

#### **REVIEW ARTICLE**

## **3** Open Access

# **Global Renewable Energy**

Pushpaanjali.G<sup>1</sup>, Lakshminarayanan Arivarasu<sup>2\*</sup>, Leslie Rani.S<sup>3</sup>

<sup>1</sup>Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University Chennai-77, TamilNadu, India

Email: 151801096.sdc@saveetha.com

<sup>2</sup>Assistant Professor, Department of Pharmacology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai-77, Tamil Nadu, India,

Email: lakshmin.sdc@saveetha.com

<sup>3</sup>Lecturer, Department of General Pathology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai-77, Tamil Nadu, India.

Email: leslieranis.sdc@saveetha.com

#### **ABSTRACT**

Energy derived from renewable resources, and which are replenished inside the human common lifestyles scale, inclusive of sunlight, wind, rain, tides, waves and geothermal heat, is called renewable strength. About 19% of worldwide very last strength intake got here from renewable, with 13% coming from conventional biomass, and 3.2% from hydroelectricity. The percentage of renewable power technology is round 18%, 15% of worldwide power coming from hydroelectricity. Earlier evaluation of destiny strength pathways indicates that it's miles technically viable to reap progressed strength access, air great and strength safety concurrently even as keeping off risky weather change. Economic growth, automation and modernization especially relies upon the safety of strength supply. Global strength call for is rapidly growing and presently the global situation is on a way to satisfy the destiny strength call for. The air and water pollutants emitted through coal and herbal fueloline plant life are related to respiratory problems, neurological harm and coronary heart attack. Renewable strength regularly gives strength in hydro, biomass, solar, smart grid.

### **ARTICLE HISTORY**

Received October 05, 2020 Accepted November 13, 2020 Published December 09, 2020

## **KEYWORDS**

Renewable energy, Resources, Solar energy, Smart grid, Wind energy.

## **INTRODUCTION**

Energy derived from renewable resources, and which are replenished within the human common lifestyles scale, consisting of sunlight, wind, rain, tides, waves and geothermal heat, is named as renewable power. It often offers power for four sectors, electric era, air and water heating or cooling, transportation and rural power service. Economic growth, computerization and modernization specially rely upon the safety of power supply. Global power call for is speedy growing and currently, the not unusual place subject is on how the destiny power call for could be addressed if fossil fuels exhaust out. Fossil

gasoline emits greenhouse gases that distinctly have an effect on the surroundings and destiny era [1–3]. Renewable power is derived from herbal techniques that are refilled continuously in its diverse forms, it derives without delay from biomass geothermal assets etc. 19 % of the world's very last power intake got here from renewable, 13% coming from conventional biomass and 32% from hydroelectricity. A part of the renewable power era is around 18 %, with 15 % of world power drawing close hydroelectricity and 3% from new renewable [4]. Earlier analyses of destiny power pathways indicate that it's far technically feasible to gain advanced power right of entry to

<sup>\*</sup>Contact: Lakshminarayanan Arivarasu, Assistant Professor, Department of Pharmacology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai-77, Tamil Nadu, India,

Islandia India India

<sup>2020</sup> The Authors. This is an open access article under the terms of the Creative Commons Attribution Non Commercial Share Alike 4.0 (https://creativecommons.org/licenses/by-nc-sa/4.0/).

air-first-rate and power safety concurrently even as averting risky weather trade. These goals are attained with the aid of using a numerous mixture of resources, rules and technology [5]. Newer technology will allow destiny long-distance exchange in Renewable power carriers. Such exchange either required the set up of Continental power grids for transmitting renewable power or generating Renewable gasoline and transporting them with liauid or gaseous gasoline infrastructure. A power transmitting grid allows financial blessings for exchange over mid-variety distance, as an example among north Africa and Europe [6]. Furthermore, the air and water pollutants produced with the aid of using coal and herbal fueloline plant life are attached with respiration issues, neurological damage, coronary heart attack, most cancers, untimely demise and hosts lots of different critical issues [7]. Previously we have focused our research on various invitro and invivo studies [8-23] We have currently shifted our focus to this review.

One of the issues of most cancers can have an effect on any part of the frame as a collection of sickness because of lack of mobileular cycle control [24][25]. Oral most cancers consist of cancers of the lips ,tongue, cheeks, ground of the mouth, tough and tender palate, sinuses and pharynx [26]. Human colon most cancers are the improvement of most cancers from colon or rectum [27][28]. One of the essential sorts of cancers, lung most cancers is thought to be the maximum persistent shape of most cancers withinside the world [29][30][31][23]. Some of the ayurvedic remedies also are used to deal with most cancers [32]. Herbal panacea [33]is commonly used withinside the circumstance of inflammation, most cancers. And now it's far utilized in dentistry. Type-2 diabetes is related to extended chance of most cancers such as colon, pancreatic, bladder most cancers and non hodgkin lymphoma [34]. Hyperglycemia may also make contributions to a extra malignant phenotype of most cancers cells, such as proliferation, apoptosis inhibition, metastasis, perineural invasion, chemotherapy resistance and chemotherapy intolerance[35,36][37]. Nanoparticle[38] [39] is a small particle that stages from 1 to 100 nanometre in size. Likewise, selenium nanoparticles were set up to expose excessive cap potential in most cancers chemotherapy and as drug carriers [40]. Breathing problem, like asthma, is a heterogenous institution circumstance [41]. Several persistent liver accidents additionally arise due to the pollutants [42][43]. Natural merchandise like Fruit stones and seeds in addition to fruit husk but used to lesser variety than different normalized gasoline consisting of gasoline wooden, wooden chips and pellets additionally represent an more and more more utilized in stable biofuels certainly it's been proven that mango Stone, peanut shell and sunflower seed husk have a excessive power cap potential with the better heating cost much like different commercialised biofuels [44][45][46]. Flavonoids are used to deal with Chronic infection [47]. Some of the natural drugs such as herbs, natural coaching and completed natural merchandise comprise energetic elements of plant life or different plant substances seemed to have healing blessings[48].

Biomass refers to all natural count number current withinside the biosphere whether or not of plant or animal origin, in addition to the ones fabric acquired via their herbal or synthetic scenario [49].

### **Hydropower**

Hydropower is taken into consideration as renewable power. It is specially generated using the mechanical power of flowing water with the aid of forcing it via piping known as pen stock, which in flip generates power that allows you to produce power[50]. It has numerous blessings over maximum different assets producing electric power. These encompass an excessive stage of reliability, demonstrated technology, very low working preserving price and capacity to effortlessly regulate load changes. Disadvantages of hydropower encompass excessive preliminary price of facilities, dependence on precipitation, trade in circulate regimens and displacement of humans residing within the reservoir area [51].

## Solar energy

Concentrating sun energy makes use of the warmth from the solar to supply steam which in flip energy a generator that creates energy. With a low running price and excessive efficiency, it may offer a dependable delivery of power with thermal storage [52]. The price of recent photovoltaic energy is losing swiftly and if the photovoltaic enterprise maintains to develop and improve in the era with the aid of using 2020 the price may be corresponding to the price of traditional energy, as will the price of the sun thermal energy [53]. Solar panels don't have any transferring elements and require nearly little or no protection past everyday cleaning. Without transferring elements to interrupt and protection. Photovoltaic sun panels are the handiest green supply taken into consideration with the ability to fulfill present demands [54].

## **Geothermal Energy**

Geothermal power is warmth that is obtained withinside the sub-floor of the earth. Water and steam that deliver the geothermal power to the earth floor .It may be used for heating and cooling functions to generate smooth energy [55].

#### **Biomass**

Beneficial biomass use also can be taken into consideration a part of the terrestrial carbon cycle, the balanced cycling of carbon from the environment into the plant after which into the soil and the environment for the duration of plant decay [56]. Transportation and combustion emissions are kind of equivalent for all forms of biomass. Thus it's far critical to discriminate among biomass sources which can be useful in lowering internet carbon emission, ambiguous effect and growth internet emission [57]. The environmental effect of biomass power is related to land erosion due to the elimination of inexperienced vegetation [58].

## Smart grid

Smart grid is a brand new idea that ends in the modernisation of the transmission and distribution grid. The clever grid device is the virtual improvement of transmission and new markets for opportunity power era renewable power assets [59]. Smart grid linked with the energy era is a brand new platform that notably generates dependable safety of delivery and standard of electrical power. With several forms of power assets like sun, wind, biomass and disbursed energy era hyperlink being included into the clever grid era, this idea could be very sensible and dependable [60]. It is the answer to modernisation of the electric power device and infrastructure to offer an extra wise and dependable energy grid. Smart grid gives many blessings over traditional grid [61].

## Renewable power and weather change

The quantity of carbon in fossil gasoline reserves and sources this is unconventional oil and fuel line sources in addition to plentiful coal now no longer but burned has to probably upload traits of carbon dioxide to that environment if burned overcoming centuries that could exceed the variety of any of the eventualities taken into consideration [62] [63]. Transmission strains and different regions alongside the price chain of the power area also can be affected [64] [65].

# **CONCLUSION**

The way to the trouble of securing good enough power resources withinside the integration of numerous alternatives and technology from diversified fields viz biomass, biogas ,bioethanol, biodiesel, sun power, wind power, hydropower and different fairly green alternatives. No unique alternative can be taken into consideration because the panacea. Different nations and respective areas of the arena might must determine and select at the mixture of alternatives which match them, giving consciousness to their sources base, era level, and available manpower to utilize the numerous systems. Environmental and political deliberation

also are critical. For the tropical and agrarian nations, alternatives have to consist of the cultivation of cassava, cocoyam and different second-era biofuels in addition to the usage of farm animals and different agro wastes as sustainable assets within the manufacturing of ethanol gasoline for the delivery of power.

### **AUTHOR CONTRIBUTION**

Idea was conceptualized by Lakshminarayanan Arivarasu, manuscript was drafted by Pushpaanjali Ganapathy and revising of the manuscript was done by Leslie Rani

### **CONFLICT OF INTEREST**

The authors declare no conflict of interest

#### REFERENCE

- 1. Hasanuzzaman M, Rahim NA, Hosenuzzaman M, Saidur R, Mahbubul IM, Rashid MM. Energy savings in the combustion based process heating in industrial sector [Internet]. Vol. 16, Renewable and Sustainable Energy Reviews. 2012. p. 4527–36. Available from: http://dx.doi.org/10.1016/j.rser.2012.05.02
- 2. Hasanuzzaman M, Rahim NA, Saidur R, Kazi SN. Energy savings and emissions reductions for rewinding and replacement of industrial motor [Internet]. Vol. 36, Energy. 2011. p. 233–40. Available from: http://dx.doi.org/10.1016/j.energy.2010.10. 046
- 3. Zhang J, Fu M, Geng Y, Tao J. Energy saving and emission reduction: A project of coal-resource integration in Shanxi Province, China [Internet]. Vol. 39, Energy Policy. 2011. p. 3029–32. Available from: http://dx.doi.org/10.1016/j.enpol.2011.03.0
- 4. Jr. MJE, Ellsworth MJ Jr. New ASHRAE Thermal Guidelines for Air and Liquid Cooling [Internet]. 2012 SC Companion: High Performance Computing, Networking Storage and Analysis. 2012. Available from: http://dx.doi.org/10.1109/sc.companion.20 12.122
- 5. Riahi K, Dentener F, Gielen D, Grubler A, Jewell J, Klimont Z, et al. Energy Pathways for Sustainable Development [Internet]. Global Energy Assessment (GEA). p. 1205–306. Available from: http://dx.doi.org/10.1017/cbo97805117936 77.023
- Dahl M, Rodriguez RA, Søndergaard AA, Zeyer T, Andresen GB, Greiner M "walterson." Infrastructure Estimates for a Highly Renewable Global Electricity Grid [Internet].

- New Horizons in Fundamental Physics. 2017. p. 333–56. Available from: http://dx.doi.org/10.1007/978-3-319-44165-8\_25
- Epstein PR, Buonocore JJ, Eckerle K, Hendryx M, Stout BM III, Heinberg R, et al. Full cost accounting for the life cycle of coal [Internet]. Vol. 1219, Annals of the New York Academy of Sciences. 2011. p. 73–98. Available from: http://dx.doi.org/10.1111/j.1749-6632.2010.05890.x
- 8. Robert R, Justin Raj C, Krishnan S, Jerome Das S. Growth, theoretical and optical studies on potassium dihydrogen phosphate (KDP) single crystals by modified Sankaranarayanan–Ramasamy (mSR) method [Internet]. Vol. 405, Physica B: Condensed Matter. 2010. p. 20–4. Available from:
  - http://dx.doi.org/10.1016/j.physb.2009.08.0
- 9. Sahu D, Kannan GM, Vijayaraghavan R. Size-dependent effect of zinc oxide on toxicity and inflammatory potential of human monocytes.

  J Toxicol Environ Health A. 2014;77(4):177–91
- 10. Suresh P, Marimuthu K, Ranganathan S, Rajmohan T. Optimization of machining parameters in turning of Al-SiC-Gr hybrid metal matrix composites using grey-fuzzy algorithm [Internet]. Vol. 24, Transactions of Nonferrous Metals Society of China. 2014. p. 2805–14. Available from: http://dx.doi.org/10.1016/s1003-6326(14)63412-9
- 11. DeSouza SI, Rashmi MR, Vasanthi AP, Joseph SM, Rodrigues R. Mobile phones: the next step towards healthcare delivery in rural India? PLoS One. 2014 Aug 18;9(8):e104895.
- 12. Sekhar CH, Narayanan V, Baig MF. Role of antimicrobials in third molar surgery: prospective, double blind,randomized, placebo-controlled clinical study. Br J Oral Maxillofac Surg. 2001 Apr;39(2):134–7.
- 13. Chellaswamy C, Ramesh R. Parameter extraction of solar cell models based on adaptive differential evolution algorithm [Internet]. Vol. 97, Renewable Energy. 2016. p. 823–37. Available from: http://dx.doi.org/10.1016/j.renene.2016.06. 024
- 14. Danda AK, Muthusekhar MR, Narayanan V, Baig MF, Siddareddi A. Open versus closed treatment of unilateral subcondylar and condylar neck fractures: a prospective, randomized clinical study. J Oral Maxillofac Surg. 2010 Jun;68(6):1238–41.
- Samuel MS, Bhattacharya J, Raj S, Santhanam
   N, Singh H, Pradeep Singh ND. Efficient

- removal of Chromium(VI) from aqueous solution using chitosan grafted graphene oxide (CS-GO) nanocomposite. Int J Biol Macromol. 2019 Jan;121:285–92.
- Lakshmanan A, Bhaskar RS, Thomas PC, Satheesh Kumar R, Siva Kumar V, Jose MT. A red phosphor for nUV LED based on (Y,Gd)B03:Eu3 [Internet]. Vol. 64, Materials Letters. 2010. p. 1809–12. Available from: http://dx.doi.org/10.1016/j.matlet.2010.05. 034
- 17. Venu H, Subramani L, Dhana Raju V. Emission reduction in a DI diesel engine using exhaust gas recirculation (EGR) of palm biodiesel blended with TiO2 nano additives [Internet]. Vol. 140, Renewable Energy. 2019. p. 245–63. Available from: http://dx.doi.org/10.1016/j.renene.2019.03. 078
- 18. Manimaran G, Pradeep kumar M, Venkatasamy R. Influence of cryogenic cooling on surface grinding of stainless steel 316 [Internet]. Vol. 59, Cryogenics. 2014. p. 76–83. Available from: http://dx.doi.org/10.1016/j.cryogenics.2013.11.005
- 19. Neelakantan P, Varughese AA, Sharma S, Subbarao CV, Zehnder M, De-Deus G. Continuous chelation irrigation improves the adhesion of epoxy resin-based root canal sealer to root dentine. Int Endod J. 2012 Dec;45(12):1097–102.
- 20. Babu MN, Naresh Babu M, Muthukrishnan N. Investigation on Surface Roughness in Abrasive Water-Jet Machining by the Response Surface Method [Internet]. Vol. 29, Materials and Manufacturing Processes. 2014. p. 1422–8. Available from: http://dx.doi.org/10.1080/10426914.2014.9 52020
- 21. Panda S, Doraiswamy J, Malaiappan S, Varghese SS, Del Fabbro M. Additive effect of autologous platelet concentrates in treatment of intrabony defects: a systematic review and meta-analysis. J Investig Clin Dent. 2016 Feb;7(1):13–26.
- 22. Adalarasan R, Santhanakumar M, Rajmohan M. Optimization of laser cutting parameters for Al6061/SiCp/Al2O3 composite using grey based response surface methodology (GRSM) [Internet]. Vol. 73, Measurement. 2015. p. 596–606. Available from: http://dx.doi.org/10.1016/j.measurement.2 015.06.003
- 23. Rajeshkumar S, Kumar SV, Ramaiah A, Agarwal H, Lakshmi T, Roopan SM. Biosynthesis of zinc oxide nanoparticles usingMangifera indica leaves and evaluation of their antioxidant and cytotoxic properties

- in lung cancer (A549) cells. Enzyme Microb Technol. 2018 Oct;117:91–5.
- 24. Lakshmi T, Ezhilarasan D, Vijayaragavan R, Bhullar SK, Rajendran R. ethanolic bark extract induces apoptosis in human oral squamous carcinoma cells. J Adv Pharm Technol Res. 2017 Oct;8(4):143–9.
- 25. Gheena S, Ezhilarasan D. Syringic acid triggers reactive oxygen species-mediated cytotoxicity in HepG2 cells [Internet]. Vol. 38, Human & Experimental Toxicology. 2019. p. 694–702. Available from: http://dx.doi.org/10.1177/0960327119839 173
- 26. Ezhilarasan D, Sokal E, Najimi M. Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets. Hepatobiliary Pancreat Dis Int. 2018 Jun;17(3):192–7.
- Kumar MDA, Ashok Kumar MD, Brundha MP. Awareness about nocturia-A questionnaire survey [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1707. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00344.9
- 28. Ashwini S, Ezhilarasan D, Anitha R. Cytotoxic Effect of Caralluma fimbriata Against Human Colon Cancer Cells [Internet]. Vol. 9, Pharmacognosy Journal. 2017. p. 204–7. Available from: http://dx.doi.org/10.5530/pj.2017.2.34
- 29. Mp B, Brundha MP, Nallaswamy D. Hide and seek in pathology- A research on game-based histopathology learning [Internet]. Vol. 10, International Journal of Research in Pharmaceutical Sciences. 2019. p. 1410–4. Available from: http://dx.doi.org/10.26452/ijrps.v10i2.606
- 30. Sharma P, Mehta M, Dhanjal DS, Kaur S, Gupta G, Singh H, et al. Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. Chem Biol Interact. 2019 Aug 25;309:108720.
- 31. Ezhilarasan D. Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective [Internet]. Vol. 19, Arab Journal of Gastroenterology. 2018. p. 56–64. Available from: http://dx.doi.org/10.1016/j.ajg.2018.03.002
- 32. Rajeshkumar S, Agarwal H, Venkat Kumar S, Lakshmi T. Brassica oleracea Mediated Synthesis of Zinc Oxide Nanoparticles and its Antibacterial Activity against Pathogenic Bacteria [Internet]. Vol. 30, Asian Journal of Chemistry. 2018. p. 2711–5. Available from: http://dx.doi.org/10.14233/ajchem.2018.21 562
- 33. Lakshmi T, Krishnan V, Rajendran R,

- Madhusudhanan N. Azadirachta indica: A herbal panacea in dentistry An update [Internet]. Vol. 9, Pharmacognosy Reviews. 2015. p. 41. Available from: http://dx.doi.org/10.4103/0973-7847.156337
- 34. Ezhilarasan D, Evraerts J, Sid B, Calderon PB, Karthikeyan S, Sokal E, et al. Silibinin induces hepatic stellate cell cycle arrest via enhancing p53/p27 and inhibiting Akt downstream signaling protein expression [Internet]. Vol. 16, Hepatobiliary & Pancreatic Diseases International. 2017. p. 80–7. Available from: http://dx.doi.org/10.1016/s1499-3872(16)60166-2
- 35. Perumalsamy H, Sankarapandian K, Veerappan K, Natarajan S, Kandaswamy N, Thangavelu L, et al. In silico and in vitro analysis of coumarin derivative induced anticancer effects by undergoing intrinsic pathway mediated apoptosis in human stomach cancer. Phytomedicine. 2018 Jul 15:46:119–30.
- 36. Anitha R, Ashwini S. Antihyperglycemic activity of Caralluma fimbriata: An In vitro approach [Internet]. Vol. 13, Pharmacognosy Magazine. 2017. p. 499. Available from: http://dx.doi.org/10.4103/pm.pm\_59\_17
- 37. Ezhilarasan D, Lakshmi T, Nagaich U, Vijayaragavan R. Acacia catechu ethanolic seed extract triggers apoptosis of SCC-25 cells [Internet]. Vol. 13, Pharmacognosy Magazine. 2017. p. 405. Available from: http://dx.doi.org/10.4103/pm.pm\_458\_16
- 38. Rajeshkumar S. Synthesis of Zinc oxide nanoparticles using algal formulation (Padina tetrastromatica and Turbinaria conoides) and their antibacterial activity against fish pathogens. Res J Biotechnol. 2018;13(9):15–
- 39. Karthiga P, Rajeshkumar S, Annadurai G. Mechanism of Larvicidal Activity of Antimicrobial Silver Nanoparticles Synthesized Using Garcinia mangostana Bark Extract [Internet]. Vol. 29, Journal of Cluster Science. 2018. p. 1233–41. Available from: http://dx.doi.org/10.1007/s10876-018-1441-z
- 40. Menon S, Ks SD, R S, S R, S VK. Selenium nanoparticles: A potent chemotherapeutic agent and an elucidation of its mechanism. Colloids Surf B Biointerfaces. 2018 Oct 1:170:280-92.
- 41. Dave PH, Preetha. Pathogenesis and Novel Drug for Treatment of Asthma-A Review [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1519. Available from: http://dx.doi.org/10.5958/0974-

- 360x.2016.00297.3
- 42. Rajeshkumar S, Naik P. Synthesis and biomedical applications of Cerium oxide nanoparticles A Review [Internet]. Vol. 17, Biotechnology Reports. 2018. p. 1–5. Available from: http://dx.doi.org/10.1016/j.btre.2017.11.00
- 43. Mehta M, Deeksha, Tewari D, Gupta G, Awasthi R, Singh H, et al. Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases [Internet]. Vol. 308, Chemico-Biological Interactions. 2019. p. 206–15. Available from: http://dx.doi.org/10.1016/j.cbi.2019.05.028
- 44. Perea-Moreno A-J, Perea-Moreno M-Á, Pilar Dorado M, Manzano-Agugliaro F. Mango stone properties as biofuel and its potential for reducing CO2 emissions [Internet]. Vol. 190, Journal of Cleaner Production. 2018. p. 53–62. Available from: http://dx.doi.org/10.1016/j.jclepro.2018.04. 147
- 45. Perea-Moreno A-J, Perea-Moreno M-Á, Hernandez-Escobedo Q, Manzano-Agugliaro F. Towards forest sustainability in Mediterranean countries using biomass as fuel for heating [Internet]. Vol. 156, Journal of Cleaner Production. 2017. p. 624–34. Available from: http://dx.doi.org/10.1016/j.jclepro.2017.04.
- 46. Perea-Moreno M-A, Manzano-Agugliaro F, Hernandez-Escobedo Q, Perea-Moreno A-J. Peanut Shell for Energy: Properties and Its Potential to Respect the Environment [Internet]. Vol. 10, Sustainability. 2018. p. 3254. Available from: http://dx.doi.org/10.3390/su10093254
- 47. Muresan AA, Attia S. Energy efficiency in the Romanian residential building stock: A literature review [Internet]. Vol. 74, Renewable and Sustainable Energy Reviews. 2017. p. 349–63. Available from: http://dx.doi.org/10.1016/j.rser.2017.02.02
- 48. Varghese S, Thomas H, Jayakumar ND, Sankari M, Lakshmanan R. Estimation of salivary tumor necrosis factor-alpha in chronic and aggressive periodontitis patients [Internet]. Vol. 6, Contemporary Clinical Dentistry. 2015. p. 152. Available from: http://dx.doi.org/10.4103/0976-237x.166816
- 49. Ramesh A, Varghese SS, Doraiswamy JN, Malaiappan S. Herbs as an antioxidant arsenal for periodontal diseases. J Intercult Ethnopharmacol. 2016 Jan;5(1):92–6.
- 50. Zheng XF, Liu CX, Yan YY, Wang Q. A review of

- thermoelectrics research Recent developments and potentials for sustainable and renewable energy applications [Internet]. Vol. 32, Renewable and Sustainable Energy Reviews. 2014. p. 486–503. Available from: http://dx.doi.org/10.1016/j.rser.2013.12.05
- 51. Liu J, Zuo J, Sun Z, Zillante G, Chen X. Sustainability in hydropower development— A case study [Internet]. Vol. 19, Renewable and Sustainable Energy Reviews. 2013. p. 230–7. Available from: http://dx.doi.org/10.1016/j.rser.2012.11.03
- 52. Bull SR. Renewable energy today and tomorrow [Internet]. Vol. 89, Proceedings of the IEEE. 2001. p. 1216–26. Available from: http://dx.doi.org/10.1109/5.940290
- 53. Delucchi MA, Jacobson MZ. Meeting the world's energy needs entirely with wind, water, and solar power [Internet]. Vol. 69, Bulletin of the Atomic Scientists. 2013. p. 30–40. Available from: http://dx.doi.org/10.1177/0096340213494 115
- 54. Pogson M, Hastings A, Smith P. How does bioenergy compare with other land-based renewable energy sources globally? [Internet]. Vol. 5, GCB Bioenergy. 2013. p. 513–24. Available from: http://dx.doi.org/10.1111/gcbb.12013
- 55. Barbier E. Geothermal energy technology and current status: an overview [Internet]. Vol. 6, Renewable and Sustainable Energy Reviews. 2002. p. 3–65. Available from: http://dx.doi.org/10.1016/s1364-0321(02)00002-3
- 56. Tilman D, Socolow R, Foley JA, Hill J, Larson E, Lynd L, et al. Beneficial Biofuels--The Food, Energy, and Environment Trilemma [Internet]. Vol. 325, Science. 2009. p. 270–1. Available from: http://dx.doi.org/10.1126/science.1177970
- 57. Basu P. Biomass Gasification, Pyrolysis and Torrefaction: Practical Design and Theory. Academic Press; 2013. 548 p.
- 58. Pimentel D, Harvey C, Resosudarmo P, Sinclair K, Kurz D, McNair M, et al. Environmental and Economic Costs of Soil Erosion and Conservation Benefits [Internet]. Vol. 267, Science. 1995. p. 1117–23. Available from: http://dx.doi.org/10.1126/science.267.5201.
- 59. Wissner M. The Smart Grid A saucerful of secrets? [Internet]. Vol. 88, Applied Energy. 2011. p. 2509–18. Available from: http://dx.doi.org/10.1016/j.apenergy.2011.0 1.042
- 60. Vijayapriya T, Kothari DP. Smart Grid: An

- Overview [Internet]. Vol. 02, Smart Grid and Renewable Energy. 2011. p. 305–11. Available from:
- http://dx.doi.org/10.4236/sgre.2011.24035
- 61. Beaulieu A, De Wilde J, Scherpen JMA. Smart Grids from a Global Perspective: Bridging Old and New Energy Systems. Springer; 2016. 283 p.
- 62. Stern N, Stern NH, Great Britain. Treasury. The Economics of Climate Change: The Stern Review. Cambridge University Press; 2007. 692 p.
- 63. Mondal MAH, Kamp LM, Pachova NI. Drivers, barriers, and strategies for implementation of renewable energy technologies in rural areas in Bangladesh—An innovation system analysis [Internet]. Vol. 38, Energy Policy. 2010. p. 4626–34. Available from: http://dx.doi.org/10.1016/j.enpol.2010.04.0 18
- 64. Bank AD, Asian Development Bank. Mainstreaming Climate Risk Management in Development: [Internet]. 2017. Available from:
  - http://dx.doi.org/10.22617/tcs179040-2
- 65. Schaeffer R, Szklo AS, de Lucena AFP, Bruno Soares Moreira, Nogueira LPP, Fleming FP, et al. Energy sector vulnerability to climate change: A review [Internet]. Vol. 38, Energy. 2012. p. 1–12. Available from: http://dx.doi.org/10.1016/j.energy.2011.11. 056