short-term hazards	3		10	17	21
55	CR2.5 Manage heat islands effects	1	2	4	6			
			<b>12</b>	<b>21</b>	<b>39</b>	<b>100</b>	<b>101</b>	
			<b>79</b>	<b>178</b>	<b>355</b>	<b>700</b>	<b>514</b>	

Figure 7: The Envision credits, levels of achievement and point scores. Image courtesy of Zofnass Program at Harvard University & Institute of Sustainable Infrastructure

Other means such as thresholds are also used where scientifically possible, where commonly accepted thresholds for human or wildlife danger are available in the case of pollutant-related credits, such as greenhouse gas emissions. Furthermore, we may consider stakeholder input and infrastructure types to allow local communities to have a say in what is considered important to them.

### *Applications*

Envision considers that sustainability issues may arise at various points during the life-cycle of infrastructure, and every phase of an infrastructure project has unique impacts on sustainability. Typically, infrastructure projects affect larger areas, require a lot of resources, and take longer to plan and construct compared to individual buildings and other construction. Envision promotes infrastructure systems that continue to meet these demands for the next generations to come.

As such, the project team can choose to specifically address time, a factor that is regularly overlooked when applying sustainability rating systems. To take time into account, one could divide a project into relevant phases. In total, we can identify four major phases: planning and design, construction, operations, and decommissioning.

Because timing requirements among different phases may differ significantly, the project team should address each phase separately. This allows to place equal value with regard to sustainability on both the construction and operation phase to comprehensively consider the impact of a project on the environment. Furthermore, by directly certifying operations existing infrastructure and networks are also eligible for analysis, directly broadening the scope of the application.

Expanding the framework to include all phases of an infrastructure project also allows the key stakeholders to encompass the conceptual actions that majorly affect a project's overall sustainability. We can identify this phase as "Explore Options" to facilitate the investigation of many different solutions with regard to addressing the need of an infrastructure project in a more sustainable way. Alternative solutions, however, may not have to be a completely new project. They could also include upgrading an existing system or various non-built solutions, such as policy or education. Envision specifically promotes projects that follow sustainability principles throughout their complete lifecycle. It guides projects to meet evaluation criteria in all phases reserving special

recognition for projects that aim and achieve these goals.

### *Explore Different Infrastructure Options*

Evaluating the need for infrastructure that exists within a given society is very important and the first stage towards achieving sustainability. At this stage, different infrastructure options should be explored, without deciding immediately on a given solution. This evaluation phase should be planning or design, to thoroughly investigate whether the need for a specific project is legitimate, as well as to explore alternative options that could potentially satisfy that need. It is critical to identify alternative solutions that could potentially upgrade an existing system or include non-built solutions. Oftentimes a different type of infrastructure project than originally thought might be more sustainable.

Explore options could potentially be the most influential stage with regard to sustainability, and oftentimes requires the buy-in of a diverse array of stakeholders. Here it is important to follow a recommended procedural framework (like Envision), including guidelines for the project phase and a set of alternatives for consideration. This can encompass broad categories of alternatives with the goal to educate users, owners, politicians, and communities about potential sustainability best practices, technologies and ecological solutions. Alternatives can include the upgrade or retrofit of existing systems, the construction of new infrastructure, investment in natural systems, policies that lead to demand reduction, and doing nothing.

## **Integrating the Economic Externalities**

Envision focuses on environmental, social and governance/ leadership aspects of sustainability. Sustainability, however, is multifaceted and economics is one of its most crucial parameters. Even when developing sustainably, infrastructure projects might unintentionally affect nearby systems and the societies that depend on them. Even the most sustainable projects have costs beyond those explicitly stated in project budgets. These costs and benefits, commonly known as externalities, are often intangible, indirect and require long-term considerations for their quantification. Therefore, project teams frequently reach roadblocks when stakeholders struggle to identify sustainability opportunities and the inherent benefits between economics and sustainability.

In conjunction with Envision, the Zofnass Program has developed an economic assessment tool to help project owners identify the benefits of pursuing sustainable solutions. More importantly, they can determine the sustainable return on investment of their sustainable project designs. The Zofnass Economic Process Tool (Zofnass) , developed in collaboration with the Harvard Business School, provides project teams with a preliminary quantification and monetization of their projects' potential externalities based on the Envision Rating System. It further expands the Envision Rating System and reinforces its economic dimension. The Economic tool pioneers the field of interactive quantification and monetization tools developed in parallel with a comprehensive sustainability rating system.

The tool is in the form of an easy to use web and mobile application. It allows users to develop their unique inventory with their specific values to attain transparent externality quantification. Users are guided through a specific three-step process illustrating the outcome of following the Envision guidelines, and the respective added value. A comprehensive data set is utilized to specify a range of values that might correspond to their project requirements. A report sheet is included at the end with calculation methodologies, source lists, and brief descriptions of values that correspond to each external effect. As such, no background in economics is necessary, ensuring that all infrastructure stakeholders can use it for a wide variety of applications. This process facilitates stakeholder engagement, and provides an easy to understand, transparent justification to promote the implementation of sustainable projects and supports their acceptance by surrounding communities and stakeholders.

## Next Steps

An integral part of Envision is to provide a framework for sustainable infrastructure that is scalable and adaptable to any future risks and environmental changes, and the Zofnass Program continues to perform upgrades and integrates innovative technological changes to Envision. In the course of the next years, however, we are likely to witness a substantial rise in already growing climate variations, urban pressures, and resource constraints. For these reasons, the Zofnass program plans to expand the Envision Rating System from its current state of individual infrastructure project applicability to encompass city scale infrastructure systems. The Zofnass Program is already developing infrastructure

planning guidelines at urban scales, modeled after evaluation criteria for highest certification in the Envision Rating System. The guidelines cover energy, water, transportation, solid waste, landscape, food, and information infrastructure, as well as their synergies on urban planning and policy making.

## Potential Application of Envision in Lebanon

The Envision rating system for sustainable infrastructure is promoted through the Institute for Sustainable Infrastructure (ISI) (sustainable infrastructure), which is the entity responsible for all project certifications through Envision and professional engineer accreditations. As many countries witness the need for a unified framework to evaluate and assess sustainability for existing as well as new infrastructure projects, the need to apply Envision will be prevalent. Each country needs are and will be different, but all have a common denominator: their people's quality of life, as well as their economic development and environmental preservation are intrinsically linked to successful and well-planned infrastructure projects.

Lebanon is no exception: the country needs in new infrastructure projects, as well as in the rehabilitation of existing systems, are substantial. In parallel, the country's natural resource inventory and potential for renewable sources of energy is equally strong. As such, Lebanon would benefit much from the dissemination and application of a system like Envision, in order to provide a holistic framework for assessing different infrastructure projects and prioritizing needs and resources. Envision could be applied from the very early stages of project evaluation, and in combination with the Zofnass Economic Tool (or similar holistic cost-benefit analyses) could provide a decision-making process for planning and delivery of infrastructure. As Bill Bertera, Executive Director of the Institute for Sustainable Infrastructure, would point out, "The purpose of Envision is to initiate a systemic change... to transform the way infrastructure is designed, built, and operated." (Envision v2, 2012).

The first steps of such an introduction of Envision to the country will need to include the establishment of a reputable institution to handle the application of the system and any adaptations necessary. ISI in the United States would be the obvious partner for any such effort, which would need to include several partners in Lebanon for success. The paradigm in the United States, where ISI partnered with Harvard's

Zofnass Program for Sustainable Infrastructure, is one example to potentially follow. A reputable academic institution can provide the grounding and resources necessary to support the first steps of bringing Envision to Lebanon, and a professional organization like ISI can ensure the relevance of the system towards the industry needs. Other key local partners will definitely need to include, formally or through a partnership, the participation of respective government bodies and agencies, established NGOs and the eventually the large industrial firms of the country. It is only through such effective and diverse partnerships that sustainability can both be meaningful and grounded in reality, with a long-term perspective and the means required for immediate action.

The benefits of bringing Envision to Lebanon are many: the engineering and planning/ design industry will have a rating system and guidelines for application to inform their work and communicate its benefits; a infrastructure project owners and operators from different sectors, technologies and scales will have a common framework to balance and evaluate environmental and social impacts; government decision-makers will have a system to both direct limited resources and also explain the rationale of such decisions to the public; citizens will be introduced to a framework that combines the many different aspects of sustainable development and explains its tradeoffs, and as such will be better informed about the impacts of projects in their lives.

## Conclusion

Infrastructure is the lifeblood of our cities and societies; the connecting tissue that enables to move, see, work and feel as individuals and as organizations. Infrastructure systems are complex, large, interconnected, and expensive; their impacts on the environment and communities will be significant – either positive or negative. As such, the development of a holistic framework to assess and quantify sustainability for infrastructure projects is a necessity that enables decision-makers and project stakeholders to balance impacts, provide guidelines and best practices and decide about the optimal configuration of technology, design and resources within a given project. The Envision rating system came to fill that gap. More importantly, Envision doesn't stop in analyzing a given project and optimizing its design – it is a framework to identify the right project for a given societal need. Doing the right project is maybe more important than doing a project right; even if that means that sometimes, a project

should not happen. Sustainability addresses the delicate balance between current needs and the future's potential. Tradeoffs are bound to happen, and after-the-fact changes on projects will always be very costly. Cities and countries worldwide will need to invest trillions of dollars in the coming decade to meet the needs of their populations. Lebanon is no exception and Envision could be a framework to guide decisions for future infrastructure investment in the country.

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Beirut, Maarad street, Building 287 B, 1st floor, Lebanon  
T/F: +961-1-981944  
[info@cedro-undp.org](mailto:info@cedro-undp.org)  
[www.cedro-undp.org](http://www.cedro-undp.org)