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Acoustic Filters for Sensors and Transducers: Energy Policy Instrument for Monitoring and Evaluating Holy Places and Their Habitants

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Abstract

The aim of the study is to present a brief overview of energy policy instrument for monitoring and evaluating holy places and their habitants with the aid of acoustic filters for sensors and transducers. A monitoring protocol for policy instrument is presented for noise protection and security from power systems. Methods of information and data collection are briefly elaborated. The power systems are classified as per source signals of solar power, electric power, light power, sound power, heat power, fluid power and fire power. The acoustic filters as per source of noise signals from power systems are defined. The filters are differentiated as per source signal of unwanted frequencies from solar power, electric power, light power, sound power, heat power, fluid power and fire power. Some examples of acoustic filters are mentioned as per source of noise signal. A slide rule for noise measurement is illustrated along with its noise grades and flag colors under limiting conditions. Some noise filtering results from various power systems of an outdoor duct are also tabulated. An overview of noise systems integration with command and control center is described. A brief discussion on management of holy places and their habitants through monitoring and evaluation is also mentioned.

Keywords: source, security, power system, signal, acoustic filter, sink, resonance, holy place, monitoring

1. Introduction

With increasing demands of worshiping, the world's holy places are congesting at an alarming rate. Many reasons are attributed to this crowding, some of which are given below:

- Growing human and worshipers' population;
- Increased purchasing power, high standard of living, and ease of travel caused sprawl at holy places;

- Increase in spiritual life style and thoughts with diversion from main stream of life because of increase in unemployment and dissatisfaction rates;
- Increase in awareness and beliefs about various faiths and religions.

1.1 Pressures on holy places

The growing pressures on holy places are leading to degradation of land and water bodies besides causing noise due to unwanted physical agents (heat, fluid, electricity, light, sound and fire) at these places [1]. The sprawl and congestion at Holy places is narrowing the access to the human resource base, especially for rural poor, who are directly dependent on these places of worships for their day to day existence. In addition, it has resulted in a serious local shortage of material resources, which is affecting the global economy and people in all walks of life.

‘Noise’ is defined as a sensation of unwanted intensity of a wave, is a perception of pollutant and a type of environmental stressor [2]. An environmental stressor of noise can have detrimental effects on various aspects of health. It is important to filter out unwanted intensity of wave from power systems (such as heat, fluid, electricity, light, sound, fire and sun) with use of acoustic filters for sensors and transducers after proper signal conditioning. This chapter contains basic introduction on monitoring and its protocol for the policy instrument on noise protection and security from power systems at holy places. Lot of noise and discomfort levels has been observed due to crowding and unwanted physical agents at holy places. The effects of unwanted physical agents from various power systems at holy places need to be thoroughly investigated.

The power systems are classified as per source signals of solar power, electric power, light power, sound power, heat power, fluid power and fire power [1]. The acoustic filters as per source of noise signals are defined [1–12]. The filters are differentiated as per source signal of unwanted frequencies from solar power, electric power, light power, sound power, heat power, fluid power and fire power. Some examples of acoustic filters for sensors and transducers with their energy balance for a human brain along with human comfort and health are exemplified [1, 2]. A slide rule for noise measurement is illustrated along with noise grades and flag colors under limiting conditions [1, 2]. Detail discussions on dynamics of holy places are also presented later in the chapter.

1.2 Literature review

There are various aspects of studying power systems. Numerous studies are conducted on power systems from energy and economic point of view. Taner and Demirci [13] presented energy and economic analysis of the wind turbine plant’s draft for the Aksaray city. A 1 MW of the wind turbine plant was calculated for energy and economic analysis. Taner [14] conducted scenario analysis for a wind power plant in the Cappadocia region. The region was selected due to its high wind potential. This study determined that the construction of wind power plant can be suitable for the Cappadocia region by using the escalation method of inflation. Topal et al. [15] studied the significance of a trigeneration (TG) system. In this theoretical study, a trigeneration system converts a single fuel source into three useful energy products (i.e. power, heating and cooling), and focuses on the simulation with direct co-combustion of poultry wastes. Taner et al. [16] presented a case study of energy management in a sugar factory in Turkey. The study has analyzed energy consumption, the quantity of material production, and figure out a suitable energy efficiency measures for the sugar factory. Topal et al. [17] performed

thermodynamic analysis on Çan Circulating Fluidized Bed Power Plant (CFBPP) co-fired with olive pits. Taner and Sivrioglu [18] conducted energy and exergy analysis of a model sugar factory in Turkey. The study determines the best energy and exergy efficiency with mass and energy balances as per design parameters for a sugar factory. Taner [19] studied the optimization processes of energy efficiency for a drying plant. The objective of study was to find the optimum energy and exergy efficiencies for the drying plant (production of bulgur). Taner [20] studied the performance of a proton exchange membrane (PEM) fuel cell with variation of its pressure and voltage parameters. The objective of the study was to improve the performance, efficiency and development of modeling and simulations of PEM fuel cells with aid of experimental optimization. Taner and Sivrioglu [21] developed a general model (sugar production processes) based on data provided by a real plant through an exergy analysis. The study explored the improvement of performance indicators of a turbine power plant through thermoeconomic analysis.

Some studies are also conducted on monitoring of pilgrims of holy places. Suryavanshi and Pandita [22] developed Wireless Sensor Network (WSN) based parameters for each pilgrim, who is equipped with a mobile unit which consists of micro-controller, GPS, GSM module, LCD, heartbeat sensor, temperature sensor, keypad and battery. Server unit initiate and transmit the query to mobile unit. On receiving the query by Mobile unit, it transmits its UID, latitude, longitude and a time stamp as a reply of received query to the server. Rajwade and Gawali [23] presented a real-time pilgrim tracking and health monitoring system, which was designed and implemented using Arduino in order to help the authority solve problem of pilgrim tracking and health monitoring system. A wearable unit was provided to each pilgrim for sensing the location and vital health parameters of that person. The authority in the control room was connected to the wearable unit using global system for mobile communication. The significance of this system is benefits to both pilgrims as well as to the authority.

Studies are also conducted on acoustic and other comfort parameters at religious places and mosques. Adnan et al. [24] presented a study to assess the acoustic quality level of three public mosques in Batu Pahat. They presented that good acoustic quality is necessary for appreciation in prayers. Karaman and Guzel [25] investigated the objective parameters of sound for the main prayer hall of the Bedirye Tiryaki Mencik Mosque in Manisa (Turkey). Prawirasasra and Mubarak [26] studied Syamsul Uloom Mosque (MSU) located at Telkom University, Indonesia for its actual acoustic condition and acoustical design. Main hall was considered as primary venue and is taken as analysis area. Measurements of the mosque covered only speech-related objective parameters; reverberation time (RT), Definition (D50), Sound Strength (G) and Noise Criteria (NC). Gul and Caliskan [27] discussed the design issues of a contemporary mosque, namely, Dogramacızade Ali Pasa Mosque in Ankara, Turkey. Architectural design parameters are evaluated supported with acoustical parameters with aid of computer simulation. Sezer and Kaymaz [28] studied users' perception of indoor environmental conditions in historical mosques in Turkey. The study focused on thermal, visual and acoustical comfort. For this purpose, a user's satisfaction survey was conducted to eight historical mosques' users in Bursa.

Few relevant papers on wind energy conversion and their annoying effects are briefed here. The annoying effects of wind energy conversion were investigated by Pohl et al. [29]. The study combined the methodology of stress psychology with noise measurement with an integrated approach and residents of a wind farm in Lower Saxony were interviewed on two occasions (2012, 2014) and given the opportunity to use audio equipment to record annoying noise. In another study, Krug and Lewke [30] presented a general overview on electromagnetic

interference (EMI) with respect to mega-watt wind turbines. Possibilities of measuring all types of electromagnetic interference were explained with emphasis on a GSM transmitter mounted on a mega-watt wind turbine. Karpat and Karpat [31] reviewed and discussed electromagnetic compatibility (EMC) for a wind turbine.

1.3 Possible solutions

The need of the hour is to conserve these holy places and their habitants. This however requires long term planning and judicious management, developed on the basis of sound scientific knowledge on the status and dynamics of the different holy places and their habitants along with their interaction with the environment and their physical agents. Such information is few and far apart, resulting in a poor understanding of the noise systems at these places.

It is essential therefore to generate a global data base on the present condition of the different noise system parameters at these places. Developing such an information bank, is not easy task, for at following reasons: (i) the existing diversity in noise systems at these places, because of wide variations in climate, topography, land use patterns, noise types, life forms and human societies makes this task immense; and (ii) this diversity in noise systems and human societies, have resulted in very distinct resource use patterns that are area specific.

The data when generated could be used for local specific planning of holy sites, participatory management and appropriate conservation strategies.

1.4 Micro-planning

Micro-planning also referred to as local or decentralized planning is probably necessary for efficient use, management and conservation of holy places [32]. The best source of such information would be the local communities who regularly use these holy places for their basic survival needs, though very little has been learnt from them. Local specific data is therefore scarce, and collecting them is not easy job.

One method of achieving this goal would be, to promote studies on monitoring noise system data parameters at these holy places. Involving the literate local communities, youth and non-governmental organizations, in the task of monitoring, could be one way of solving this problem. Local people with collaboration of experts monitoring their own local habitants as well as monitoring their data would be more effective.

1.5 Importance of monitoring

- Monitoring is a tool, that could be used for developing a data base for micro level planning;
- Monitoring is a process of inventory repeated at regular intervals of time, which can be used for building ongoing or continuous data base of noise systems parameters at holy places and their habitants;
- The first study on a given parameter may be used as the baseline data or information used for comparisons with the periodically monitored information;
- Monitoring gives an in depth understanding of the status and dynamics of the noise data resources in the ecosystem;

- It identifies the needs of the community;
- It helps in evaluating people's own actions;
- It promotes better resource planning both at the individual level and at the community level;
- It gives a continuous feedback during project implementation thus ensuring quality;
- It helps in evaluating real-time data base of noise systems;
- It provides an information base for future projects;
- It furnishes information for decision makers;
- Monitoring is therefore an essential aspect of noise systems resource planning and management.

1.6 Noise systems monitoring methods: an ecosystem approach

As stated by Odum (1983), the term ecosystem means 'systems of the environment'. Thus, the physical environment in a given area or unit, with all the living components there, together with the network of interactions among these people and with their physical environment constitutes an ecosystem [32].

1.6.1 Collection of essential information on the ecosystem

The first part in noise systems monitoring study is to define a geographical area of the holy place where the study is to be conducted. Once the study area is selected, some important background information about this region needs to be collected in order to plan and conduct a scientific study on noise systems monitoring. This information is mainly on two aspects of the chosen study area, namely the socio-economic features and acoustic filters use patterns.

Given below is a list of background information that may be collected from the ecosystem of holy places and their habitants:

- Historical and cultural information about the area (e.g. changes in soil quality, water quality and its availability, traditional spiritual practices etc.);
- Information on social, economic, educational, demographic (local and transit population), health and development activities;
- Maps of the land;
- Soil conditions;
- Facts on water resources, rainfall, solar and temperature pattern;
- Data on all the households in the noise ecosystem;
- Information on acoustic filters use pattern and their topography.

2. Monitoring protocol

The theory of 'Acoustic filters for sensors and transducers' as proposed by the author is used in designing energy policy instrument for monitoring and evaluation of holy places and their habitants [1]. The noise data monitoring protocol has to be structured with a systematic approach. Depending upon interaction with local authorities of the holy places, a specific region specific monitoring protocol can be established on a case to case basis.

A monitoring protocol and its questionnaire can be used for survey of noise ecosystem at holy places. These questionnaires are related to the monitoring and assessment of noise that has to be abated. These noise monitoring surveys are conducted for variety of reasons. These can be: (i) evaluation of current noise levels at holy places; (ii) assess the noise exposure of habitants in their dwellings; (iii) identify sources of noise; (iv) establish a base line data for noise; (v) establish community response through measurement and verification of noise data; (vi) establish laws and legislation for setting up permissible noise levels; and (vii) develop and validate noise models for simulation.

In the monitoring survey, for each parameter the following are explained: (i) the aim of monitoring; (ii) importance of monitoring; (iii) sampling techniques; (iv) the procedure to be followed; and (v) recording and analysis of information. Points that can be considered while taking up a monitoring program: (i) visits to holy places should be structured and informed well in advance; (ii) appropriate modifications can be adopted for field methods depending on local conditions; (iii) developing a good relationship with the local people and organizations is necessary for field monitoring; and (iv) certain rules and precautions should be adopted during the field work depending upon faith and religion.

2.1 Methods of information collection

The first step in noise monitoring program is to collect scientifically sound information or data which can be used for further analysis and interpretation. This can be achieved by appropriate procedures to the noise parameter that is to be investigated. Sampling methods simplify the process of collecting scientifically accurate information. Such data can be used for further analysis to reveal reliable patterns and features of the parameters of the noise monitoring study.

2.1.1 Data collection

This is the first step for a noise monitoring investigation. Utmost care should be taken while collecting the data. A description of data collection methods is briefed here. There are two distinct methods of data collection. Primary and Secondary; Primary data collection involves data that is directly collected during the process of investigation. Secondary data collection involves data that is collected from different sources (i.e. data that is already available).

Methods of primary data collection include: (i) tapping the local knowledge; and (ii) direct measurements. In tapping the local knowledge, the members of the local community are an excellent source of information. They can provide valuable information on the local data. Two methods may be employed to collect information from the local source: (i) formal interviews; and (ii) informal interviews and participant observation. In both the above methods the investigator directly contacts the local inhabitants from whom the information has to be collected. Formal interviews are conducted when: (i) the objectives of the study are clearly defined prior to the interview; and (ii) the contents of the interview are distinctly listed. A structured questionnaire is generally used for this purpose.

2.1.2 Questionnaire

A questionnaire consists of a list of questions related to the noise monitoring investigation [33]. This is prepared by the investigator who collects the information in the space provided in the questionnaire.

Preparation of questionnaire requires a great deal of understanding and thought about the noise system and its affected ecosystem. Some general principles which may assist in drafting the questionnaire may consist of the following parameters:

- The number of questions should be kept to the minimum;
- The questions should be relevant to the objectives of the noise monitoring program;
- The questions should be short and in simple words. They should be unambiguous and easily understood;
- Questions should be arranged in a logical sequence such that, those pertaining to the background of the respondent (i.e. person who is being interviewed) should precede questions on the main information. The respondents could express their views toward the end of the questionnaire;
- As much as possible, the questions should be framed in such a way so as to extract brief, clear answers like 'yes' or 'no';

It is desirable to pre-test the questionnaire (i.e. try it once in the field) in order to check its effectiveness and to eliminate any drawbacks.

Informal interviews and careful observation of the subject often gives better information, as this method, does not have the obvious limitations of the formal approach. Here, the subject without being self-conscious may offer better information. In informal interviews, the number of questions should be limited and relevant to the objective so that the interviewer is able to recall the information later. The interviewer should document the information and observations as soon as possible after the informal interview.

In the direct measurements, the investigator directly measures to find out the required information. Direct measurements can give better information on the various parameters that will be collected and analyzed. Sampling is an important tool which helps in better understanding the quality and quantity of an entire noise ecosystem of holy place and its habitants. When the study area is very large, an extensive study demands enormous amounts of money and human resources. A portion, or sub-set of the entire population referred to as a sample, is therefore chosen for a detailed assessment. Such a careful selection of sample is considered to be as good as examining the entire population. Sample size may be selected depending on: (i) degree of accuracy desired; (ii) time availability; (iii) available financial and other resources; and (iv) available manpower.

2.1.3 Sampling methods

There are many sampling methods for different kinds of ecological studies. In this manual simple random sampling and stratified random sampling are described because they are widely used. These methods result in more reliable representative distribution of samples.

The simple random sampling is used for a homogeneous population. In this technique sample selection is done randomly so that each and every section of the population has the same chance of being included in the sample. This process results in less chance of bias. There are two methods: (a) Lottery method: This is followed to ensure the randomness. In order to use this method for selecting the samples, the names of all the items of the entire population are individually written on paper slips. The slips are folded and scrambled. The numbers are selected using the lottery method. This process is difficult to implement when the population is large. In small population, as the paper slips are taken out, the number of paper slips reduces in the lottery box. Therefore the chances of each paper slip being picked up increases. (b) Random table: To avoid the problems involved in the lottery method the table of random numbers is used. The random table has been tested for its randomness which is well established. Usually the random table gives the figures in four digits. In random sampling the sample size should be large.

Stratified sampling is done if the population is heterogeneous or is made of distinct groups. The population is first classified or divided into the different groups. For example, if a human population study is done in a village the population can be divided into sub groups based on the type of acoustic filters in different households. Each of these groups is distinct and forms a division. The households in a noise ecosystem can be classified according to their socio-economic status (and type of acoustic filter being one of the determining criteria). The stratified random sampling method is considered as the most satisfactory and efficient method as it gives more representative samples. It should be noted however that, great care should be taken while dividing the population into different groups.

Data collection is followed by presentation, analysis and interpretation. After the data collection, it is necessary to be aware of methods of organizing data and performing basic statistical calculations even before one begins the study. Organization involves classifying and tabulating the data collected which is then analyzed and presented in an orderly form.

Methods of secondary data collection involve the information which is already available from different sources and should be collected prior to the field investigation and measurements. These can be: (i) recorded information, which are published data from governmental and non-governmental agencies, scientific institutions and historical records; and (ii) group discussions with the local community, which involve informal group discussions with members of the local community can yield valuable information. This helps in identifying some of the salient features of the ecosystem or community to be studied, which in turn helps in deciding on the noise system parameters that are important in that ecosystem. This also helps in building good rapport with the local community which is essential to collect good information. Discussions can also be held with a few key informants. Maps are essential tools in the monitoring exercise. They give quantitative information on a geographical or spatial scale. Maps are simple, effective and can therefore be easily understood. One can visualize vast spatial information at a glance. Maps tell us exactly where the selected study area is, and in addition, gives details on the physical features of the study area. This saves considerable amount of time in the field. Remote sensing is restricted to methods which use electromagnetic energy, to collect information on the different geographical features on the earth's surface. Based on the physical and chemical properties (tone, texture, shape and location), the different objects on the surface of earth, reflect, re-radiate or emit varying amounts of electromagnetic energy in different wave lengths. The measurements of the reflected, re-radiated or emitted electromagnetic radiation, forms the basis for understanding the characteristic features on the earth. These typical responses are used to distinguish the objects from one another.

2.2 Data interpretation and report making

Interpretation is making conclusions based on the analyzed data. This is the most important part of the investigation. The data is interpreted based on the trends, patterns, principles of noise ecosystem and its concepts. The information thus analyzed and interpreted requires to be communicated to different groups of the community and various stakeholders like, decision makers and planners, researchers, students and general population. Report making is one method of communicating the findings to these target groups. The language and method used in preparing the report should vary depending on the group for whom it is aimed.

2.2.1 Data interpretation

Interpretation helps to take decisions and plan developmental work. The whole task of investigation fails if the conclusions drawn are not correct. A wrong or incomplete interpretation may mislead the decision making process. While interpretation of data, other associated and related factors should be considered.

In interpretation of data, following points should be considered:

- Bias or preconception must be avoided while interpreting data. Conscious or unconscious bias on the part of the investigator leads to false interpretations;
- While making comparisons there should be consistency in defining the noise monitoring parameters under study;
- General conclusions should not be made based on inadequate data. Conclusions driven based on micro-level data of noise ecosystem should not be generalized or extrapolated at the micro-level;
- While interpreting the data, other relevant variables should be considered. This is applicable specially to noise ecosystems as the interactions between the different factors are too many;
- Smaller differences should not be neglected as these may lead to important conclusions;
- Devising of any hypothesis should be supported with sufficient data.

2.2.2 Report making

Report making can be done in different ways. Three forms of report are: (i) a scientific reporting for researchers, students, teachers and other stakeholders who are involved in similar investigations; (ii) reporting for planners and decision makers and other governance officials; and (iii) reporting for literate local communities.

Scientific reporting gives a detailed account of the investigation and includes the methodology, data and a complete view of holy places and their dynamics. It should also analyze the findings and give possible reasons for them. Such report helps in comparative analysis of various noise ecosystems. A detailed account of the material and methods used for investigation should be provided. It is important to clearly describe the procedures followed in the investigation. Any noise ecosystem study should have a description of the holy site. A description of the holy site should include its historical, social and cultural background, weather, soil conditions, demographic factors and acoustic filters use pattern. Tables, diagrams, graphs and

photographs should be used to support the description. This is for easy understanding and interpretation of the results of the investigation. The holy site description is followed by description of results, discussions, future planning, summary and references.

Reporting for planners and decision makers and other governance officials do not have much interest in detailed and technical scientific reports. This group is normally interested in the planning. Time may also be constraint for this group, therefore a report targeted for this group should be brief and clear and may contain brief and easy to understand sections of site description, status of noise ecosystem, conclusions and future planning. Future planning section is of major importance to the target group. The proposed plan for holy place and its noise ecosystem must be explained from the ecological, economic, social and cultural points of view with adequate figures to support it. Both the benefits and drawbacks of the plan should be discussed.

Reporting for the literate local community should be simple, brief and clear. Too many technical details should be avoided. The report should revolve around the community's interest. In the introductory part the importance and objectives of the study with reference to the community should be highlighted. Data which is relevant to the welfare of the community should be presented as simple as possible. Important conclusions drawn from the study should be emphasized. The proposed plan and the projected benefits as well as the possible drawbacks associated with it in terms of ecological, economic, social, and cultural considerations should be explained with brief discussions. The role of community members in the proposed plan should be mentioned. Any new technological information to be presented should be simplified with clarity. It is a good idea to provide the brief know how of the technology, with name of the provider and contact person.

3. Theory of acoustic filters for sensors and transducers

The displacement for any charged particle is defined by change of its position. A displacement has length and direction. The physical quantities that have features like displacements are called vectors. Vectors have both magnitude and direction and combine as per rules of addition. The physical quantities that are defined by number and unit and that only have magnitude are called scalars. The behavior of gases over wide range of temperatures is predicted through kinetic theory model by average kinetic energy of translation.

In collisions with the source of an energy such as due to firing in air at the kinetic velocity of a bullet of a gun, the rotational and vibrational modes of motion are excited, which contribute to the internal energy of the air for propagation of sound waves. The total energy consists of kinetic energy of translation and kinetic energy of vibration of atoms in a molecule and potential energy of vibration of the atoms in a molecule. The magnetic energy also contributes to the total energy, however the available energy depends only on the temperature and has distribution of equal parts to each of the independent ways in which the molecules are able to absorb energy. The theorem (mention here, with no proof) is called equipartition of energy was deduced by James Clerk Maxwell. Each such independent way of absorbing energy is termed as degree of freedom for a molecule of gas.

The acoustic filters are defined based on the model of kinetic theory of gases for filtering unwanted frequencies of oscillations from a power system. It is a network with selective transmission for currents from a power system of varying frequency. A new theory for noise protection and security from power systems is presented. An acoustic filter is used to filter unwanted frequencies of oscillations from a power

system. It is a network with selective transmission for currents from a power system of varying frequency. The noise protection and security is a crucial operation for obtaining a desired output from a power system.

The unwanted frequencies generated from a power system are removed by using an operational amplifier with different combination of filter arrangements. The filters are differentiated as per source signal of unwanted frequencies from solar power, electric power, light power, sound power, heat power, fluid power and fire power. The acoustic filter is an electrical analog circuit of various combinations of RC feedback circuit with an operational amplifier [1–7].

3.1 Operational amplifier

An operational amplifier is an integrated circuit that consists of several bipolar transistors, resistors, diodes, and capacitors, interconnected so that amplification can be achieved over a wide range of frequencies. The open loop configuration of an operational amplifier has the highest possible gain when running wide open. In the closed loop configuration, it is easy to control the gain due to negative feedback. This feedback is obtained by connecting the output to the inverting input through a potentiometer. The negative feedback is useful for volume control of a highly versatile amplifier. The gain in closed loop configuration is directly proportional to the feedback loop resistance.

3.2 Acoustic filters

The action of filtering the frequency from a power system is based on the variation in the reactance of an inductance or a capacitance with the frequency. The band of frequencies that can be removed from a power system can be at the low frequency end of frequency spectrum, at the high frequency end, at both ends, or in the middle of the spectrum. The filters to perform each of these operations are known respectively as low-pass filters, high-pass filters, band-pass filters and band-stop filters. There are many configurations of design of filters. The filters are divided into passive and active configurations. The passive filters are less effective simple circuits constructed with resistors, capacitors, and inductors. The active filters are useful in providing an effective filtering action than passive filters. The active filters require a source of operating power.

3.3 Acoustic filter systems

The criteria for definitions of filters for noise filtering is based on areas of energy stored in a wave due to noise interference, speed of wave and difference of power between two intensities of wave [6]. The filtered noise signals are considered from systems of solar power, electric power, light power, sound power, heat power, fluid power and fire power. The acoustic filters as per sources of noise are defined [12].

3.3.1 Filter for noise of sol

This filter is used to filter noise due to power intensities difference between two solar power systems. Example: window curtain, window blind, wall and sunglasses.

3.3.2 Filter for noise of therm

This filter is used to filter noise due to power intensities difference between two heat power systems. Example: house, insulation, clothing and furnace.

3.3.3 Filter for noise of photons

This filter is used to filter noise due to power intensities difference between two lighting systems. Example: 3-D vision of any object, cell-phone, electric bulb, television, computer and LCD screen laptop.

3.3.4 Filter for noise of electrons

This filter is used to filter noise due to power intensities difference between two electrical power systems. Example: AM/FM radio clock with ear phones, telephone instrument with ear phones, cell-phone with ear phones and CD audio player with ear phones.

3.3.5 Filter for noise of scattering

This filter is used to filter noise due to power intensities difference between two fluid power systems. Example: electric fan, pump, motor vehicle, river stream and tap water.

3.3.6 Filter for noise of scattering and lightning

This filter is used to filter noise due to power intensities difference between two fire power systems. Example: lighter, matchstick, gas stove, locomotive engine and thunder-bolt.

3.3.7 Filter for noise of elasticity

This filter is used to filter noise due to power intensities difference between two sound power systems. Example: your vocal chords, organ pipe, thunder-bolt and drum beats.

4. Sensors and transducers: energy balance for a human brain

Your body has feedback systems that regulate the internal environment of your body. The feedback systems make use of storage depots and numerous feedback loops. The monitoring of plasma calcium is a good example of negative feedback. The bones constitute large storage depots for calcium, for the plasma to withdraw these storage supplies in times of need. Our body's homeostatic regulatory systems are represented by feedback loops. The feedback is considered negative, when it is compensating or negates any change. The negative feedback is essential to stabilize a system. The gastrointestinal tract, the lungs, the kidneys, and skin of your body make exchange of materials and energy between the internal and the external environments. A steady state is achieved by regulatory mechanisms involving the balance between the inflow and outflow of the internal environment that stabilizes the composition of the internal environment. The tendency to regulate the internal environment so that it is maintained in a steady state is called homeostasis.

The keeping of face beard (facial hair) and wearing of a knitted head cloth (*patka*) and a turban (*pag*) on your body has a logical and a scientific significance. The daily self-making folds of hair knots and making round folds of turban over the head of your body with colorful cotton cloths has following historical, medical benefits: (i) it indicate, protects and concentrate the disciplinary physical and mental strength of a person; (ii) it gives hair tonic to the growth of hairs on your body due to solar energy;

(iii) the whole system acts as an acoustic filter and provides immunity to your body; and (iv) the folded *Patka* with style, folded design of hair knots on top of your head is your identity in time domain, the face beard on your body is a measuring ration and a sign of man, the turban with style, color, design is your identity in space domain.

The energy generated by metabolism rate of your body varies considerably with the activity of your body. A unit to express the metabolic rate per unit of area of your body is termed as met ($1 \text{ met} = 58.2 \text{ W m}^{-2}$), defined as the metabolic rate for your body while seated quite (called sedentary). The variable which affects the comfort of your body is the type and amount of clothing that you are wearing. The insulation of clothing is defined as a single equivalent uniform layer over your whole body. The insulation value for clothing of your body is expressed in terms of clo units ($1 \text{ clo} = 0.155 \text{ m}^2\text{-C W}^{-1}$). A heavy business suit with accessories has insulation value of 1 clo, whereas a pair of shorts has 0.05 clo.

5. Results: a slide rule for noise measurement

Table 1 has summarized units of noise and their limiting conditions [8–12]. **Table 1** has also notated grades and flag colors under limiting conditions.

Figure 1 has presented a double-sided hexagonal slide rule with seven edges for noise measurement representing seven sources of noise. Reference value used for I_2 is -1 W m^{-2} on positive scale of noise and 1 W m^{-2} on negative scale of noise. Positive scale of noise has 10 positive units and one negative unit. Whereas,

Grades	Noise Grades and Flag Colors under Limiting Conditions		
	Noise of Sol	Noise of Scattering	Noise of Elasticity
$G_2^a = \pm U$	Sol	Sip	Bel
$G_1 = G_2 = U$	No Positive Solar Energy	No Positive Fluid Energy	No Positive Sound Energy
Base Color for $G_1 = G_2$			
$G_1 = U \rightarrow 0 \text{ Wm}^{-2}$	Decreasing Solar Energy	Decreasing Fluid Energy	Decreasing Sound Energy
Base Color for G_2			
$G_1 = +ve$	Increasing Solar Energy	Increasing Fluid Energy	Increasing Sound Energy
Base Color for G_2			
$G_1 = -U \text{ Wm}^{-2}$	Negative Solar Energy	Negative Fluid Energy	Negative Sound Energy
	Darkness	Low Pressure	Inaudible range
Base Color for G_2			
$G_1 = -ve$	Darkness increasing, distance from point source of light increasing	Low pressure increasing, vacuum approaching	Inaudible range increasing, vacuum approaching
Base Color for G_2			
$G_1 = -U \rightarrow 0 \text{ Wm}^{-2}$	Negative Solar Energy	Negative Fluid Energy	Negative Sound Energy
	Decreasing Darkness	Decreasing Low Pressure	Decreasing inaudible range
Base Color for G_2			

^aReference value of $G_2 = \pm U$ signifies the limiting condition with areas of noise interference approaching to zero.

Table 1.
Noise grades and flag colors under limiting conditions.

negative scale of noise has 1 positive unit and 10 negative units. Each unit of sol, sip and bel is divided into 11 parts, 1 part is 1/11th unit of noise. The base of logarithm used in noise measurement equations is 11.

The results of noise filtering using various noise measurement equations for an outdoor duct exposed to solar radiation are tabulated in **Tables 2–5** [2].

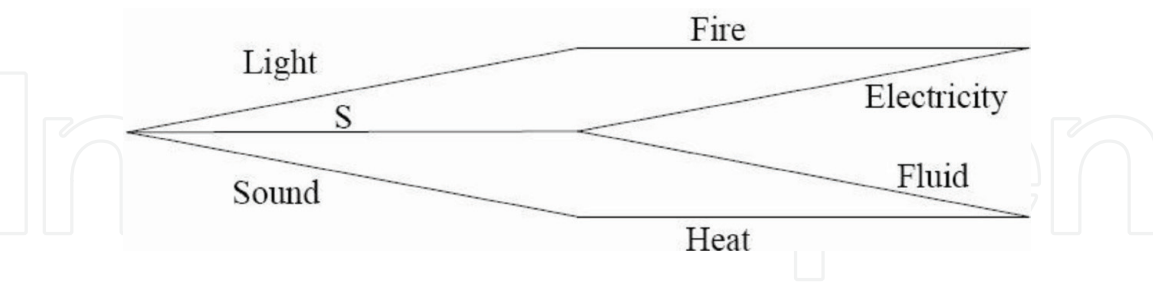


Figure 1.
A double sided hexagonal scales of noise with seven edges (S denotes sun).

Solar irradiation (W m ⁻²)	Air temperature difference (ΔT) °C	Noise of sol oS (oncisol)
450	15.50	28
550	18.90	28.93
650	22.40	29.7
750	25.90	30.36
850	29.40	30.91

Table 2.
Temperature difference and noise of sol with solar irradiation (air velocity: 0.75 m s⁻¹).

Air velocity (m s ⁻¹)	Fluid power (W m ⁻²)	Air temperature difference (ΔT) °C	Noise of scattering oS (oncisp)
1.35	47.62	15.28	17.72
1.05	37.0	18.22	16.50
0.75	26.45	22.40	15.02
0.45	15.87	28.15	12.65
0.15	05.29	29.80	07.64

Table 3.
Temperature difference and noise of scattering with air velocity (S = 650 W m⁻²).

(ΔT) °C	Mass flow rate (Kg s ⁻¹)	Thermal power (W m ⁻²)	Noise of therm oS (oncisol)	(ΔT) °C	Mass flow rate (Kg s ⁻¹)	Thermal power (W m ⁻²)	Noise of therm oS (oncisol)
15.50	0.01376	71.09	19.5602	15.28	0.0231	117.65	21.868
18.90	0.01275	80.325	20.119	18.22	0.0171	103.85	21.296
22.40	0.0120	89.6	20.614	22.40	0.0120	89.6	20.614
25.90	0.0115	99.2833	21.043	28.15	8.1 × 10 ⁻³	76.0	19.866
29.40	0.0111	108.78	21.505	29.80	6.2 × 10 ⁻³	61.59	18.898

Table 4.
Mass flow rate and noise of therm with (ΔT) °C.

Air velocity (m s ⁻¹)	Fluid power (W m ⁻²)	Noise of scattering oS (oncisp)	Sound pressure (N m ⁻²)	Sound power intensity (W m ⁻²)	Noise of elasticity oB (oncibel)
1.35	47.62	17.72	557.5	752.7	30.36
1.05	37.0	16.50	433.65	455.33	28.05
0.75	26.45	15.02	309.75	232.31	24.97
0.45	15.87	12.65	185.85	83.63	20.24
0.15	05.29	07.64	61.94	09.29	10.12

Table 5.
Noise of elasticity with air particle velocity (Impedance $Z_0 = 413 \text{ N s m}^{-3}$ at 20°C).

6. Integration of real-time noise system parameters with command and control center

Noise monitoring data of holy places and their habitants can be collected in real-time domain with aid of computerized monitor and control distributed systems at master location. The system is called Supervisory Control and Data Acquisition (SCADA). The control may be automatic, or initiated by operator commands. The data acquisition is accomplished firstly by the remote terminal units (RTU's) scanning the field inputs connected to the programmable logic controller (PLC). This is usually done at the fast rate. The central host will scan the RTU's usually at a slower rate. The data is processed to detect alarm conditions, and if an alarm is present, it will be displayed on special alarm lists. Data can be of three main types. Analogue data (i.e. real numbers) will be trended on data analytics software (i.e. placed in graphs). Digital data (on/off) may have alarms attached to one state or the other. Pulse data (e.g. counting revolutions of a meter or counter) is normally accumulated or counted.

A typical SCADA system includes remote sensors, controllers, or alarms located at facilities of holy places, as well as a central processing system situated in an appropriate location. SCADA systems integrate data acquisition systems with data transmission systems and graphical software in order to provide a centrally located monitor and control system for numerous process inputs and outputs. SCADA systems are designed to collect information, transfer it back to a central computer and display the information to the operators, thereby allowing the operator to monitor and control the entire noise system parameters from a central location in real time.

6.1 Components of SCADA system

SCADA system is composed of the following:

- Central Monitoring Station;
- Remote Terminal Units (RTUs);
- Field Instrumentation;
- Communications Network

The Central Monitoring Station (CMS) refers to the location of the master or host computer. Several workstations may be configured on the CMS. It uses a

Man Machine Interface (MMI) program to monitor various types of data needed for the operation. The Remote Station is installed at the remote points in the facilities being monitored and controlled by the central host computer. This can be a Remote Terminal Unit (RTU) or a Programmable Logic Controller. Field instrumentation refers to the sensors and actuators that are directly interfaced to the remote locations in the holy facilities. They generate the analog and digital signals that will be monitored by the Remote Station. Signals are also conditioned to make sure they are compatible with the inputs/outputs of the RTU or PLC at the Remote Station. The Communications Network is the medium for transferring information from one location to another. This can be via telephone line, radio or cable.

7. Discussions

A power system is defined as a power station with network of light, sound, heat, fluid, electricity, fire and sun, and its consumers living within its natural ecosystem vicinity area. Irrespective of the type of station, energy as a rule, produced on a centralized basis, which means that individual power stations supply energy to a common power grid and therefore, are combined into integrated power systems which may cover large territory with a larger number of consumers. Consumers are called habitants of the ecosystem vicinity area in the holy place.

Management of habitants through use of acoustic filters at the holy places from the perspective of protection from unwanted physical agents of various power systems is a need of time and a crucial energy policy tool. Thus management becomes the function of getting things done effectively by others. It is not just 'doing' – but 'doing well'. Management primarily is a function of managing people or habitants first and then comes the materials, equipment and systems. If habitants work properly, systems perform well automatically. Management is principally a task of planning, coordinating, motivating and controlling the efforts and interest of others to achieve a specific objective. The functions of management in general are: (i) planning; (ii) organizing; (iii) directing; (iv) coordinating; (v) controlling; and (vi) decision making.

Planning can be done for holy places and forecasting anticipated growth of habitants. Planning is an activity of anticipating the future and discovering alternative courses of action. It involves in-out-lining what, how, where, when and by whom a particular job has to be done. It is against random action. Planning is the rational and orderly thinking about ways and means of achieving certain goals. It involves thought and decision-pertaining to a future course of action. If there is no proper planning—rashness, short-sightedness, random-working or haphazard setup in the performance of work.

Proper organization of holy places is required so as to cater the mechanism for all the necessary things required for their proper monitoring and evaluation. Organizing involves: (i) determination of activities; (ii) determining staff and their requirements, developing and planning qualified people in various roles and responsibilities; (iii) allocation of work; (iv) determination of authority and duty; and (v) delegation of power. Organizations calls for the matching of roles and responsibilities with individuals in such a way personal contentment and social satisfaction of people, is addition to achieving their well-being.

Knowing well that management is the art of getting work done through the people, management plans, organizers and staff. Directing involves energizing the organizational mechanism, activating it or putting it into action to carry out the management plan. Human resources have emotions, aspirations, sentiments, capacities of their own, etc. Direction of human resources is through leadership,

guidance, supervision, communication and counseling. Human aspect should not be overlooked. Workers should be made to carry out their roles and responsibilities willingly, wholeheartedly and with good team spirit.

Coordinating is a process of achieving team spirit and unity of action among human resources at all levels. Even there are people of different origins, different psychologies and interests, and different capacities are engaged in holy places, and if there is disharmony, and inefficiency, and if the workers are poorly selected or improperly placed at holy places, their performance is greatly weakened.

Coordination is necessary to achieve and maintain harmony and a sound working balance. Coordination is the integration, synchronization or orderly pattern of group activities. Coordination should not be confused with cooperation. Cooperation implies collective efforts put in by a group voluntarily in any work. It has no time, quantity, or direction element in its observations. Both coordination and cooperation are essential for effective management. The disintegrating forces which adversely affect coordination are: (i) diverse and specialized activities; (ii) empire building tendencies; (iii) personal rivalries and jealousies; and (iv) conflict of interest.

Controlling is the process of measuring the results obtained and measuring the deviation or error between what is realized and what is expected from a system or device. If there is deviation, suitable corrections have to be effected so that, realized result is in full or close agreement with the targets or expected/desired results. Control—ensures both qualitative and quantitative performance of work. Proper control ensures accuracy. Control also brings to light, any lapses in the management, hindering the satisfactory progress of work. Controlling at holy places involves: (i) setting up of standards or yardsticks for habitants; (ii) assessment of actual performed work; (iii) determination of deviation; and (iv) corrective action.

Decision making, basically is the process or means of selecting one alternative out of two or more available alternatives. At holy places, decision making covers all functions of management. Good management performs its functions with wise, conscious, effective and appropriate decision making. Success of decision making is with good management, through their workers by sound judgements and quick logical divisions. Decision making can be done effectively through: (i) statement of problem; (ii) collecting or finding alternative solutions; (iii) through full study and management experiments; and (iv) final judicious choice. Aids for making decisions consist taking wise and judicious and practical decisions, which are highly critical, complicated and also requires deep imagination. The techniques which have been developed for decision making are: (i) operations research; (ii) linear programming; and (iii) break-even analysis. Computer systems at holy places can be used to solve problem of decision making. This is because it involves numerous data. Decisions with regard to future course of action are important concerning—inventory control, working conditions, cost price volumes, investments, etc.

7.1 Need for committees

(i) to study complex problems of holy places. These problems are beyond the capacity of single specialists. These committees are called investigating and advisory committees; (ii) for achieving control and coordination, so that unity of action results. The committees to work for this action are the standing committees, being permanent in structure and action; and (iii) to train the new staff, regarding the problems, policies of the holy places. Standing committees called education committees or dissemination committees are appointed for this purpose.

7.2 Dynamics of holy places

Changes in the structure and operation of holy places and their habitants are necessary for the reason that with modern times, the management of holy places should move with times. It can be changed in several ways, to keep it in turn with the managerial performance so that high quality output is realized. Any holy place should be flexible enough to get adjusted to get adapted to ever changing practices in operation, from time to time. The structure should be such that conflicts, misunderstandings and all forms of friction, inefficiencies, indiscipline and other negative factors of holy places are avoided and a serene informal atmosphere is created in it. One of the important and necessary results of the dynamics of holy places is to achieve from the top most level to the bottom most grades so that following shortcomings are totally avoided: (i) delay in decision making; (ii) frequent and serious errors in decision; (iii) bottlenecks; (iv) inadequate communication; (v) lack of clear-cut-objectives; and (vi) frequent and serious clashes among different groups and so on. The presence of any of the above or all the above indicates poor organization of holy place. If such anomalies and other negative traits occur, the changes are absolutely necessary. But what is called 'earthquake approach' to make unnecessary drastic changes-should be guarded against. Because of significant growth of holy places due to increase of consumerism, modern economy, quite far reaching alternations may become absolutely necessary. The main purpose of changes should be to minimize the disturbing effects. Long range plan is more productive than the earthquake approach. In this long-run plan changes are put into effect over a period of years.

7.3 Management systems

The management system at holy places is conceived as a multitude of elements being integrated and disintegrated in a random fashion. Consequently, it is difficult to reveal regularity and to define the system structure at holy places. However, for the system to perform its main function, consistent with the objective for which it has been devised, it is immaterial what the specific complexes will be, i.e., which facilities of holy places will be integrated in them. This implies that there must exist such a system structure that is sufficiently stable and adequately defines the system on hand. Two holy places having the same objective will never be exactly identical and consequently will have distinct structures. The differences occur as a result of different traditions, individual features of personnel and managerial staff, regional differences, and many other intangibles. However, these too must be embodied into a common framework from which an objective description may evolve in the form of an abstract structure. The approach of representing the management system as a purposeful process can be used at holy places. The goal programming method in which purposefulness peculiar to management systems is represented as an ordered structure of a tree of goals. This isolation of goals into an independent structure corresponds to a stratified approach in system theory, i.e., the structure of the goal stratum is evaluated. The goal stratum represents the system but from one side. The structure of goals is of static nature and gives only an indication of what is to be achieved, saying nothing of how this can be done. The functional structure is the one to answer this question, i.e., structuring in the functional stratum gives a clue to solve problems of evaluation and improvement of system performance. And, last but not the least, one should not overlook the physical structure of the system at holy place, which describes the relation between the physical objects or elements of the management system.

7.4 Modeling of management systems at holy places

To summarize the discussions, a generalized discussion of modeling of management system at holy places is briefed here. The generalized modeling of holy places can be pursued with the use of entropy maximization principle [34]. The holy places are like a transportation terminal or hub, in which devotees are arrived by different modules: (i) maritime; (ii) railroad; and (iii) highway. There are also: (iv) storage depots of materials; and (v) environmental interconnections. This structure of five modules reflects the actual structure of the holy places. The interactions with these different components of holy places are called events. Events in turn may be viewed as elements of the functional structure of the holy place system. On the one hand, they are induced by other elements, and on the other, they generate new elements themselves. In a module, each event is associated with a set of integer-valuable variables which have physical meaning owing to the simulating nature of the model. At the same time, these variables constitute a mechanism of interaction of modules. A variable being written in a module implies an event for this module. Variables being read out in a module mean that the events which are established for this module by another module are recorded. This pattern of simulation modeling requires that the events to be modeled occur at definite time instants and be respectively synchronized. This is achieved by imposing control on the time of modeling. In this model each module is connected with a timer, operating as a synchronizing clock. Modules operate step-wise. At each step of module operation all the events established for it by other modules are evaluated and the event for which time is right is recorded. As the processing of events goes by, the timer changes the current time.

All the modules of holy place system describe the processes of arrival and departures of the transportation facilities, operation of servicing of habitants. The module of storage of materials deals with the processes of accumulation and storage of goods with all transportation facilities. Accordingly, it records the events associated with the arrival and departure of habitants. The module responsible for the impacts of the environment models the probabilistic and independent pattern of arrival and departure of vehicles (of habitants and materials). Operating interactively with the model implemented on a computer, the analyst can adjust the values of the key variables so as to achieve a satisfactory performance of the entire holy place. The maximum entropy principle is realized in that the distribution of arrival of vehicles is reduced to a random process, and the rates of service processes and the vehicular units are averaged. The degree of generalization may be established by the analyst depending on the interpretation of the events and noise systems being modeled. Of course management systems at holy places are not thermodynamic and their structures are stable away from a thermodynamic equilibrium. Borrowing from the non-equilibrium terminology, these systems may be categorized as dissipative structures.

8. Conclusion

The chapter has introduced the energy policy instrument for noise protection and security by monitoring and evaluation of holy places and their habitants. A theory for noise protection and security with use of acoustic filters is presented. The acoustic filters for filtering noise from power systems are defined. The power systems are classified as per source signals of solar power, electric power, light power, sound power, heat power, fluid power and fire power. Some advanced level configurations of acoustic filters for different power systems are described. Sensors and

transducers for a human brain are illustrated. The example of turban as an acoustic filter is illustrated. **Table 1** has presented the noise units under limiting conditions along with noise grades and flag colors. **Figure 1** has illustrated sketch of a slide rule for noise measurement. A brief overview of integration of noise systems parameters with command and control center is also presented. Discussions on dynamics and modeling of holy places from management perspective are also presented.

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