ISSN 2278 - 5663

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EDITORIAL

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CEO, IT Power - India

Our learning curve for MW scale solar power is a global trendsetter. Not only has it achieved remarkable reductions in cost of generation, bringing it close to grid parity; the entire ecosystem for further growth of this sector seems to be in place. The distributed roof-top market is also on an ascending curve. However, the off-grid sector with its solid 30 years of experience appears to be following a reverse trend.

> The off-grid sector with its solid 30 years of experience, appears to be following a reverse trend

Our learning is being re-learnt, particularly in the micro-minigrids sector. The first solar DC microgrid (5 kWp) was commissioned almost 30 years back in a small village in Uttar Pradesh. It provided electricity to streetlights, a community television viewing facility and domestic light connections to rural households using fluorescent lights, which were considered state-of-the-art lighting at that time. In 1996, an AC microgrid of 25kWp was commissioned in Sunderbans region of West Bengal.

Next 10 -12 years saw the learning curve of AC microgrids of capacities upto 100 kWp rising fast in terms of (a) design & engineering for generation, power conditioning, distribution network and household wiring & connections (b) standardization of procurement practices and contracting, including O&M (c) load management and optimization (d) tariff determination, including experimentation with differential tariffs (e) community involvement in local management and payment collection including theft control (f) facilitation of livelihood, drinking water schemes with the involvement of NGOs and CBOs. One critical element was missing though - private sector participation and investment. The microgrids were hence considered unsustainable.

Today, we are again talking about microgrid, private sector driven microgrids, as viable and sustainable options for providing access

to energy not only for domestic but also for community and productive applications. We are overwhelmed about entrepreneurship in this sector, which is installing microgrids as small as 100 Wp catering to 10-20 household and discussing about their innovative methods to deal with challenges of payment collection, theft control, among others. These microgrids typically supply electricity to two LED light points (1 Watt average each), one charging point for mobile phone, and charge upto Rs. 150 per month per household. A simple back-of-the-envelope calculation would tell that an independent solar home system with the same or more electricity services with easy finance would perhaps be a better option for these households.

So our three decade old microgrid learning curve collectively ascended by the government, public sector and the communities themselves, is being re-learnt by the enterprises of today and we are all hoping, including the donor and financing community, that their individual learning will make this sector more and more viable as this experience grows. We promote PPP (Public-Private-Partnership) model in investment, it should be extended to cross-learning also. The private sector with its acumen to maximize its return on capital investment should complement and supplement the public sector with its inclusive approach towards maximizing the returns on social capital. We need to work smart in PPP mode to advance the learning curve of micro-minigrids which can make substantial contribution in advancing energy access agenda, in addressing MDGs and concerns of climate change.

We need to work smart in PPP mode to advance the learning curve of micro-minigrids

The Bulletin in its new avatar is focusing on access to energy for addressing the primary health sector. I hope you enjoy reading the contents and we enjoy your continued patronage.

ITP News Update

Scaling up Access to Electricity in Rural Areas of Bihar, India
IT Power India is extending consulting services to the World Bank and MNRE for scaling up access to electricity in rural areas of Bihar. The specific objectives of the assignment are to conceptualise and design projects to provide off-grid and / or grid-interactive renewable energy solutions to two districts in Bihar, India. The assignment includes developing business models, service delivery mechanisms and institutional frameworks for effective execution of these projects so that they can sustainably meet the energy needs of the served populations.

ITP signs MoU for SPEED
IT Power India signed an MoU for Rockefeller funded SPEED programme to become its Energy Applications Partner. SPEED or Smart Power for Environmentally-sound Economic Development, focuses upon addressing the growing power needs of rural poor in the underserved regions of India. As the Energy Applications Partner, IT Power India will develop service delivery models for utilizing electric power from decentralized renewable energy plants by rural communities for irrigation and local enterprise needs, and document information on service delivery models and disseminate such information to promote knowledge sharing among practitioners and policy makers.

East African Centre for Renewable Energy and Energy Efficiency
IT Power has completed the technical and institutional structure design of the East African Centre for Renewable Energy and Energy Efficiency (EACREEE), a programme supported by UNIDO and Austrian Development Agency. The design of the centre was presented as feasibility study and includes Renewable Energy and Energy Efficiency considerations for Burundi, Kenya, Rwanda, Tanzania and Uganda.

Supervision of 522 PV Installations in Schools, Clinics and Villages, Mozambique
IT Power will supervise an electrification programme of 522 PV systems in schools, health centres and communities in Mozambique. For this 3-year project, IT Power has partnered with TESE Engineers Without Borders from Portugal, and will carry out site visits, inspections, technicians training, and ensure all PV installations are to international standards. The programme is supported by FUNAE.

Policy Issues

Scale-up of Access to Rural Energy Services – In the Policy, Programmatic and Institutional Backdrop

Ajit Kumar Gupta

Rural Electrification - The Early Experiences

A key challenge of the energy sector in India has been to provide access to our vast rural population. Rural electrification efforts in India were earlier confined to village electrification and pumpset energisation through the Rural Electrification Corporation (REC) under Ministry of Power (MoP) in association with the erstwhile State Electricity Boards. Apart from this, several initiatives were taken to develop National Programmes by the Ministry of New and Renewable Energy (MNRE) for providing modern energy services for cooking, heating, motive power and electricity through technologies based on locally available renewable resources such as solar, biomass, wind and small hydro, with implementation mainly through State Energy Development Agencies. These interventions have included distribution or installation of devices and systems such as improved cookstoves, biogas plants, solar cookers, solar water heaters, solar driers, solar lanterns and other lighting systems, solar pumps, biomass gasifiers, biofuel engines, wind mills, gharats and other mini and micro hydel units.

The Period of Policies and Regulatory Frameworks

The learning from these efforts helped in shaping the rural energy policies and establishing the legal, regulatory and institutional framework for providing energy access and energy security in rural areas. The Government's Power for All initiative of 2001 was followed by the Electricity Act, 2003 which obligated the Central Government and State Governments to jointly endeavour to provide access to electricity to all areas including villages and hamlets through rural electricity infrastructure and electrification of households. Generation and distribution of electricity was de-licenced with local distribution to be undertaken through panchayat institutions, users' associations, co-operative societies, NGOs or franchisees. The National Electricity Policy, 2005 called for electricity access to be secured to all households while also ensuring that electricity reaches poor and marginal sections of the society at reasonable rates. Wherever it is neither cost effective nor the optimal solution to provide grid connectivity, Decentralized Distributed Generation (DDG) facilities together with local distribution network are to be provided so that every household gets access to electricity. This could be done either through conventional or non-conventional methods of electricity generation whichever is more suitable and economical. Non-conventional sources of energy could be utilized even where grid connectivity exists provided it is found to be cost effective. Targeted subsidies with funding through budgetary resources, effective community participation, education and awareness programmes were other elements of the Policy. The Rural Electrification Policy, 2006 further envisaged provision of minimum lifeline consumption of 1 unit per household per day. While recommending off-grid solutions based on stand-alone systems, isolated lighting technologies and decentralised distributed generation, the Policy also advocates utilisation of non-conventional sources of energy, even where grid connectivity exists, after evaluating its cost effectiveness. The Integrated Energy Policy, 2006 also supported DDG facilities, based either on conventional or non- conventional electricity generation, whichever is more suitable and economical, together with a local distribution network, wherever grid-based electrification is not feasible.

Programme Implementations

With a conducive legal and policy framework in place, the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) was launched by the Ministry of Power in 2005 to achieve full electrification of villages and rural households in a time-bound manner. An important feature introduced by MoP under RGGVY in 2009 was the creation and deployment of franchisees for the development/operation of a generation and distribution system within an identified contiguous area for a prescribed duration with revenues to be collected directly from rural consumers. This arrangement was aimed at ensuring stable revenue flows and services to consumers, by reducing commercial losses through efficient billing and revenue collection. Franchisees were to purchase bulk power, and ensure routine operation and maintenance of the distribution infrastructure. On the other hand, MNRE fine-tuned its Remote Village Electrification Programme (RVEP) also in 2005 to take up electrification of villages, which may not get covered under RGGVY, mainly through solar photovoltaic systems. In addition, MNRE also took up a Village Energy Security Programme (VESP) on a pilot basis to test the efficacy of biomass-based solutions for meeting total energy requirements of a village. A major initiative came through the Jawaharlal Nehru National Solar Mission (JNNSM) launched by MNRE in 2010 under the National Action Plan on Climate Change (NAPCC).

Apart from grid power, the Mission also came up with Targets and Guidelines for off-grid solar solutions, including 20 million solar lanterns by 2022.

The Institutional Set-up

A wide-ranging institutional set up has been put in place comprising government, public and private sectors to facilitate implementation and financing of the rural energy and energy access programmes. Led by MoP and MNRE, they include public sector entities such as REC, Power Finance Corporation (PFC), Indian Renewable Energy Development Agency (IREDA), Solar Energy Corporation of India (SECI) at the Central level; agencies and discoms at the State level; and, NGOs, CBOs, SHGs, franchisees, channel partners, manufacturers at the field level. A recent trend is the emergence of RESCOs (Rural Energy Service Companies)that provide energy services (often metered) through fee-based business models for micro-grid and stand-alone system configurations. They are often backed by international funding sources and VC/PE funds. A number of success stories of innovative technological solutions and implementation models have emerged from such isolated efforts, and in a few instances have also received international recognition. Notable examples include Selco's SHS, D'lite's solar lighting, TERI'S LaBL, TIDE's cook stoves, Husk Power System's biomass and IT Power's watermills based energy access programmes. Energy access interventions are also coming through CSR and sustainability mandates from the corporate sector. In addition, opportunities are emerging through National and State-level Rural Livelihood Missions; National Missions on Micro-irrigation, Literacy, Rural Health; TRAI greening targets and regulations for telecom towers, etc.

The Rural Unmet Demands

Yet despite a robust policy, legal, institutional framework in place along with significant allocation of funding, there still remains a lot to be done to meet the large unmet demand in rural areas. Even in the villages already electrified, the electricity supply position remains highly unsatisfactory. Majority of the villages that still remain to be electrified are remote, inaccessible and have very low load densities. About 84% of the household energy consumption still comes from traditional biomass such as firewood, chips and dung cake. There is thus an unmet demand, which can be met by setting up small power plants with a localized mini grid, or stand alone systems, based on locally available resources. The unmet demand is only likely to grow in future to support the projected rapid economic growth and rising aspirations of rural populations. In such a scenario, it is necessary to scale-up deployment of distributed renewable energy systems alongside grid electricity to meet the full demand for electricity in rural areas.

Way Forward

Scale-up efforts should begin by taking stock and making an assessment of the work done so far in the country, sharing experiences and lessons learnt and identifying success stories and replicable projects. Challenges faced will need to be recognised – dispersed, non-homogeneous settlements; low capacity utilization from lack of productive loads; low affordability; and, competition from free grid supply, even though erratic. The scale-up will need to focus on development of sustainable business models and their implementation through an entrepreneur-driven approach, with full community participation. An integrated approach which encompasses local resources, conversion technologies, capacity building, financing and which adequately addresses the social, gender and institutional issues, will be necessary. This will ensure effective delivery of energy services, improve productivity and create new avenues for employment and income generation, thereby improving the overall quality of life in the rural areas.

Entrepreneur-driven business models, developed and implemented by RESCOs, will need to carefully consider the following dimensions for providing effective and remunerative rural energy services:

- Needs Assessment and Demand profile - rural energy services provided, particularly for productive end uses
- Micro enterprise development and involvement of Self Help Groups
- Income generation, livelihood improvement and creation of new employment opportunities
- Ownership, operation, post-installation and management modalities including local capacity building and training
- Social engineering, community mobilization and local NGO engagement
- Reliability of supply – storage, hybridization, where necessary
- Costs & mode of financing including targeted subsidies, Viability Gap Funding (VGF)/ annuity based funding, micro credit facilities - need for competition
- Revenue generation, tariff fixation and sustainability issues
- Institutional arrangements - Government-led development programme linkages to bring about local area convergence and engagement with local administrative machinery
- Scale of the intervention - household, hamlet/ village, cluster of villages or taluka/block level, and whether scalable
- Off-grid utility/franchisee tariff/regulatory issues - whether grid tie-up feasible, now or in future

Interview

Tarujyoti Buragohain, PhD

Dr. Tarujyoti Buragohain is associated with the National Council of Applied Economic Research (NCAER), New Delhi, India. She has conducted various studies on rural electrification. This particular interview is based upon her own experiences and the study report she prepared on Remote Village Electrification Program (RVEP) in 6 States of India (Assam, Meghalaya, Jharkhand, Odisha, Madhya Pradesh and Chattisgarh)

Dr. Buragohain, what specific impacts of "Access to Energy/Renewable Energy" do you see on health?

Good health depends upon pure drinking water, fresh fruits, vegetables, milk, eggs, fish, meat, etc. Renewable energy does not directly contribute to any one of these however, it has linkages in improving health conditions in various ways:

- Refrigerators may be used to keep food fresh and in hygienic condition.
- People will avoid kerosene lamps which affect health due to indoor air pollution.
- Access to energy will help running television sets, which is one of the most important media for creating awareness.
- Solar streetlight becomes a source of entertainment for 'Adivasi' villagers. They organize cultural programs of various kind. These types of activities are good for health.
- Solar power plants have also been installed in the Primary Health and Community Health Centres. It helps in providing immediate care to the patients when conventional electricity goes off.

Our study also finds that (especially in Jharkhand), due to easy access to energy the villagers keep the village clean and move around the village without fear of wild animals. This type of atmosphere helps in improving living conditions as well as health.

Your team conducted a study on RVEP in 6 states. What was the objective of the study?

Yes, we had carried out an evaluation survey of RVEP in six states: Assam, Meghalaya, Jharkhand, Odisha, Madhya Pradesh and Chhattisgarh. The study was sponsored by MNRE.

The objectives of the study was to assess:

- Functionality of the systems
- Satisfaction level of the beneficiaries after having solar home lighting systems
- Effectiveness of implementation arrangement of the programme
- Effectiveness of service and maintenance infrastructure
- Level of community participation

What were the social impacts of RVEP according to your findings?

After having solar home lighting systems, the lifestyles of the people have changed. Visiting neighboring homes have increased. Women find it more comfortable in doing household work. Some of the beneficiaries in Chhattisgarh said that school teachers and forest guards, who earlier did not stay in the villages, started doing so due to the solar lights. Additionally, solar lighting has increased get-togethers in the temples and community centres. Some of the beneficiaries said that TV was a dream for the villagers. Now they see cricket match and other programs on TV. School going children are studying better and scoring good marks in their exams. This has encouraged non school going children to go to school. Solar energy has improved social convergence. Our study finds that before installation of solar lights people used to sleep early in the villages. Now they come out from home after dinner, sit near the streetlight and share their personal problems and try to help each other. It is really amazing.

Can you specifically highlight the health related benefits?

There are many health benefits. Now, due to availability of light women can cook food more hygienically. Some of the beneficiaries said that 'looking after old and sick people' has become easier. Using kerosene lighting systems are hazardous, fire prone and create indoor pollution, which is not good for health. Now they have pollution free light, which is good for health.

What were the functionality issues at the ground level?

The functionality of the systems is good during summer and winter irrespective of the States. On an average, one luminaire works for 4 to 5 hours. Performance of the systems reduces during rainy seasons due to lack of adequate sunshine. The suppliers made arrangement for maintenance at the time of installation. However, beneficiaries are not very happy with the maintenance arrangement. It has not been institutionalized. Many of the beneficiaries are not aware about the service centre. Nevertheless, all the sample beneficiaries of the RVEP are very happy as their expenditure on lighting has reduced significantly.

Thank you for sharing your views.

Thank you!

Solar-Chill: The Sunny Side of Battery-less Vaccine Refrigerator

Dr. Suneel Deambi

Technology Spotlight

Did you ever dream of running a solar application at night without the customary lead-acid battery storage (the commonly used batteries)? For sure there is no guess value either for using some other form of energy storage like super capacitor or a flywheel. Well! the product use under mention is that of a battery-less solar PV powered vaccine refrigerator. The underlying cause is noble and of a far reaching importance in terms of storing vaccine for pulse polio immunisation programme. Solar refrigerators with battery storage have marked their presence many years back, but their chilling effect is still to be felt in places far and wide. Key constraint being a high enough cost as also a frequent need for battery maintenance and replacement.

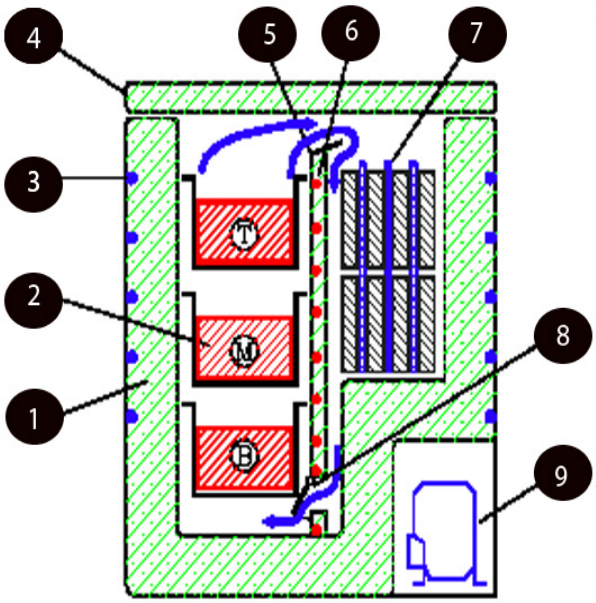

Figure source: Danish Technological Institute

1. Cabinet wall with 100 mm of insulation (made by Vestfrost)
2. Vaccine packages (in three baskets)
3. Integrated condenser
4. Lid (also 100 mm insulation)
5. Internal wall, insulated
6. Electric heating element, thermostat controlled by temperature in the bottom of the box
7. Evaporator (wire on tube) and ice packs
8. Self-acting damper
9. Compressor (made by Danfoss Compressors)

Cooling with Conventional Energy Sources

Presently there are more than 2,00,000 domestic kerosene and gas based fridges in use worldwide, apart from around 1,00,000 kerosene vaccine coolers. The most severe drawback resulting from their use is emission of more than 1 million tons of CO_2 per year in addition to threat from HFC leakages.

The operating principle

The underlying principle is quite novel in case of storing solar energy in an ice battery. This unit comprises of 2 or 3 solar modules which drive a DC compressor. In turn, the compressor enables a refrigeration cycle with formation of an ice bank. The ice bank provides cooling within a storage cabinet. This is how solar power remains deposited in an ice battery. Thermostat maintains the temperature between 2-8^{0}C for vaccine storage. Temperature is maintained by a thick insulation cover even in the absence of adequate sunlight for up to 3 to 5 days.

Benefits

Solar chill product offers some ready gains like substitution of refrigerant and insulation gas HFC, by Hydro-Carbons (CnHn). This leads to further lowering of carbon emissions apart from the use of a thermal ice battery. It also avoids the use of lead in the process. More importantly, the battery-less refrigerator is easy to install as no charge controller is required.

WHO Pre-qualification

The World Health Organisation pre-qualified its first ever solar direct-drive vaccine refrigerator (Vestfrost model MKS044) in 2010. This, despite the fact that around a dozen models of battery-less refrigerators existed in year 2000 itself. It took around a decade for the solar chill refrigerator in the making. A recent survey has pointed to over 60% of battery related faults in traditional solar refrigerator units. Thus WHO has hailed the development of solar chill refrigerator as a milestone of sorts.

Market Outlook

Solar chill refrigerator is still waiting to take off on a large scale. A kerosene vaccine cooler costs around $ 1500 as against $ 1800-2800 for a battery-less refrigerator.

Some of the issues and challenges that can be highlighted on this technology are:

- limited recognition of the existence and availability of solar chill technology
- acceptance issues
- technical challenges to technology transfer
- willingness of the companies to work with hydrocarbons
- supply of high-grade hydrocarbon refrigerants
- putting in place proper safety measures, training and service infrastructure
- price variations with the kerosene models (i.e. on capital cost)

Expectedly as technology matures further, this battery free refrigerator may well steal a march over the traditional makes in terms of a diminished cost too.

Energy & MDGs

Health

Samir Prasad

Energy is all-pervasive in our lives; just like other natural basic prerequisites. Though it is mostly linked to activities such as cooking, boiling water, lighting, heating, but actually it seeps directly and indirectly into most of our activities. Clean energy accentuates the process of overall human and societal development –the rationale behind all the Millenium Development Goals (MDGs).

In the health sector the role of energy is all the more significant – a reality that has been somewhat ignored by the world community. Following are 2 examples that show how clean energy is being produced and made accessible to the remote communities for health benefits.

Case-1: Clean Energy for Primary Health Services
(Source: GoI-UNDP - Epowering Rural India the RE Way-Inspiring Success Stories)

This is a case study of Saran district in Bihar; a State which is one of the poorest of all in India. It has one of the lowest per capita electricity consumption in the country. Saran Renewable Energy (SRE) took up the challenge to electrify Garkha Village of Saran district by setting up biomass gasification plants. The plants use local raw materials such as *Dhaincha*, which is grown locally and provides opportunity of profit to the farmers. The electricity thus generated is provided to about 1000 households, 1 school and 2 medical units. With the electricity at hand, medical clinics can now run simple though important equipment such as nebulizer used in cases of respiratory problems. Besides, blood collection lab now functions unhindered and has become cost affective compared to the diesel run generators. Villagers are now using energy to expand their livelihood opportunities. The success of this venture brought SRE the prestigious Ashden award.

Case-2: Solar Suitcase
(Source: "We Care Solar")

Maternal deaths account for millions of deaths annually around the globe, most of which occur in the developing and underdeveloped countries. One of the reasons for high rate of maternal deaths is the lack of electricity at the health centers in remote areas. Getting into the core of this problem, "We Care Solar" came up with a solar suitcase; a portable solar electric system designed to power the overhead surgical lights in the operating room, labor and delivery wards. Besides, it can power cell phones and radios to enhance mobile telecommunication between health center staff and on-call physicians. The basic system comes with 40 or 80 Wp of solar panels and 12 Ah sealed lead acid battery. The system is designed to be user-friendly, robust, durable, and nearly-maintenance free.

Energy & MDGs (Health) *Source: WHO*

Goal 4: Reduce child mortality: Reducing indoor air pollution will prevent child morbidity and mortality from pneumonia; Protecting the developing embryo from indoor air pollution can help avert stillbirth, perinatal mortality and low birth weight; Getting rid of open fires and kerosene wick lamps in the home can prevent infants and toddlers being burned and scalded.

Goal 5: Improve maternal health: Curbing indoor air pollution will alleviate chronic respiratory problems among women. A less polluted home can improve the health of new mothers who spend time close to the fire after having given birth. A more accessible source of fuel can reduce women's labour burdens and associated health risks, such as prolapse due to carrying heavy loads.

Goal 6: Combat HIV/AIDS, malaria and other diseases: Lowering levels of indoor air pollution levels can help prevent 1.6 million deaths from tuberculosis annually. Sufficient energy may help the households use more preventive measures against such diseases and hospital units may be functioning more time in a day, with better health facilities to diagnose and treat the patients.

Product Feature

Solar Batteries for Hearing Impaired

Would you like to whisper to the Sun, not for fun - but for a real need? Well the product in question is a solar battery charger for hearing aids. As per the available estimates, nearly 7% of the global population is hearing impaired. This means a massive size of around 312 million people, most of whom live in the developing countries.

A standard size battery used in 95% of all the "behind the ear hearing aids" costs a user $ 1.0 to $ 1.20 and lasts just about a week. This cost is obviously unaffordable in the developing countries. A ready solution in current practice is a solar powered battery charger. It is placed next to a window that receives good amount of sunlight. This light charges 2 AA rechargeable batteries via a solar cell placed on the charger's top. It takes around 6 to 8 hours to charge a battery fully and charge thus stored lasts for a week or so. These batteries are good enough to take 300 cycles of repeated charging. Is it not an amazing way to befriend the sun and listen to the world all the time?

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Design & Editorial Consultants: Samir Prasad & Prodyut Mukherjee
Technical & Creative Inputs: All ITP members
Published By:
IT Power Consulting Pvt. Ltd.
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Dear Readers,
We invite cases of significance in the field of Access to Energy. If you are involved in such initiatives or know about it, do write to us, we will be happy to feature those in our upcoming issues.

Here is a scrabble you may enjoy solving.

OFISLS

ROASL

GREENY

LLEUDEF

Now pick up letters from the grey boxes and make the final word

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Hint: often used where accessibility is poor