SUSTAINABILITY

Sustainability assessment (SA) is one of the most complex types of appraisal methodologies. Not only this does entail multidisciplinary aspects (environmental, economic and social), but also cultural and value-based elements. Besides, SA is usually conducted for supporting decision making and policy development in a broad context.

Principles-

Different principles of sustainability are-

1)The First Principle:
Contain entropy and ensure that the flow of resources, through and within the economy, is as nearly non-declining as is permitted by physical laws

2)The Second Principle:
Adopt an appropriate accounting system, fully aligned with the planet's ecological processes and reflecting true, comprehensive biospheric pricing to guide the economy.

3)The Third Principle:
Ensure that the essential diversity of all forms of life in the Biosphere is maintained.

4)The Fourth Principle:
Maximize degrees of freedom and potential self-realization of all humans without any individual or group, adversely affecting others.

5)The Fifth Principle:
-Maximize degrees of freedom and potential
-Recognize the seamless, dynamic continuum
-Of mystery, wisdom, love, energy, and matter
-That links the outer reaches of the cosmos
-With our solar system, our planet and its biosphere
-Including all humans, with our internal metabolic systems
-And their externalized technology extensions —
-Embody this recognition in a universal ethics
-For guiding human actions

Different principles of SA are as follows-

1)Guiding vision. Progress towards sustainable development should be guided by the goal of delivering well-being within the carrying capacity of the biosphere and ensuring it for future generations.

2)Essential considerations. Underlying social, economic and environmental components of the system as a whole should be taken into account as well as the interactions thereof. This includes issues related to governance; the dynamics of current trends and drivers of change, and interactions thereof; the risks, uncertainties, and activities that can have an impact across boundaries; and the implications for decision making (including trade-offs and synergies).

3)Adequate scope. The assessment of progress towards sustainable development should adopt an appropriate time horizon, to address both short- and long-term effects of current policy decisions and human activities, and an appropriate geographical scope, to capture both their local and their global effects.

4)Framework and indicators. SAs should be based on: a conceptual framework as basis for identifying core indicators and related reliable data, projections and models; the most recent data in order to infer trends and build scenarios; standardised measurement methods wherever possible, to ensure comparability. Finally, the comparison of indicator values with targets and benchmarks has to be performed, where possible.

5)Transparency. In the context of SAs, transparency of data and data sources, models, indicators and results is crucial, as well as public accessibility to the results. Choices, assumptions and uncertainties which determine the results of the assessment have to be clearly reported and explained. Equally, sources of funding and potential conflicts of interest have to be disclosed.

6)Effective communications. SAs should be required to use clear and plain language, to ensure effective communication and to attract the broadest possible audience as well as minimise the risk of misuse; for building trust and aid interpretation, information should be presented in a fair and objective way as well as supported by innovative visual tools and graphics;

7)Continuity and capacity. SAs require that they are complemented by a continuous monitoring phase. Therefore, repeated measurement as well as responsiveness to change are needed. Investments are therefore necessary to develop and maintain adequate capacity (via, for example, continuous learning and improvement).

8)Broad participation. SAs should find appropriate ways to strengthen legitimacy and relevance, engaging early on with users of the assessment, reflecting the views of the public while providing active leadership.

Procedure-

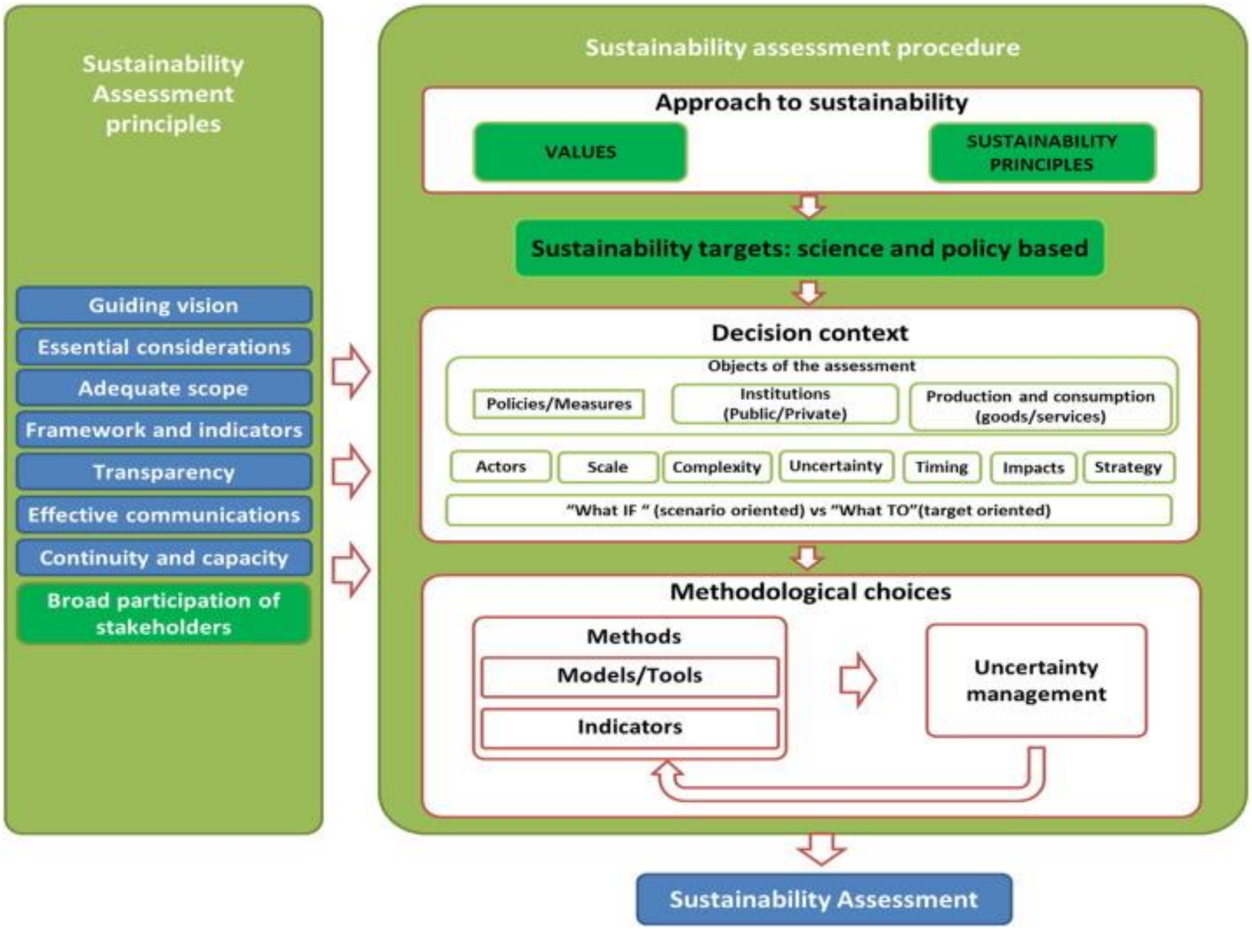
The SA procedure comprises several steps, based on the definition of the approach to sustainability, the sustainability targets, the decision context and the methodological choices for the assessment, as presented in Fig. 1 at the beginning of this section. The selection of the most appropriate approach has to be evaluated case-by-case and will influence the final phase consisting of the pure assessment framework.

This is the core of the SA framework. It is composed of different phases:

-identification of the most suitable assessment methodologies (and related methods,3 models, tools, and indicators);

-sensitivity and uncertainty analysis of the assessment framework;

-definition of monitoring strategies to track progress towards sustainability



We have outlined here three approaches to the identification and selection of suitable methodologies and related methods for sustainability assessment, to be applied in the specific case/context:

•the reductionistic approach, in which the results of several models and tools are combined, covering the three pillars;

•the holistic approach, in which methods and models specifically developed for SA are chosen, in order to assess the emergent properties of the socio-ecological system affecting the problem/issue being evaluated;

•the combined approach, in which in the framework of the holistic approach to the evaluation, the reductionistic model and methods are used to delve into some specific theme/issue within the assessment.

In the context of SA, the analyst often needs to combine different methods, models and indicators. The main challenges that we identified in the combination/integration of these SA methods are:

•How to combine different tools/methods (from concepts to data), assuming that, from multidisciplinary and interdisciplinary perspectives, such a combination might be feasible and meaningful, and the results robust (see, e.g. Castellani and Sala, 2012);

•How to set hierarchically-different tools to assess and measure the emergent properties of the socio-ecological systems at hand (specifically developed for tackling sustainability problems);

•How to address uncertainty propagation;

•How to assure the Galilean replicability/comparability of the evaluation, especially considering that SA implies dealing with complexity and non-linearity, presenting a dynamic variation of the system rather than a linear relationship of a cause-effect type (Gallopin, 2001);

•How to ensure transparency.

Subject Area: Air Pollution / Transport

Geographic Area: California, United States

Focal question: Have federal, state, and local economic incentives been successful in promoting the sale of zero emission vehicles (ZEV) in California?

SOURCES:

(1) California Air Resource Board, http://arbis.arb.ca.gov

(2) Interview with Tom Avasenk of the California Air Resource Board

(3) Environmental Protection Agency, http://www.epa.gov

(4) Calstart News Center, http://www.calstart.org

(5) Activist Corner, Transportation, http://www.ucsusa.org

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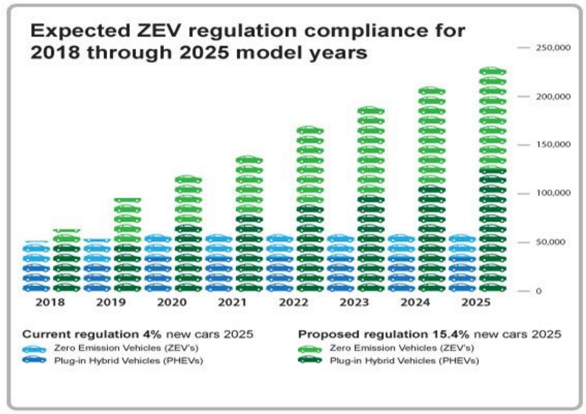
review the:

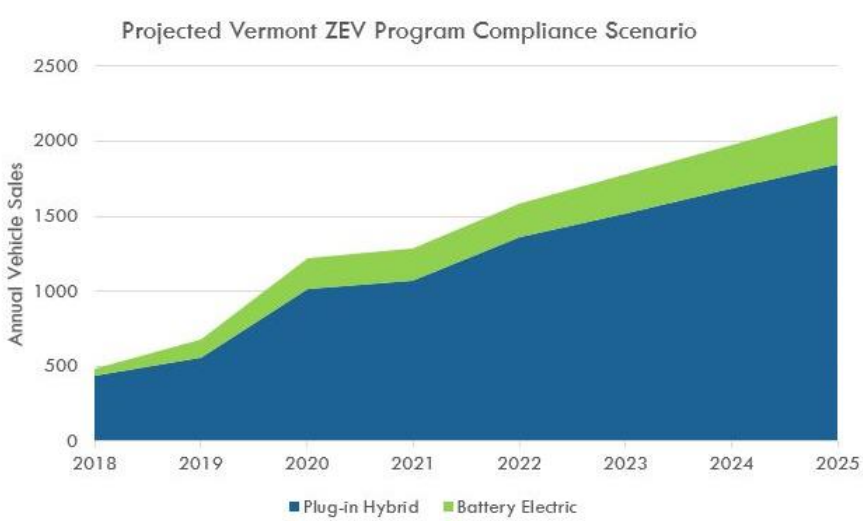
During the late 1980s it became clear that



California's growing air pollution problem could not improve without some very significant changes. Motor vehicles were targeted as a major contributor to this problem, as traditional gasoline-driven and diesel vehicles are more than 60% of smog-forming pollutants in California. This fact led to a move to evaluate various solutions to the mobile source air pollution problem. One of the most progressive solutions laid on the table was the further development of zero emission vehicles (ZEVs). By 1990, the California Air Resource Board (CARB) determined that even significant improvements in gasoline and diesel-powered combustion engines could not clean them enough to meet the drastic cuts in air pollution mandated by the state of California. Either driving would have to be restricted or a switch would have to be made for non-polluting vehicles. The CARB decided that a switch to emission vehicles without tailpipe or evaporation made the most sense and adopted low emission vehicles and clean fuel regulations.

Low emission vehicles and clean fuel regulations include requirements that outline ZEV production for the seven largest auto producers through the year 2003. As per the original plan, ZEVs would be 2% of total production in 1998, 5% in 2001 and 10%. In 2003 and thereafter. However, the interests of car manufacturers and the oil industries were accepted in a court ruling that revised the requirements. The requirements of 1998 and 2001 were changed to a fixed 3,750 vehicles each year. The original ten percent requirement for 2003 was not changed.

To help auto manufacturers meet these regulations, economic incentives were created at the federal, state, and local levels. These incentives were adopted to help determine the cost of such an expensive change in technology. Lead-acid, nickel-metal hydride and lithium-ion batteries currently used in ZEV are still in the development stage and are being produced in very limited quantities, causing their price to remain extremely high. For this reason, the government introduced incentives that seek to bring the price of the ZEV to a level comparable with traditional vehicles to ensure that the auto manufacturer sells its prototype vehicles and is scheduled for 1998, 2001 and 2003 Be able to meet the requirements. .

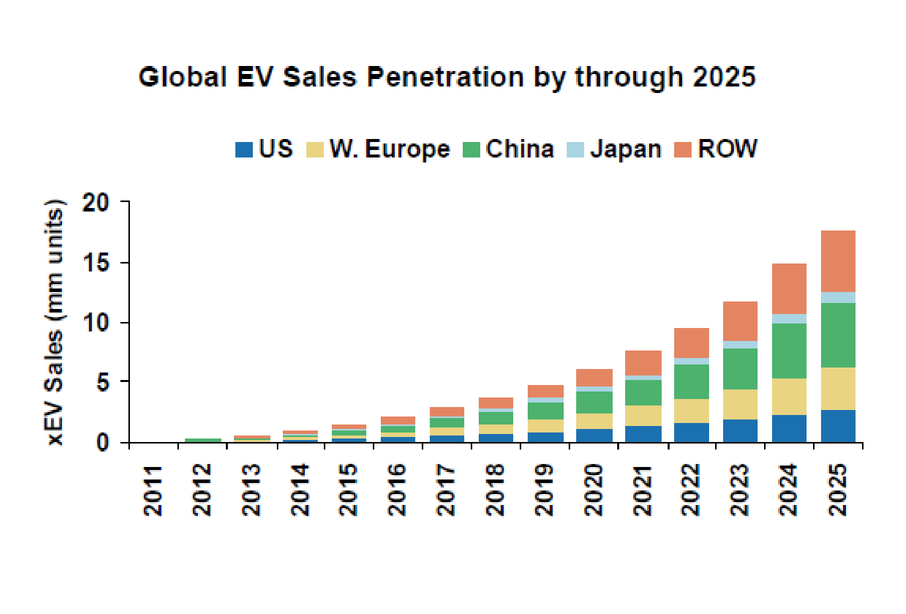


The first incentive adopted in 1992 was at the federal level. The government offered a 10% tax credit (up to $ 4,000) at the cost of a ZEV. The federal incentive also includes a $ 100,000 business tax deduction for electric recharging facilities. In

addition, the Energy Policy Act of 1992 provided a ten-year $ 50 million electric vehicle demonstration program and a fifteen-year $ 40 million cooperative program between government and industry for research, development and demonstration of electric vehicle infrastructure. Finally, the federal government abolished the luxury tax on alternative fuel vehicles.

California's state incentives on ZEV began to emerge in 1995. The California Energy Commission began funding the Electric Vehicle Loan Program which provides an electric vehicle, charging and technical assistance to representatives of local public agencies who are likely converting their fleet to ZEVs. The California Energy Commission and the

US Department of Energy now provide $ 5,000 (a cap of 200,000 vehicles) for the rising cost of an electric vehicle for fleets located in specific high-pollution cities.



Source: Company data, FactSet, Morgan Stanley Research

A number of local incentives for ZEV have also been established in the last two years. The South Coast Air Quality Management District, which includes Los Angeles, and the San Diego Air Pollution Control District offer a $ 5,000 rebate on every electric vehicle sold prior to 1999. In addition, Los Angeles Airport provides free parking and charging for ZEV at its central terminal. . Local utility providers also offer incentives to purchase ZEV. Edison International offers $ 3,600 to any employee interested in the lease or purchase of ZEV. The Los Angeles Department of Water and Power, San Diego Gas and Electric, Sacramento Municipal Utility District, and Pacific Gas and Electric all offer discounted electricity rates for recharging during the off-peak period.

Subject Area: IIT-Roorkee to work on energy efficiency with Power-grid Corp

The Indian Institute of Technology (IIT) Roorkee on 12th July, 2019 signed an MoU with Power Grid Corporation of India Ltd (POWERGRID), state-run utility, on energy efficiency and sustainable energy.

The MoU targets to bring together academic and industry/corporate prowess, in building efficient, reliable and low-cost energy systems.

The main objective of this MoU is to have long term association between POWERGRID and IIT Roorkee in the area of Energy Management, the institute said in a statement.
POWERGRID is a Navratna Central Public Sector Enterprise and the Central Transmission Utility (CTU) of the country involved in Inter-State Electric Power Transmission Planning and Execution.

"We look forward to working together for improving energy efficiency in IITR campus. Energy efficiency is the key to sustainable development and we believe that our joint efforts will bring good results in this area. It will also help us collaborate for research in this area," said Professor Ajit K. Chaturvedi, Director, IIT Roorkee.

The MoU aims at advancing and implementing energy efficiency and sustainable energy projects at IIT Roorkee campus in the mutually agreed areas of space cooling/heating, lighting and fans, water pumping, power distribution, waste to the energy, etc. The

MoU also aims at carrying out joint Research and Development related to Energy sector.

According to Sanjay Garg, Executive Director, POWERGRID, thanked IIT Roorkee for entrusting their company with this prestigious association.
"IIT Roorkee is the first-ever academic institution for which POWERGRID will be providing cost-effective state of the art energy efficiency solutions. With this collaboration, we believe that there is going to be a lot of learning for our team members too," he said.

EXAMPLES OF SUSTAINABLE DEVELOPMENT
WIND ENERGY

Wind energy is the use of wind to provide the mechanical power through wind turbines to turn electric generators and provide energy. Wind power is a sustainable and renewable energy.

SOLAR ENERGY
Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis.

CROP ROTATION
Crop rotation is the practice of growing a series of dissimilar or different types of crops in the same area in sequenced seasons. It

is done so that the soil of farms is not used for only one set of nutrients. It helps in reducing soil erosion and increases soil fertility and crop yield.

NUMERICALS

Example

Find the delta for a crop when its duty is 864 hectares/cumec on the field. The base period of this crop is 120 days.

Solution.

In this question, $B = 120$ days; and $D = 864$ hectares/cumec

Since, $\Delta = \mathbf{864}\ \boldsymbol{B / D}\ \boldsymbol{cm}$

$= 864 \times 120 / 864$

$= 120$ cm

Example 1

If rice requires about 10 cm depth of water at an average interval of about 10 days. and the crop period for rice is 120 days, find out the delta for rice.

Solution.

Water is required at an interval of 10 days for a period of 120 days.

Hence, No. of required waterings = 120/10 = 12

Therefore, Total depth of water required = No. of waterings x Depth of watering

= 12 x 10 cm = 120 cm.

Hence, Δ for rice =120 cm. **Ans.**

PEOPLE INVOLVED IN THIS PROJECT

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