

Water & Energy. A Strategic Review. A symphony of solutions

Preamble: Water is our main endowment. The dream of going beyond the 42mn acres of irrigated crop lands remained a mirage. At least 21mn acres are available but cannot receive irrigation water. We have over-exploited the ancient & priceless sweet water aquifers. All the 40MAF mined annually in Punjab is not renewable. When electricity was unavailable the farmers relied on expensive diesel based pumping. A black hole in the agricultural economy besides the irreversible ecological damage inflicted. Regulation of GW Resource has become imperative. It must be understood that surface hydro flows & surface hydro storages are the basic source of Ground Water Recharge. Rainfall is the other main source in the hydrological cycle. Our main rivers are glacier fed. The ever deeper mining of GW has resulted in arsenic & unacceptable contamination of the GW resource far exceeding WHO recommendations. In addition the unchecked / untreated discharge of sewage, industrial & agriculture effluents into GW resource has south of Potohar caused an irreversible deterioration of water quality. Due to extreme variations of river flows (1 to 30 some years) an element of thermal power becomes essential.

Pakistan's average annual surface flows are 145MAF. It had 16MAF useable storage in 1974 after completion of Tarbela; about 11% of its annual surface flow. Sedimentation of reservoirs has resulted in a storage capacity of less than 11MAF (about 7.5%). The world average is 40%. Pakistan wastes +USD 60bn worth of water every year; reckoning the irrigation/energy/social value of 30MAF. Pakistan's population has tripled since 1974. The political elite has been helpless in creating a consensus to build the required mega dams on the Indus Main. Pakistan as a consequence sinks deeper into an energy crisis. The scourge of imported oil based electric energy has ravaged the national economy in the last some 18 years. Today Pakistan power sector swallows +Rs3bn worth of furnace oil (RFO/HFO) each day but still cannot overcome the energy deficit. After 1990 the hydel:thermal ratio of 70:30 has become lopsided & unsustainable. Pakistan is one of nine countries in the world blessed with great hydropower potential which can meet more than 50% of their energy needs. Pakistan's economic sustainability & energy security are basically dependent on its water resource. Around USD 1tr equivalent has been denied to the national economy in 30 years. This is the loss of irrigation water, unutilized hydel potential. We see the ravages inflicted on Pakistan's water-stressed economy. Not only has Pakistan been unable to break the endemic poverty cycle but due to social inequities there are insurrections in its two Western provinces. The nation must follow Mr. Shams ul-Mulk's advice and treat water as a strategic resource.

Dams create storages and do not consume water. Sindh benefited with additional supplies over a 12 months period from the construction of Mangla Dam & Tarbela Dam. While this strange state of anarchy & defiance of common-sense is unfolding since several decades we see that the Indians start a huge dam building exercise in IHK. Over 172 projects of which about 44 are commissioned give the upper riparian a real time control of the so-called Western Rivers: Indus, Jhelum & Chenab, in open defiance of the letter & spirit of the Indus Waters Treaty 1960. She is creating a dangerous cascade of dams in IHK. The IWT 1960 has serious flaws but may not be renegotiated. There is no exit strategy. The nation must identify those who interpret that Pakistan won the Kishenganga Award. Understand the corruption at Neelum Jhelum HPP. A comprehensive solution to the energy crisis for the medium & long term is crucial.

Measuring Water & Energy: *This review will include reference to MAF & Cubic Kilometer. The units of flow are cusecs (cubic feet/second) and cumecs in the metric system. MAF is simply one million acres covered by one foot of water. Roughly speaking if you multiply by 1.2 the figure is converted to cubic kilometers. Even one cubic meter of water is no small measure. It is a thousand liters and weighs a ton. A continuous flow of 1381 c/s for one full year conveys ONE MAF or about 1.2 Cubic Kilometer. Electrical energy measured as the well known kWh also known as the "unit". A 1000GWh is 1bn units.*

Water scenario 2013 & recommendations by the PBC Water cmte

The Pakistan Business Council Main Report (12 Jan 2013) & its abbreviated version (23 March 13) were based on the input & deliberations of three meetings held during Nov & Dec 2012. The committee comprised of the following had agreed to the basic recommendations.

1. Mr. Sikandar Mustafa Khan (Chairman)
2. Mr. Shams ul-Mulk
3. Begum Dr. Zaigham Habib
4. Dr. Bashir A. Chandio
5. Mr. Shamshad Gohar
6. Mr. Khalid Mohtadullah
7. Mr. Sardar Mohammad Tariq
8. Mr. Suleman Najib Khan (Co-Chairman)

There were five basic Terms of Reference (TOR) which were debated & discussed.

- AA. **The nexus** between water-food-energy is the major issue of the 21st century. Infrastructure is crucial to mitigate poverty & hunger. Pakistan is an arid semi desert country. There was subsistence agriculture in areas now comprising Pakistan as 84% rains are in summer (Kharif season). Therefore a mechanism had to be made for winter, early summer & late summer. Storages became crucial for survival. Dams inherently also provide flood protection & control. If we are unable to create storages for the additional waters due to global warming let us not be destroyed by floods.

There was a consensus that the replacement value of the Irrigation assets including the IBIS (Indus Basin Irrigation System) and WAPDA assets (dams + barrages) is close to USD 1tr. It is unleveraged and available for financing of mega storages & hydel generation. There was a consensus that the drinking water quality due to over mining / over exploitation of the ground water (GW) resource, south of Potohar, has been seriously contaminated. Surface water (SW) storages & flows are a major factor in aquifer recharge (through seepage). **IWT 1960 ignored drinking water needs.**

- BB. **Hydel** from multi-purpose dams today costs Rs1.39 per unit after amortization of debt compared to gas generation which is +Rs6/7. Furnace oil (RFO/HFO) is approaching + Rs 22. Nuclear is about +Rs9/10. Imported coal is expected to touch +Rs 12. Diesel based thermals +Rs29. The average cost of "power service" is around Rs 14.89 which includes Rs 3 as transmission & distribution losses, wheeling charges & margins etc. Every Pak Re (equivalent one US cent) makes a huge difference in the cost of power. Pakistan generated around 125bn units in 2012. Around 100bn were thermal units averaging an additional Rs9 per unit. Translates into a USD 9bn black hole in the economy now manifesting itself as the "circular debt". This is unsustainable.

Pakistan does not have a feasible & viable alternate to the hydro-electric route. The cumulative hydel potential of multipurpose mega-dams and run of river (ROR) hydels are now estimated at +100,000MW. New technologies & studies have shown that Bunji HPP (ROR) alone can sustain a power house of +7,000MW with a reasonable plant utilization factor. Many high-head projects (300m to 800m head) have been studied in the Northern Areas, AJK & KPK with excellent results. With careful planning & execution it may be possible to do an EPC / turnkey high head HPP in the cost range of USD 1.0 to 1.4mn/MW. Many could be peaking projects as well. These high head HPPs must be studied by entrepreneurs & corporate investors. They could hold the key to Pakistan's energy future & provide a string of "Peaking" hydel plants that would be used at high load periods. **GoP could assist these initiatives with "green attributes" & generous upfront / feed-in tariffs to improve financial viability.**

- CC. **DBD cannot replace KBD.** In 2004 DBD height was proposed as a 920ft high structure by adding its original 660ft design height with 260ft height proposed for KBD downstream. Implying that KBD stands assimilated. A childish & hazardous brain-wave of the Senate technical committee of Mr. Nisar Memon. Pakistan's great geotechnical & civil engineering expert on the Northern areas late Lt. Gen. (R) Dr. Ghulam Safdar Butt personally led a protest on 30 June 2004. During his protest meeting with the WAPDA Chairman Mr. Tariq Hameed witnessed by over 70 senior executives as well as associates of Dr. Butt it was observed that the "WAPDA experts" including Dr. Izhar a retired officer serving as internal consultant had no credible arguments/response. We refer to the PBC cmtte report and attached four letters of 2004 written by Dr. Butt to Gen Pervez Musharraf & WAPDA Chairman. Dr. Butt was heavily critical of the dam's height proposed by lead consultant M/s Nespak - MWH/Harza & others known as the NEAC consultants JV. He was upset that the 281m Roller Compacted Concrete (RCC) design would have an unprecedented crest level at +3900 ft asl. The possibility of 8MAF (10 cu km) breaking loose; a potential "hydro bomb" hanging over the nation. Construction of the world's highest light structure RCC dam in the region of severe seismic history was "playing with fire". Perhaps he could have condoned an Arch-Gravity structure (with an earth/rock core) with a lower height & smaller storage. The absence of construction inputs at site compels WAPDA to accept a light RCC design. The March 2013 warning by the Director General of the Geological Survey of Pakistan (GSP) has stated that Basha Dam is highly vulnerable because of huge "fault lines". The fact that India blocks multilateral financing in the Northern Areas (under World Bank's Kashmir Policy) is another hurdle. Now DBD must be a safer, lower & smaller structure constructed at less than 50% of the present cost estimate. **Its purpose will be electrical energy and as a "debris check dam" to enhance the life of Tarbela.**
- DD. **Neelum Jhelum 969MW HPP:** WAPDA has used a false pretext. There is no race between Indian IHK & Pakistani projects. PCIW states that whoever builds first will have perpetual rights over Neelum waters. Such a misinterpretation is suicidal & treacherous. Mr. Jamaat Ali Shah, the 5th PCIW from 1991 to 2011 had failed to respond within the stipulated period to the ICIW's communication as per procedure laid out in Annex D of the IWT 1960. The flow of the western rivers are perpetually Pak endowment and for the "uninterrupted use" of Pakistan as stated in the IWT 1960 and may only be ignored at Pakistan's peril. The IWT 1960 is sacrosanct. Now the longer tunnel option N-J HPP & enlarged DBD both have the obvious purpose of distracting the nation from the critical KBD project. The people of Pakistan are paying a Neelum Jhelum surcharge in their utility bills. The project is further burdened with additional costs for operating TBMs instead of the economical "drill & blast" method originally agreed in the contract. The corruption on this project has been unprecedented. The purchase of TBMs was never sanctioned by any major project consultant due to the soil conditions. The option of going below the Jhelum upper stem makes the Neelum Jhelum tunnels the deepest hydraulic tunnels in the world. The project will cost +USD 5bn. The original USD 1.4bn was a bluff. Can Pakistan afford to spend USD 4bn for an additional 400MW? The project design may revert to Option 1 and tunnels terminated at the upper Jhelum stem, where the 550MW power house may be located. The 18 Feb 2013 decision by the Court of Arbitration permits India to divert waters for the Kishenganga HPP. Decision on Neelum ecology is awaited. **GoP may consider abandoning the project as the energy / plant factor does not justify the costs.**
- EE. **WAPDA be revived financially.** This vital organization created in 1958, modeled on the TVA, was a gift of the Eisenhower Administration. The private sector must play its role & also invest in hydel ROR projects. Mr. Kamal Majidullah a non technical person presently acting as the czar presiding over PCIW & IRSA affairs must be shown the door. A strategic commission may guide the PCIW (Pakistan Commissioner on Indus Waters) on matters of hydrology including the water issues with its Indian counterpart. **Remember Pakistan has no response to the ICID & hydrologic experts with ICIW.**

Energy Scenario in early 2013, an outline sketch

Energy Facts: Pakistan's primary energy consumption was estimated in 2011 at 65.8m tons of oil equivalent. The breakup being:

- ❖ 21.4 million tons was use of Oil (**nearly 60% was for power generation**)
- ❖ 34.1 million tons from Natural Gas
- ❖ 4.3 million tons from Coal
- ❖ 0.6 million tons from Nuclear
- ❖ 6.2 million tons from Hydro Resources

Electric Energy Specific Notes:

- ❖ In 2011, 12m tons of RFO/HFO was imported for power gen by public & private sectors. This has caused the energy black hole leading to the "circular debt". It is the inability of the consumers to pay for the real electric energy tariffs when based on imported oil and for the State Corporations to manage the oil imports in view of the power utilities inability to balance its books. Basically Pakistan produced around 125bn electrical units of electrical energy in 2011 of which the 25 odd private sector IPPs produced over 50%. About 100bn thermal units averaging an additional Rs9 per unit. This translates into a USD 9bn black hole in the economy which has manifested itself as the "circular debt". **Corruption/theft increased exponentially with these shortages.**
- ❖ Thermal generation capacity is + 75% of the 23,000MW installed capacity in Pakistan. The derated capacity due to old GENCO plants is in fact 20,400MW. The available power at any time of the year is dependent on the surface flows (hydel) & the imported RFO supply logistics for thermal plants. Here we assume that GoP will not curtail gas supplies for three months under the traditional gas supply contracts signed by WAPDA. The depletion of gas wells will increase the imported energy burden. Perhaps a private initiative for Shale gas exploitation will be permitted by the GoP. The LNG private import initiative Phase-1 was floated for an import of around 3MTPA of LNG annually which could provide 400 mmcf/d (million cubic feet per day). **Can LNG compete IP or TAPI?**
- ❖ Pakistan produced only 1.5m tons coal in 1999 that marginally increased to 1.6m tons in 2009. Coal consumption in Pakistan was 2.1m tons of oil equivalent that increased to 5.3m tons of oil equivalent in 2008. In 2011 imported coal alone crossed 6m tons especially for the Cement Industry. It has been an energy dilemma that Pakistan's Coal & Lignite Resource has high sulphur content. In technical terms it is an immature resource. **Fortunately the Thar Lignite has low sulphur content (around 1%).** However there is the issue of high moisture content (around 49%) that makes handling a hazardous task. The Thar Coal Development projects are a public-private initiative since the provincial government of Sindh will be involved in the mining & infrastructure. At least three power generation projects based on mine mouth power plants totaling over 3,000MW are also in an advanced stage of investigations. Thar Coal reserves represent an Eldorado as reserves estimated at 184bn tons. The best mode for utilization will be above or below ground gasification. **Thar lignite has high moisture content and cannot be stored in open atmosphere due to being highly inflammable when dry.**
- ❖ The IPPs are predominantly based on imported energy. There are exceptions including a part of the privatized KAPCO (1638MW derated 1343MW) and UCH-1 (501MW dependable) based on a dedicated gas field. A few small hydel stations in KP controlled by KHYDO are also classified as IPPs. Several larger hydel IPPs totaling some 2000MW are in different stages of implementation in KP province & AJK. Around 1330MW gas based IPPs were commissioned in the post 2008 period with RFO or HSD as backup fuel. All new IPPs are not governed by the old 1994 private power policy. Similarly another ten thermal IPPs based on imported oil are in different stages of construction. Some thermal IPPs based on dedicated gas fields are also expected to add about 500MW this year. **Power capacity could reach 30,000MW by 2018 of which private utility generation will be around 50%. Remember an IPP with +10% is a monopoly.**

A symphony of solutions to achieve sustainability

Causes of Pakistan's economic dilemma in 2013 can be simply summed up as for a nation that has not understood in sixty five years that its key strategic natural endowment is its water resource. The source of life is also the source for growth in all the sectors including energy. The regional adversary understood it perfectly and took all measures to weaken, damage & eventually destroy (God forbid) the lower riparian through the water resource route. Pakistani society is predominantly naïve, pervasively feudalistic & perilously indifferent. The national economy has reached the precipice. Here are the few very painful steps to restore sanity:

- AA) Plan with one criterion; **“import substitution”**. Reduce oil imports by 15% every three years. Replace it with renewable energy which includes hydels/hydropower, solar energy, biomass, wind-power and domestic biogas. The national objective to regain the Hydels:Thermal ratio of 70:30 may be modified and be replaced with a new objective of achieving Renewables:Hydrocarbon energy mix of 70:30 within 12 years. Thermal nuclear energy is unavoidable in the mix. Water must be treated as a strategic resource. **RFO may in the medium term be replaced by a mix of imported & local coal.**
- BB) Recharge & regulate the water aquifers by building two more mega-dams on the Indus Main. The nation also desperately needs the low cost energy of large dams. Expose the people who carried out the vicious anti-dam, anti-national propaganda in the last forty years. Convince the population of Sindh with scientific logic. KBD is fully ISO 14000 compliant. The Sindhi people benefited enormously from Mangla & Tarbela dams and they will benefit from any new mega dams on the Indus Main. Instead of “salaba” irrigation during monsoons which has twice become a killer flood in the last three years let the new storages be used for storing Indus waters during the short monsoon period so that Sindh & KPK both receive life giving waters for all twelve months duly regulated. Sindh must understand that it uses more than 2 meters /acre/year but this irrigation water cannot be recycled as it percolates into a useless aquifer of brackish water full of pathogens & impurities. **Sindh desperately needs drinking water provided by regular surface flows of rivers & canals.** It is the highest test of the political leadership.
- Hydropower potential is now estimated at +100,000MW but only +6500MW is utilized. Mega-dams always involve large hydel capacity. However 80% of the hydel potential will be ROR (Run-of-River) and within this at least 8,000MW is very high head (low cost construction/most economical hydel generation) as identified on tributaries in the northern highlands. They are the key to provide energy “Peaking”. A potential of about 500MW (low head) exists on IBIS canals. Private initiative on non-reservoir projects must be encouraged. Hydel projects upto 1MW (without storage) may be allowed for investment with a feasibility study only to ensure ecological/environmental compliance. Let Diamer Basha dam be a safer, lower and smaller structure to be built at half the cost. **KBD & DBD must work in conjunction with Tarbela to make Pakistan prosperous as advised since 50 years by all the eminent/recognized engineers & hydrologists. Large hydels together with the large coal plants may be the base load providers.**
- CC) Solar PV power potential is over 2.9mnMW as calculated by the late Dr. Bhutta of the International Islamic University, Islamabad. The energy content will be a multiple of time. Perhaps he was not foreseeing the high concentrated HCPV or simply CPV variants that maximize the power of the solar PV resource by 500 to 1000 suns. The beauty of this boundless resource is that simultaneously the solar PV modules can generate PV current based on intensity of sunlight and in tandem the heat source of the sun can be captured by all the other solar thermal technologies. The most prominent solar thermal applications are based on CSP (Concentrated Solar Power) which involves arrays of mirror troughs that focus sun rays on a concentric tube containing mineral oil raising its temperature to +400 deg C. This heat energy has enormous applications for power generation and industrial heat. Standalone power projects using CSP are presently in the 10MW to 300MW range. These projects involve thermal storage systems which

makes it possible to produce 24 hours. The sun does not shine 24 hours. Many Hybrid solar projects such as the ISCC (Integrated Solar Combined Cycle) mode are also under construction where CSP will help increase the combined cycle plant (gas turbine / HRSG boiler / waste energy steam turbine) output by 10 to 20%. It is estimated that by 2020 more than 320 CSP plants will be in operation globally giving 16,000MW (16GW) of clean power to ISCC plants. CSP is also the technology of choice for the DESERTEC initiative in the Sahara desert to channel low cost clean energy for Europe. CSP is also the technology of choice for desalinating seawater a critical subject in many parts of the world. It will help reduce CO2 reductions by 148mn tons annually by 2020. The solar power tower technology abbreviated as CST is a variant of CSP. The tower CSP has the advantage of taking the working temperature to +600 deg C. It has limitations due to the size of the mirror field that can be developed around it. **CSP should be used to create an ISCC and enhance the output & efficiency of the 320MW UAE 2003 gifted plant for Faisalabad, once this project receives gas allocation.** It is a shameful fact that UAE generously gifted GE gas turbines (Frame 5s & Frame 6s) totaling 200MW was made part of a 320MW combined cycle project PC-1. The USAID agreed to finance it. **The Federal Ministry refused gas allocation to the project. It lies in storage.**

Another solar thermal technology is the dish-sterling system involving a parabolic dish structure that captures solar radiation and concentrates onto the heat absorption unit of a sterling engine. An efficient technology suited to decentralized & small scale electricity generation similar to solar PV Off-grid systems. Most relevant for rural electrification. Renewable technologies include wind power, biomass, bio-fuels & biogas. Now wave / tidal energy is over looked although it is the nature's way of providing bulk solar and wind power. The oceans are the biggest solar thermal collectors and near surface winds induce wave action. Change of water level also produces energy. Germany has declared its national policy to close nuclear stations and replace with alternate / renewable energy by 2022. **Pakistan has a negligible contribution of Alternate / Renewable sources.**

- DD) **Privatization of Utilities may not be attempted. Fate of former REPCO & MESCO etc are well known. They had to be nationalized in 1972.** Avoid this terribly short sighted step. There can be no value addition in the power distribution chain. Power theft is a major component of the 23% distribution losses. These need to be brought down. Arrears need to be collected from all entities. **In this respect the Government of Sindh & so-called privatized KESC are major bleeding points in the system.** They owe over Rs100bn to the GoP. It is a social service which every government must provide to its people. Previous attempts to take control of FESCO are well documented. The investor was maneuvering to take the entire asset on book value instead of market value. Such attempts be discouraged. Under Article 157 of the Pakistan Constitution both water distribution and electric power distribution are provincial subjects. We failed to handover the electric power distribution in the past to the provinces and crippled WAPDA with an unmanageable army of +80,000 linemen, meter readers & supervisory staff. Privatization is not the only answer to corruption. Good governance & strong governance are not contradictory. Private sector could help manage state institutions.
- EE) **WAPDA has to be made solvent.** Its balance sheet severely weakened after separation of PEPCO assets especially EHV transmission. It is now unable to finance even small ROR hydel projects. Its dam building capability is now at the mercy of multilateral institutions. It is trapped in the regional "politics of water". The IHK waters are being diverted. Some regional politicians in KPK & Sindh oppose large dams. The nation has to bring WAPDA out of this impasse. Neelum Jhelum HPP based on a longer tunnel option involves extreme corruption which will jack final costs to +USD 5bn. It could be abandoned after the Partial Award of 18 Feb 2013 by the Arbitrator/COA in India's favor. Alternately the attempt to create the world's deepest hydraulic tunnels in the world by going below the Jhelum upper stem be forthwith stopped. The tunnels be day lighted at the Jhelum upper stem & a 550MW powerhouse built. **Let WAPDA save USD 4bn.**

- FF) **The Hydrocarbon Addiction.** The nation hopes to achieve +50,000MW power capacity by 2025. Based on current 4% GDP growth rate the unconstrained demand is projected to be 38,000MW. If we continue using RFO for an additional 20,000MW its import bill will be over USD 30bn/yr. **If oil prices move to USD 200/bbl by 2020 as predicted the RFO bill +USD 60bn & oil import bill will be +USD 100bn which is unsustainable. More hydel & coal generation is unavoidable & must be achieved on war footing.**
- GG) **Oil & Gas corporations (PSO, OGDCL) must remain in the Federal domain.**
- HH) **Pak Railways must remain a Federal corporation & continue to haul thermal fuel.**
- II) **The planning imbroglia and the 18th Amendment.** After the devolution of WAPDA and the illogical act of dissolving PEPCO without creating its successor there is no state institution able to prioritize energy; specifically power sector projects. The 18th Amendment has actually created serious structural flaws as the impression is taken by provincial authorities that they own all the energy & water assets. KPK & AJK have started to treat WAPDA with contempt; as a usurper who wants to steal their resource base of energy & water. **The 18th Amendment must be modified. One institution should plan, prioritize and control the energy & hydel projects above 50MW.**
- JJ) **Unclogging of the energy chain for the emergency situation in summer 2013.**
- 1) A national commission on hydrology be made responsible for WAPDA and PCIW. WAPDA management has concealed critical facts. **Energy available not power installed is the critical data e.g.** Tarbela 4th Ext HPP with a 1410MW rating will only provide max 3bn units of electrical energy **but after** a few smaller units are closed.
 - 2) RFO supply chain be restored which should allow another 1,200MW. This may not be confused with the “circular debt” caused by the tariff / real costs black hole.
 - 3) Let captive power units sell directly their excess power to the nearest load centers. A minor premium may be charged by the Distributor as wheeling charges.
 - 4) Nature will soon play its role as snow melt fills the two major reservoirs. Let us hope the monsoon months will permit structural changes and floods remain in control.
 - 5) A Renewable Energy revolution may be induced. All import tariffs & taxes be withdrawn similar to policy for solar PV equipment. No restrictions on sale of power.
 - 6) **Re-divert gas.** From appendix “AA” attached a thermal plan on 12 months basis. CNG for private transport has to be stopped. This could release about 220mmcf. The thermal plan should increase gas based thermal generation by 1690MW which is in addition to the 1200MW imagined by restoring the RFO supply chain.

Dividends of Energy & Electric Power Autarky: The positive fallout of a course correction is obvious. Some medium & long term solutions in outline:

- i) Energy is analogous to the blood flowing in the body. Its normal flow will revive the national economy. WAPDA’s revival is central. Stop or curtail the N-J HPP project & save USD 4bn. WAPDA can divert these funds to ROR projects. The nation must moderate the “Politics of Water”; build KBD first, ensure drinking water, equitable water distribution to provinces while keeping hydel generation at optimum.
- ii) By unclogging the system & carrying out the structural changes the effect on GDP will be creating its own dynamics. Import substitution of RFO is a +USD 12bn issue.
- iii) Sustainable energy autarky can be achieved by indigenization and best use of local resource base. This is the sustainable route to increase jobs & economic activity. Let HMC, Shipyards/KSEW as well as private sector compete for locally produced base steam power plants and hydel turbo-alternators. The import of raw materials and components be allowed tariff and tax free. The thermal unit size for indigenization be limited to 50MW and the hydel unit be limited to 25MW unit size. The technology selection be left to the engineer / constructor as this is his risk & prerogative.
- iv) Prosperity & national defense of a nation is linked to energy autarky & self reliance. The technocrat must finally be given a chance to improvise and work unfettered.

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Convener WRDC, Fellow IEEEEP

The immediate <shortest term> solution. “A Thermal Plan”.

- A) Provide the RFO/HFO (furnace oil) inline with the recent directives. Let PSO become solvent on this head. It is clear that immediately the public & private sector thermal generation can increase by 1200MW. This does not include generating capacity under scheduled or forced maintenance. There is a vicious circular debt cycle that has to be broken.
- B) Absolute (100%) load shedding of CNG Auto fuelling stations for the next 365 days. This would release around 220mmcf (220 million cfd). There is at least 40mmcf of theft thru unmetered UFG at about 200 CNG stations (10% stations). All CNG converted vehicles are multi-fuel and can operate on petrol. Let this saved gas be provided to the most efficient public sector thermal stations. Over 1715MW additional power generation (public & private sector) can be ensured together with some additional gas (that has to be committed) as follows:
- i) Power Station Guddu TPS under GENCO II should be able to give additional +100MW at derated capacity. The 40mmcf shortfall of Zam Zama and Tullow fields must be compensated. The dedicated gas fields including KANDHKOT & MARI are to be maintained at full flow. PM Shaukat Aziz decision of diverting MARI gas to a new Fatima Fertilizer Unit be overturned. Reallocate 40mmcf of MARI (shallow) gas. It is a fact that Guddu TPS has an installed capacity of 1655MW presently derated to 1155MW but average generation is around 1000MW. No change in infrastructure at this stage. Additional 155MW.
 - ii) Power Station Muzaffargarh TPS under GENCO III. Part of the saved CNG Auto-fuelling gas be directed to Muzaffargarh TPS to supplement the oil fired generation. Delivery of around 150mmcf would boost gas based steam power by around 500MW. It is a fact that TPS Muzaffargarh has an installed capacity of 1350MW presently derated to 1130MW but average generation is 500MW as it is totally denied its allocated gas. No change in infrastructure at this stage. Additional 630MW.
 - iii) KAPCO an IPP was former WAPDA's best & largest thermal station. It has three CCP based on the exhaust energy of eight of its large gas stations. The additional gas (150mmcf) promised by ECC could produce another 400MW at KAPCO IPP. KAPCO's installed capacity of 1638MW is derated to 1343MW but average generation is about 950MW. No change in infrastructure at this stage. Additional 400MW.
 - iv) Power Stations SPS + GTPS Faisalabad presently denied gas since Nov 08 have an optimum gas requirement of 85mmcf. It could give an additional 210MW under derated conditions. No change in infrastructure at this stage. Additional 210MW.
 - v) Let gas quota be given to the UAE gifted 320MW CCP to be installed at Faisalabad around 85mmcf. Additional 320MW. With ISCC mode around 370MW.

Conclusion:

The monthly impact of this additional power generation of around 2915MW would be close to 2000 GWh or 2.0 billion units which represents an increase of 24000 GWh or 24 billion units on an annual basis for comparison sake. The monthly sale price of this electricity is close to USD 300m in the industrial & commercial sectors. The political cost much greater. It would be a better solution to allow this power for industrial zones (textiles, steel & process). The **value addition** of this USD 300m equivalent power is another USD 300m approx to the national economy per month. By allowing 5% of this national revenue to circulate back to the CNG owners GoP could allow a compensation of Rs 0.4m/pump station with 4 CNG dispensing units. Another 10% of this revenue maybe given as subsidy for reducing the cost of petrol. Let the national industry and agricultural tube-wells operate as they are the main source of employment & production in Pakistan's economy. The budgetary outlay for this programme under section B above is negligible as it is simply a financial & fuel reallocation regime.