Project report on k.w.h. meters

Business, Industries

A SUMMER TRAINING REPORT ON K. W. H. METERS Prepared by :- Devesh Kumar, 303956 (3rd year) CONTENTS * Certificate * Acknowledgement * Introduction of training * Company Profile * Products of BENTEX * Quality Policy and processes of BENTEX * Electricity meter * Direct current (DC) * Alternating current (AC) * Unit of measurement * Others Unit of measurement * Types of meters 1. Electromechanical meters 2. Electronic meters *Communication* Solid - state design * Multiple tariff (variable rate) meters * Domestic usage * United kingdom Commercial usage * Appliance energy meters * In - home energy use display * Smart meters * Prepayment meters * Time of day metering * Power export metering * Ownership * Location * Customer drop and metering equation * Tempering and security *Self evaluationACKNOWLEDGEMENT I am very thankful to Mr. A. K. shrivastava (GM/ SPD) for providing Me the opportunity to undergo the practical training in the Systems Production Division (SPD) of SKN Bentex Limited under the Supervision of Mr. S. C. Gupta (CM). They all guided me from ime to time and gave me dynamic ideas and suggestions by which I am able to complete my training successfully. I also want to thank all the visible and non-visible hands, which helped me to complete the practical training with great success. Introduction of training Training is a process of learning. Training is an organized procedure during which people learn knowledge and skill for the definite purpose. It is a short-term process utilizing a systematic and organized procedure in which non-managerial personnel learn technical knowledge and skills for adefinite purpose.

It refers to instruction in technical and mechanical operations like operation of a machine. It is for a short duration and for a specific job related purpose.

Training is very difficult fromeducation. Training is vocational where as education is general. Training is job-oriented whereas education is person-oriented. However, it is difficult in practice to differentiate between education and training because in many cases both of them occur simultaneously. The two are complementary and both involve development of talent and human potential. Generally, every level needs training.

Training is not something that is done once to new employees; it needs to be done continuously. Importance of training • Training leads to higher productivity. • It leads to better quality of work. • It leads to cost reduction. • It leads to highmotivationand morale of employees. • The organizational climate gets improved. • It leads to self-satisfaction of the employees. • Supervision gets reduced. • It leads to good cordial relation between employer and employee. • It leads to development of new skills in the employees. Scope of summer training

This summer training programs are designed for the students to master their technical skills. this summer training should include the following objectives- * Correlate courses of study with the way industry or potential work place operates its business or work usingtechnology. * work on implementing what has been learned in school or college. The engineering and professional courses including MCA, B. E. , B. TECH, BCA amongst other have undergraduates needinginternshipin fields of computerscience, electrical and electronics, mechanical, civil, bio informatics, etc.

The students for professional programs are required as a part of courses to undergo a few weeks the individual's tastes by improving their experience and making them reach a good enough company or workplace just in time. This training can result in learning of open source technology as a user of technology. That technology can be applied to improve the college infra-structure. The objective of training in Modern Office Practice is to give a perspective about the organization and functioning of all the areas of management in an industrial unit. Company profile

A journey that started 46years back at BENTEX - kelsons, today has reached new high in customer’s delight . During the Years , it has achieved milestones one after the other and established its forte in Electrical Industry with widespread trust goodwill. Driven by the sheer passion , exceptional foresight and acumen, Bentex has become a name to reckon with the flawless performance of products like starters, meters, MCB's and switchgear etc. These Products are manufactured in state-of-the-art plant and passed through stringent quality control tests. Not to mention , Bentex products are rated among the best in industry.

Little surprise that BENTEX - KELSONS products have crossed barriers to reach all corners of India and also Sri Lank, Bangladesh, Nigeria, Nepal etc. The Other Strength of the company is its vast presence through 750strong dealers network, which enables the company to meet demands of any magnitude. At BENTEX - KELSONS , The relentless pursuit is to exceed all expectations of customers.... and that is indeed the inspiration behind its growth. Thriving on technology and innovation, we are an eminent manufacturer of premium quality precision components of plastic and rubber for tractors, automobile and engineering industry.

We attribute our success to sharp business acumen and valuable experience of our work force. Durability, high precision, superior quality, consistent performance & smooth finish are the hallmark of our products. We have consistently increased our client base by meeting the client needs in terms of cost and performancegoals. Our machine shop is equipped with fully automatic injection molding machines of gold coin, all plas and IHI make of various capacities. We have facilities for ultrasonic & hot plate welding having our own tool room with Electra spark erosion machine to make moulds in-house.

We are O. E. M to many automobile, auto electrical, tractor and other reputed manufacturers and wish to serve our clients by supplying custom molded rubber and plastic components of high precision and best quality. Name of CEO Mr. S. C. Gupta Year of Est. 1983 Primary Business Type Manufacturers & Exporters Products We Offer Impellers, Oil Seals, Plastic Automobile Components, Plastic Industrial Products, Plastic Tractor Parts, Rubber Bellows, Rubber Hose Pipes. Products of 'BENTEX' Fly wheel * Reducton gear box * Pinion Stand| | | | | * Straightening machine * Mill stand * Gear coupling * Roll * Foundation rail * Pusher and ejector * V - belt pulley * Shearing machine * Rotary shear * Roller guide box and twist pipe * Bullet shearing * Pinch roll * Twisting machine * Gears * End cutting * Rotary shearing swivel * Universal couplings * Horizontal shearing Quality Policy / Processes “ SKN-BENTEX” Group products are at the forefront of innovation in industrial and agricultural field for protection and control of Electric Motor.

We are the pioneers and leaders in our field with latest international engineering products based on the world’s best technology since last four decades. “ SKN-BENTEX ” Group has a rich history of success, which has been achieved through dedication, teamwork and visionary thinking and sincere service of pride in result oriented performance. “ SKN-BENTEX” Group has been continuously restructuring to set up state-of-the-art electrical products manufactured at their own plants under strict quality control standard.

In this thrust , most of group companies adopted International Quality Standard and have been certified for ISO-9001 Certification and products are also available on ISI-Marked. The SKN-BENTEX Group of Companies engaged in wide range of products and has mainly three subgroups of electrical product range such as “ SKN”, “ SKN” Bentex Linger “ BENTEX-Linger” with their separate products line and “ SKN-BENTEX ” Group is a collection of smaller companies specialist in a specific range of products. Besides this “ SKN-BENTEX ” group engaged in the field of, LPG Home Appliances, LPG Regulators, Building Construction and Export Activities.

The complete manufacturing operation, marketing and installation Services of the company are certified under ISO 9001: 2000. The company has Enunciated the following quality policy to meet customer needs and expectations Through supply of quality products and services. " BENTEX is committed to strive forleadershipin the product marketed by the way of continuous improvements in the quality of its products and services and meeting the consumers needs in time and every time at a competitive Price.

These shall be achieved through continuous upgrading of technology and process improvement by involving all the employees, vendors, dealers and customers". " Quality is our basic business principle. " Fact chart :- Year of

Establishment 1983 Nature of Business Manufacturer, Exporter Number of Employees 51 to 100 People Major Markets Indian Subcontinent, East Asia, Middle East and South East Asia Quality objective :- * On time delivery of defect free products. Providing effective customer support. * Continual improvement of processes. * Improvement of infrastructure. * Development of human resources. Electricity meter An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device. Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour [kWh]. Periodic readings of electric meters establishes billing cycles and energy used during a cycle.

In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. " Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response shedding of loads during peak load periods. (analog electricity meter Typical North American domestic) (Typical North American domestic digital electricity meter) Direct current (DC)

As commercial use of electric energy spread in the 1880s, it became increasingly important that an electric energy meter, similar to the then existing gas meters, was required to properly bill customers for the cost of energy, instead of billing for a fixed number of lamps per month. Many experimental types of meter were developed. Edison at first worked on a DC electromechanical meter with a direct reading register, but instead developed an electrochemical metering system, which used an electrolytic cell to totalize current consumption.

At periodic intervals the plates were removed, weighed, and the customer billed. The electrochemical meter was labor-intensive to read and not well received by customers. In 1885 Ferranti offered a mercury motor meter with a register similar to gas meters; this had the advantage that the consumer could easily read the meter and verify consumption. The first accurate, recording electricity consumption meter was a DC meter by Dr Hermann Aaron, who patented it in 1883. Hugo Hurst of the British General Electric Company introduced it commercially into Great Britain from 1888.

Meters had been used prior to this, but they measured the rate of energy consumption at that particular moment, i. e. the electric power. Aaron's meter recorded the total energy used over time, and showed it on a series of clock dials. In the USA, Elcho Thomson perfected his 'recording wattmeter' in 1889. Alternating current (AC) The first specimen of the AC kilowatt-hour meter produced on the basis of Hungarian Bath's patent and named after him was presented by the Ganz Works at the Frankfurt Fair in the autumn of 1889, and the first induction kilowatt-hour meter was already marketed by the factory at the end of the same year.

These were the first alternating-current watt meters, known by the name of Blathy-meters. The AC kilowatt hour meters used at present operate on the same principle as Blathy's original invention, Also around 1889, Elihu Thomson of the American General Electric company developed a recording watt meter (watt-hour meter) based on an ironless commentator motor. This meter overcame the disadvantages of the electrochemical type and could operate on either alternating or direct current.

In 1894 Oliver Shallenberger of the Westinghouse Electric Corporation applied the induction principle previously used, only in AC ampere-hour meters to produce a watt-hour meter of the modern electromechanical form, using an induction disk whose rotational speed was made proportional to the power in the circuit. The Blathy meter was similar to Shallenberger and Thomson meter in that they are two-phase motor meter. Although the induction meter would only work on alternating current, it eliminated the delicate and troublesome commutator of the Thomson design.

Shallenberger fell ill and was unable to refine his initial large and heavy design, although he did also develop a polyphase version. Unit of measurement (Panel-mounted solid state electricity meter, connected to a 2 MVA electricity substation. Remote current and voltage sensors can be read and programmed remotely by modem and locally by infra-red. The circle with two dots is the infra-red port. Tamper-evident seals can be seen) Panel-mounted solid state electricity meter, connected to a 2 MVA electricity substation. Remote current and voltage sensors can be read and programmed remotely by modem and locally by infra-red.

The circle with two dots is the infra-red port. Tamper-evident seals can be seen. The most common unit of measurement on the electricity meter is the kilowatt hour [kWh], which is equal to the amount of energy used by a load of one kilowatt over a period of one hour, or 3, 600, 000 joules. Some electricity companies use the SI mega joule instead. Demand is normally measured in watts, but averaged over a period, most often a quarter or half hour. Reactive owner is measured in " thousands of volt-ampere reactive-hours", (kvarh). By convention, a " lagging" or inductive load, such as a motor, will have positive reactive power.

A " leading", or capacitive load, will have negative reactive power. Volt-amperes measures all power passed through a distribution network, including reactive and actual. This is equal to the product of root-mean-square volts and amperes. Distortion of the electric current by loads is measured in several ways. Power factor is the ratio of resistive (or real power) to volt-amperes. A capacitive load has a leading power factor, and an inductive load has a lagging power factor. A purely resistive load (such as a filament lamp, heater or kettle) exhibits a power factor of 1.

Current harmonics are a measure of distortion of the wave form. For example, electronic loads such as computer power supplies draw their current at the voltage peak to fill their internal storage elements. This can lead to a significant voltage drop near the supply voltage peak which shows as a flattening of the voltage waveform. This flattening causes odd harmonics which are not permissible if they exceed specific limits, as they are not only wasteful, but may interfere with the operation of other equipment. Harmonic emissions are mandated by law in EU and other countries to fall within specified limits.

Other units of measurement In addition to metering based on the amount of energy used, other types of metering are available. Meters which measured the amount of charge (coulombs) used, known as ampere-hour meters, were used in the early days of electrification. These were dependent upon the supply voltage remaining constant for accurate measurement of energy usage, which was not a likely circumstance with most supplies. Some meters measured only the length of time for which charge flowed, with no measurement of the magnitude of voltage or current being made.

These were only suited for constant-load applications. Neither type is likely to be used today. Types of meters Electricity meters operate by continuously measuring the instantaneous voltage (volts) and current (amperes) and finding the product of these to give instantaneous electrical power (watts) which is then integrated against time to give energy used (joules, kilowatt-hours etc.). Meters for smaller services (such as small residential customers) can be connected directly in-line between source and customer.

For larger loads, more than about 200 ampere of load, current transformers are used, so that the meter can be located other than in line with the service conductors. The meters fall into two basic categories, electromechanical and electronic. Electromechanical meters The most common type of electricity meter is the electromechanical induction watt-hour meter. The electromechanical induction meter operates by counting the revolutions of an aluminum disc which is made to rotate at a speed proportional to the power. The number of revolutions is thus proportional to the energy usage.

The voltage coil consumes a small and relatively constant amount of power, typically around 2 watts which is not registered on the meter. The current coil similarly consumes a small amount of power in proportion to the square of the current flowing through it, typically up to a couple of watts at full load, which is registered on the meter. The metallic disc is acted upon by two coils. One coil is connected in such a way that it produces a magnetic flux in proportion to the voltage and the other produces a magnetic flux in proportion to the current. The field of the voltage coil is delayed by 90 degrees using a lag coil.

This produces eddy currents in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current and voltage. A permanent magnet exerts an opposing force proportional to the speed of rotation of the disc. The equilibrium between these two opposing forces results in the disc rotating at a speed proportional to the power being used. The disc drives a register mechanism which integrates the speed of the disc over time by counting revolutions, much like the odometer in a car, in order to render a measurement of the total energy used over a period of time.

The type of meter described above is used on a single-phase AC supply. Different phase configurations use additional voltage and current coils. (Mechanism of electromechanical induction meter. 1 - Voltage coil - many turns of fine wire encased in plastic, connected in parallel with load. 2 - Current coil - three turns of thick wire, connected in series with load. 3 - Stator - concentrates and confines magnetic field. 4 - Aluminum rotor disc. 5 - rotor brake magnets. 6 - spindle with worm gear. 7 - display dials - note that the 1/10, 10 and 1000 dials rotate clockwise while the 1, 100 and 10000 dials rotate counter-clockwise)

Three-phase electromechanical induction meter, metering 100 A 230/400 V supply. Horizontal aluminum rotor disc is visible in center of meter. The aluminum disc is supported by a spindle which has a worm gear which drives the register. The register is a series of dials which record the amount of energy used. The dials may be of the cyclometer type, an odometer-like display that is easy to read where for each dial a single digit is shown through a window in the face of the meter, or of the pointer type where a pointer indicates each digit.

With the dial pointer type, adjacent pointers generally rotate in opposite directions due to the gearing mechanism. The amount of energy represented by one revolution of the disc is denoted by the symbol which is given in units of watt-hours per revolution. The value 7. 2 is commonly seen. Using the value of , one can determine their power consumption at any given time by timing the disc with a stopwatch. If the time in seconds taken by the disc to complete one revolution is , then the power in watts is . For example, if , as above, and one revolution took place in 14. seconds, the power is 1800 watts. This method can be used to determine the power consumption of household devices by switching them on one by one. Most domestic electricity meters must be read manually, whether by a representative of the power company or by the customer. an odometer-like display that is easy to read where for each dial a single digit is shown through a window in the face of the meter, or of the pointer type where a pointer indicates each digit. With the dial pointer type, adjacent pointers generally rotate in opposite directions due to the gearing mechanism.

Where the customer reads the meter, the reading may be supplied to the power company by telephone, post or over the internet. The electricity company will normally require a visit by a company representative at least annually in order to verify customer-supplied readings and to make a basic safety check of the meter. In an induction type meter, creep is a phenomenon that can adversely affect accuracy, that occurs when the meter disc rotates continuously with potential applied and the load terminals open circuited. A test for error due to creep is called a creep test. Three-phase electromechanical induction meter, metering 100 A 230/400 V supply. Horizontal aluminum rotor disc is visible in center of meter) Electronic meters Electronic meters display the energy used on an LCD or LED display, and can also transmit readings to remote places. In addition to measuring energy used, electronic meters can also record other parameters of the load and supply such as maximum demand, power factor and reactive power used etc. They can also support time-of-day billing, for example, recording the amount of energy used during on-peak and off-peak hours. Basic block diagram of an electronic energy meter) Communication Remote meter reading is a practical example of telemetry. It saves the cost of a human meter reader and the resulting mistakes, but it also allows more measurements, and remote provisioning. Many smart meters now include a switch to interrupt or restore service. Historically, rotating meters could report their power information remotely, using a pair of contact closures attached to a KYZ line. A KYZ interface is a kind of quadrature encoder. In a KYZ interface, the Y and Z wires are switch contacts, shorted to K for half of a rotor's circumference.

To measure the rotor direction, the Z signal is offset by 90 degrees from the Y. When the rotor rotates in the opposite direction, showing export of power, the sequence reverses. The time between pulses measures the demand. The number of pulses is total power usage. KYZ outputs were historically attached to " totalize relays" feeding a " totalize" so that many meters could be read all at once in one place. KYZ outputs are also the classic way of attaching electric meters to programmable logic controllers, HVACs or other control systems.

Some modern meters also supply a contact closure that warns when the meter detects a demand near a higher electricity tariff, to improve demand side management. Some meters have an open collector output that gives 32-100 ms pulses for a constant amount of used electrical energy. Usually 1000-10000 pulses per kWh. Output is limited to max 27 V DC and 27 mA DC. The output usually follows the DIN 43864 standard. Often, meters designed for semi-automated reading have a serial port on that communicates by infrared LED through the faceplate of the meter.

In some apartment buildings, a similar protocol is used, but in a wired bus using a serial current loop to connect all the meters to a single plug. The plug is often near the mailboxes. In the European Union, the most common infrared and protocol is " FLAG", a simplified subset of mode C of IEC 61107. In the U. S. and Canada, the favored infrared protocol is ANSI C12. 18. Some industrial meters use a protocol for programmable logic controllers (Modbus). One protocol proposed for this purpose is DLMS/COSEM which can operate over any medium, including serial ports.

The data can be transmitted by Zigbee, Wi-Fi, telephone lines or over the power lines themselves. Some meters can be read over the internet. Other more modern protocols are also becoming widely used. Electronic meters now use low-power radio, GSM, GPRS, Bluetooth, IrDA, as well as RS-485 wired link. The meters can now store the entire usage profiles with time stamps and relay them at a click of a button. The demand readings stored with the profiles accurately indicate the load requirements of the customer.

This load profile data is processed at the utilities for billing and planning purposes. AMR (Automatic Meter Reading) and RMR (Remote Meter Reading) describe various systems that allow meters to be checked without the need to send a meter reader out. An electronic meter can transmit its readings by telephone line or radio to a central billing office. Automatic meter reading can be done with GSM (Global System for Mobile Communications) modems, one is attached to each meter and the other is placed at the central utility office. Solid-state design

As in the block diagram, the meter has a power supply, a metering engine, a processing and communication engine (i. e. a microcontroller), and other add-on modules such as RTC, LCD display, communication ports/modules and so on. The metering engine is given the voltage and current inputs and has a voltage reference, samplers and quantizes followed by an ADC section to yield the digitized equivalents of all the inputs. These inputs are then processed using a Digital Signal Processor to calculate the various metering parameters such as powers, energies etc.

The largest source of long-term errors in the meter is drift in the preamp, followed by the precision of the voltage reference. Both of these vary with temperature as well, and vary wildly because most meters are outdoors. Characterizing and compensating for these is a major part of meter design. The processing and communication section has theresponsibilityof calculating the various derived quantities from the digital values generated by the metering engine. This also has the responsibility of communication using various protocols and interface with other add-on modules connected as slaves to it.

RTC and other add-on modules are attached as slaves to the processing and communication section for various input/output functions. On a modern meter most if not all of this will be implemented inside the microprocessor, such as the Real Time Clock (RTC), LCD controller, temperature sensor, memory and analog to digital converters. (Solid state electricity meter used in a home in the Netherlands) Multiple tariff (variable rate) meters Electricity retailers may wish to charge customers different tariffs at different times of the day to better reflect the costs of generation and transmission.

Since it is typically not cost effective to store significant amounts of electricity during a period of low demand for use during a period of high demand, costs will vary significantly depending on the time of day. Low cost generation capacity (base load) such as nuclear can take many hours to start, meaning a surplus in times of low demand, whereas high cost but flexible generating capacity (such as gas turbines) must be kept available to respond at a moment's notice (spinning reserve) to peak demand, perhaps being used for a few minutes per day, which is very expensive.

Some multiple tariff meters use different tariffs for different amounts of demand. These are usually industrial meters. Domestic usage Domestic variable-rate meters generally permit two to three tariffs (" peak", " off-peak" and " shoulder") and in such installations a simple electromechanical time switch may be used. Historically, these have often been used in conjunction with electrical storage heaters or hot water storage systems. Multiple tariffs are made easier by time of use (TOU) meters which incorporate or are connected to a time switch and which have multiple registers.

Switching between the tariffs may happen via a radio-activated switch rather than a time switch to prevent tampering with a sealed time switch to obtain cheaper electricity. United Kingdom Radio-activated switching is common in the UK, with a nightly data signal sent within the long wave carrier of BBC Radio 4, 198 kHz. The time of off-peak charging is usually seven hours between midnight and 7. 00am GMT, and this is designed to power storage heaters and immersion heaters. In the UK, such tariffs are branded Economy 7 or White Meter.

The popularity of such tariffs has declined in recent years, at least in the domestic market, due to the (perceived or real) deficiencies of storage heaters and the comparatively low cost of natural gas. An " Economy 10" meter is also available, giving five hours of heating overnight, with boosts in mid-morning and mid-afternoon. Most meters using Economy 7 switch the entire electricity supply to the cheaper rate during the 7 hour night time period, not just the storage heater circuit. The downside of this is that he daytime rate will be significantly higher, and standing charges may be a little higher too. For instance, normal rate electricity may be 9p per kWh, whereas Economy 7's daytime rate might be 14 to 17 p per kWh, but only 5. 43p per kWh at night. Timer switches installed on washing machines, tumble dryers, dishwashers and immersion heaters may be set so that they switch on only when the rate is lower. (Economy 7 Meter and Teleswitcher) Commercial usage Large commercial and industrial premises may use electronic meters which record power usage in blocks of half an hour or less.

This is because most electricity grids have demand surges throughout the day, and the power company may wish to give price incentives to large customers to reduce demand at these times. These demand surges often correspond to meal times or, famously, to advertisements in popular television programmers. Appliance energy meters Plug in electricity meters (or " Plug load" meters) measure energy used by individual appliances. There are a variety of models available on the market today but they all work on the same basic principle.

The meter is plugged into an outlet, and the appliance to be measured is plugged into the meter. Such meters can help in energy conservation by identifying major energy users, or devices that consume excessive standby power. A power meter can often be borrowed from the local power authorities or a local public library. In-home energy use displays A potentially powerful means to reduce household energy consumption is to provide convenient real-time feedback to users so they can change their energy using behavior. Recently, low-cost energy feedback displays have become available.

A study using a consumer-readable meter in 500 Ontario homes by Hydro One showed an average 6. 5% drop in total electricity use when compared with a similarly sized control group. Hydro One subsequently offered free power monitors to 30, 000 customers based on the success of the pilot. Projects such asGooglePower Meter, take information from a smart meter and make it more readily available to users to help encourage conservation. Smart meters Smart meters go a step further than simple AMR (automatic meter reading).

They offer additional functionality including a real-time or near real-time reads, power outage notification, and power quality monitoring. They allow price setting agencies to introduce different prices for consumption based on the time of day and the season. These price differences can be used to reduce peaks in demand (load shifting or peak lopping), reducing the need for additional power plants and in particular the higher polluting and costly to operate natural gas powered piker plants. The feedback they provide to consumers has also been shown to cut overall energy consumption.

Another type of smart meter uses nonintrusive load monitoring to automatically determine the number and type of appliances in a residence, how much energy each uses and when. This meter is used by electric utilities to do surveys of energy use. It eliminates the need to put timers on all of the appliances in a house to determine how much energy each uses. Prepayment meters The standard business model of electricity retailing involves the electricity company billing the customer for the amount of energy used in the previous month or quarter.

In some countries, if the retailer believes that the customer may not pay the bill, a prepayment meter may be installed. This requires the customer to make advance payment before electricity can be used. If the available credit is exhausted then the supply of electricity is cut off by a relay. (Prepayment meter and magnetic stripe tokens, from a rented accommodation in the UK. The button labeled A displays information and statistics such as current tariff and remaining credit. The button labeled B activates a small amount of emergency credit should the customer run out)

In the UK, mechanical prepayment meters used to be common in rented accommodation. Disadvantages of these included the need for regular visits to remove cash, and risk of theft of the cash in the meter. Modern solid-state electricity meters, in conjunction with smart cards, have removed these disadvantages and such meters are commonly used for customers considered to be a poor credit risk. In the UK, one system is the Pay Point network, In some cases, prepayment meters have not been accepted by customers.

There are various groups, such as the Standard Transfer Specification (STS) association, which promote common standards for prepayment metering systems across manufacturers. where rechargeable tokens (Quantum cards for natural gas, or plastic " keys" for electricity) can be loaded with whatevermoneythe customer has available. Recently smartcards are introduced as much reliable tokens that allows two way data exchange between meter and the utility. (A prepayment key) In South Africa, Sudan and Northern Ireland prepaid meters are recharged by entering a unique, encoded twenty digit number using a keypad.

This makes the tokens, essentially a slip of paper, very cheap to produce. Around the world, experiments are going on, especially in developing countries, to test pre-payment systems. In some cases, prepayment meters have not been accepted by customers. There are various groups, such as the Standard Transfer Specification (STS) association, which promote common standards for prepayment metering systems across manufacturers. Prepaid meters using the STS standard are used in many countries. Time of day metering

Time of Day metering (TOD), also known as Time of Usage (TOU) or Seasonal Time of Day (SToD), metering involves dividing the day, month and year into tariff slots and with higher rates at peak load periods and low tariff rates at off-peak load periods. While this can be used to automatically control usage on the part of the customer (resulting in automatic load control), it is often simply the customers responsibility to control his own usage, or pay accordingly (voluntary load control). This also allows the utilities to plan their transmission infrastructure appropriately.

See also Demand-side Management (DSM). TOD metering normally splits rates into an arrangement of multiple segments including on-peak, off-peak, mid-peak or shoulder, and critical peak. A typical arrangement is a peak occurring during the day (non-holiday days only), such as from 1 pm to 9 pm Monday through Friday during the summer and from 6: 30 am to 12 noon and 5 pm to 9 pm during the winter. More complex arrangements include the use of critical peaks which occur during high demand periods. The times of peak demand/cost will vary in different markets around the world.

Large commercial users can purchase power by the hour using either forecast pricing or real time pricing. Prices range from we pay you to take it (negative) to $1000/MWh (100 cents/kWh). Some utilities allow residential customers to pay hourly rates, such as Illinois, which uses day ahead pricing. Power export metering Many electricity customers are installing their own electricity generating equipment, whether for reasons of economy, redundancy or environmental reasons. When a customer is generating more electricity than required for his own use, the surplus may be exported back to the power grid.

Customers that generate back into the " grid" usually must have special equipment and safety devices to protect the grid components (as well as the customer's own) in case of faults (electrical short circuits) or maintenance of the grid (say voltage potential on a downed line going into an exporting customers facility). This exported energy may be accounted for in the simplest case by the meter running backwards during periods of net export, thus reducing the customer's recorded energy usage by the amount exported.

This in effect results in the customer being paid for his/her exports at the full retail price of electricity. Unless equipped with a detent or equivalent, a standard meter will accurately record power flow in each direction by simply running backwards when power is exported. Such meters are no longer legal in the UK, but instead a meter capable of separately measuring imported and exported energy is required. Where allowed by law, utilities maintain a profitable margin between the price of energy delivered to the consumer and the rate credited for consumer-generated energy that flows back to the grid.

Lately, upload sources typically originate from renewable sources (e. g. , wind turbines, photovoltaic cells), or gas or steam turbines, which are often found in cogeneration systems. Another potential upload source that has been proposed is plug-in hybrid car batteries (vehicle-to-grid power systems). This requires a " smart grid," which includes meters that measure electricity via communication networks that require remote control and give customers timing and pricing options.

Vehicle-to-grid systems could be installed at workplace parking lots and garages and at park and rides and could help drivers charge their batteries at home at night when off-peak power prices are cheaper, and receive bill crediting for selling excess electricity back to the grid during high-demand hours. Ownership Following the deregulation of electricity supply markets in many countries (e. g. , UK), the company responsible for an electricity meter may not be obvious.

Depending on the arrangements in place, the meter may be the property of the meter Operator, electricity distributor, the retailer or for some large users of electricity the meter may belong to the customer. The company responsible for reading the meter may not always be the company which owns it. Meter reading is now sometimes subcontracted and in some areas the same person may read gas, water and electricity meters at the same time. Location The location of an electricity meter varies with each installation. Possible locations include on a utility pole serving the property, in a street-side abinet (meter box) or inside the premises adjacent to the consumer unit / distribution board. Electricity companies may prefer external locations as the meter can be read without gaining access to the premises but external meters may be more prone to vandalism. (Current transformers used as part of metering equipment for three-phase 400 A electricity supply. The fourth neutral wire does not require a current transformer because current cannot flow in this wire without also flowing in one of the three phase wires) Current transformers permit the meter to be located remotely from the current-carrying conductors.

This is common in large installations. For example a substation serving a single large customer may have metering equipment installed in a cabinet, without bringing heavy cables into the cabinet. Customer drop and metering equation Since electrical standards vary in different regions, " customer drops" from the grid to the customer also vary depending on the standards and the type of installation. There are several common types of connections between a grid and a customer. Each type has a different metering equation. Customer supplies may be single-phase or three-phase.

In the United States and Canada, three-wire single phase is common for residential and small commercial customers. Three phase supplies may be three wire, or four wire (with a system neutral). Blondel's theorem states that for any system with N current-carrying conductors, that N-1 measuring elements are sufficient to measure electrical energy. This indicates that different metering is needed, for example, for a three-phase three-wire system than for a three-phase four-wire (with neutral) system. In North America, it is common for electricity meters to plug into a standardized socket outdoors, on the side of a building.

This allows the meter to be replaced without disturbing the wires to the socket, or the occupant of the building. Some sockets may have a bypass while the meter is removed for service. The amount of electricity used without being recorded during this small time is considered insignificant when compared to the inconvenience which might be caused to the customer by cutting off the electricity supply. Most electronic meters in North America use a serial protocol. In many other countries the supply and load terminals are in the meter housing itself. Cables are connected directly to the meter.

In some areas the meter is outside, often on a utility pole. In others, it is inside the building in a niche. If inside, it may share a data connection with other meters. If it exists, the shared connection is often a small plug near the post box. The connection is often EIA-485 or infra-red with a serial protocol such as IEC 62056. In 2010, networking to meters is rapidly changing. The most common schemes seem to combine an existing national standard for data (e. g. ANSI C12. 19 or IEC 62056) operating via the internet protocol with a small circuit board that does either power line communication, or ties to a digital mobile phone network. A commercial power meter) Tampering and security Meters can be manipulated to make them under-register, effectively allowing power use without paying for it. This theft or fraud can be dangerous as well as dishonest. Power companies often install remote-reporting meters specifically to enable remote detection of tampering, and specifically to discover energy theft. The change to smart power meters is useful to stop energy theft. When tampering is detected, the normal tactic, legal in most areas of the USA, is to switch the subscriber to a " tampering" tariff charged at the meter's maximum designed current.

At US$ 0. 095/kWh, a standard residential 50 A meter causes a legally collectible charge of about US$ 5, 000. 00 per month. Meter readers are trained to spot signs of tampering, and with crude mechanical meters, the maximum rate may be charged each billing period until the tamper is removed, or the service is disconnected. A common method of tampering on older meters is to attach magnets to the outside of the meter. These magnetically saturate the coils or current transformers, preventing the alternating current from forming eddy currents in the rotor, or inducing voltages in the current transformer.

Rectified DC loads cause mechanical (but not electronic) meters to under-register. DC current does not cause the coils to make eddy currents in the disk, so this causes reduced rotation and a lower bill. Some combinations of capacitive and inductive load can interact with the coils and mass of a rotor and cause reduced or reverse motion. The owner of the meter normally secures the meter against tampering. Revenue meters' mechanisms and connections are sealed. Meters may also measure VAR-hours (the reflected load), neutral and DC currents (elevated by most electrical tampering), ambient magnetic fields, etc.

Even simple mechanical meters can have mechanical flags that are dropped by magnetic tampering or large DC currents. Newer computerized meters usually have counter-measures against tampering. AMR (Automated Meter Reading) meters often have sensors that can report opening of the meter cover, magnetic anomalies, extra clock setting, glued buttons, A common method of tampering on older meters is to attach magnets to the outside of the meter. These magnetically saturate the coils or current transformers, preventing the alternating current from forming eddy currents in the rotor, or inducing voltages in the current transformer.

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Some tampers bypass the meter, wholly or in part. Safe tampers of this type normally increase the neutral current at the meter. Most split-phase residential meters in the United States are unable to detect neutral currents.

However, modern tamper-resistant meters can detect and bill it at standard rates. Disconnecting a meter's neutral connector is unsafe because shorts can then pass through people or equipment rather than a metallic ground to the generator. A phantom loop connection via an earth ground is often much higher resistance than the metallic neutral connector. Even in hese cases, metering at the substation can alert the operator to tampering. Substations, interties and transformers normally have a high-accuracy meter for the area served. Power companies normally investigate discrepancies between the total billed and the total generated, in order to find and fix power distribution problems. These investigations are an effective method to discover tampering. In North America power thefts are often connected with indoormarijuanagrow operations. Narcotics detectives associate abnormally high power usage with the lighting such operations require.

Indoor marijuana growers aware of this are particularly motivated to steal electricity simply to conceal their usage of it. Self evaluation This 42 days Industrial Training has led me to understand the various designing, assembling and the manufacturing processes of equipments in the industry, BENTEX. It has also enhanced my knowledge about the functioning and management of an industry, which I am sure, will be beneficial to me in mycareer. Regards, Name - Devesh Kumar Roll no. - 303956 Branch - Digital electronics (3rd year) Institute - C. R. R. I. T.