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Multisector Utility Regulation

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The **World Dialogue on Regulation for Network Economies (WDR)** facilitates an international dialogue to generate and disseminate new knowledge on frontier issues in regulation and governance to support the development of network economies. The Dialogue Theme for 2002 is: *The Next Step in Telecom Reform: ICT Convergence Regulation or Multisector Utility Regulation?* WDR research teams produce a series of discussion papers and reports on the theme to support the ongoing dialogue.

This paper is one of that series.

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0.0 Executive Summary

This discussion paper critically examines the rationales that may be used to support the creation of multisector regulatory agencies. The paper begins with definitions of industries, sectors and multisectors that rest on degrees of substitution possibilities in production or consumption. The possibility that increased reliance on common use of rights of way and conduits may have in fact caused hitherto distinct infrastructure sectors such as telecom, electricity and transportation to converge is examined by means of a description of the state of the art regarding common use of rights of way and conduits. The increased tendency of firms to cross sectoral boundaries is examined both as a possible indicator of underlying convergence and as corporate strategy that may be driven by pecuniary factors such as advantages in taxation, regulatory flexibility, etc. This discussion is supplemented by an appendix that describes the multisector activities of selected firms. The claims for multisector regulation based on common use of regulatory skill sets and potential economies of regulation are critically examined. Here, it is shown that the core problem of scarcity of regulatory resources is caused by government restrictions on the effective functioning of markets in regulatory skills. In the short term, it is possible to realize economies of regulation by means short of merger or agencies such as sharing of facilities. It is also shown that effective multisector agencies that would save costs are unlikely to result from after-the-fact consolidations, but would have to be embedded in the original design. The pragmatics of sector reform, especially when conducted by “line” ministries, are shown as likely to result in sector-specific agencies that would be susceptible to a degree of government influence. In the final section, a list of discussion questions are presented.

1.0 Introduction

The objective of this paper is to critically examine the multiple rationales that may support the creation of multisector regulatory agencies. In the process, the conditions that may affect the creation of multisector regulation, ranging from underlying commonalty of inputs and the behavior of regulated firms to considerations that are specific to the regulatory process such as scarcity of regulatory resources and safeguards for regulatory independence are examined.

1.1 Definitions of Industry, Sector and Multisector

An industry is defined in terms of substitution possibilities in consumption and in production.[1] Theoretically, complete substitutability would be the test of an industry. In reality, a high degree of substitutability defines an industry. Industry or market definitions are of critical importance in anti-trust/competition law. For purposes of regulation, it is more common to define the scope of regulatory agencies in terms of "sectors," rather than single industries. A sector is a set of closely related industries, which have a degree of substitution possibilities on the production or consumption sides. The higher the substitution possibilities, the more likely the term industry will be used over sector.

As consumption or production conditions change, the definitions of industries and sectors will change. For many decades, the telecom industry was seen as distinct from both the data communication industry and the broadcast industry because there were few substitution possibilities in consumption or production. Improvements in packet switching have increased substitutability for circuit switching on the production side. Substitution of IP based services for conventional voice telephony is becoming more feasible on the consumption side.[2] This has led to the classic telecom industry and the data communication industry being seen as converging into one industry. In regulatory terms, this is not as much of a watershed as claimed because the two industries have for a long time being seen as part of the same sector, evidenced for example by the Computer Inquiries initiated by the US Federal Communications Commission more than 30 years ago.[3]

There is less evidence of increased substitution possibilities between telecom and data communication on the one hand and broadcasting services on the other.[4] Because of the common use of electromagnetic frequencies and the long-distance transport of television signals by telecom operators the industries have been considered as related in some countries. In Canada and the United States, they have been regulated by the same federal agencies, albeit by distinct divisions. Bolivia, Brazil, Burundi, Guatemala, Honduras, India, Jordan, Kyrgyzstan,

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[1] For discussion of industry (or market) definitions, including the principles developed in anti-trust case law, see Scherer, F. M. and Ross, David (1990). *Industrial market structure and economic performance*, 3rd edition (Boston: Houghton Mifflin), pp. 73-79.

[2] ITU (2001). Secretary General's report to 2001 World Telecom Policy Forum: IP Telephony. At: http://www.itu.int/wtpf/sgreport/index.html

[3] FCC (1970). Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Service Facilities: Notice of Proposed Rulemaking and Tentative Decision, 28 F.C.C.2d 291; FCC (1971). Computer I final decision 28 FCC 2d 267.

[4] For a contrary view, see OECD Committee on Competition Law and Policy (1999). *Regulation and competition issues in broadcasting in the light of convergence*, DAFFE/CLP 99/1. Paris: OECD. At: http://www.oecd.org//daf/clp/roundtables/comp-broad.pdf

Nigeria, Tanzania, Venezuela and Zambia are among the developing countries said to have convergence regulatory agencies or to be seriously considering them.[5] Recent technological changes have affected the substitutability of cable services, which may be considered a segment of the broadcasting industry, on the production side. This makes a stronger case for industry-level convergence among telecom, data communication and cable industries.

In the same way that telecom, data communications and cable may be seen as constituting a sector because of the degree of substitutability that exists on the production or consumption sides, other sectors such as energy (gas and electricity) and transport (combining different modes) may be identified. By definition, therefore, multisector regulation must involve industries/sectors that do not have significant substitutability in terms of either production or consumption.

1.2 Bases of Multisector Regulation

In common usage, multisector regulation is understood to be the functioning of a single regulatory agency that has responsibility for sectors such as telecom, energy, water and transportation. The classic multisector regulatory agencies are the State Public Utility Commissions (PUCs) in the United States, many of which precede the Federal Communications Commission, generally portrayed as the oldest telecom regulatory agency in the world. The original name of the association that represents the PUCs tells the tale of their origins—the National Association of Railroad and Utility Commissioners, now known as the National Association of Regulatory Utility Commissioners (NARUC). What were once independent agencies mandated to regulate the railroads gradually accumulated mandates that included energy, telecom, other forms of transportation, water, and in some cases such as Virginia, even insurance.

A natural question that arises in relation to this historical process is why the railroad regulatory agencies were given additional mandates? Was it because of commonalties in the object of regulation, or was it because of commonalties in the form of regulation? Leaving aside insurance, one may see a common element in the other objects of regulation such as transport, telecom and energy—rights of way. Common use of rights of way by different infrastructure sectors such as ICTs, energy, water and sewage is perhaps a justification for multi-sector regulation.[6] Rights of way are scarce and many countries are bound to allocate them fairly because of their WTO commitments.[7] Section 2 of this paper examines the rights of way question in depth, including the possibilities of common use of rights of way and the conduits laid over them. If indeed there is substantial common use of conduits and rights of way, one could argue that the multisectors have converged, and that what exists in fact is a sector.

The object of regulation may be seen to be companies that supply the various services, not the infrastructure itself. If the same companies provide multiple services such as energy, telecom and transportation, does that suggest an underlying convergence in terms of production or consumption? Not necessarily. It is possible that characteristics of financial markets or regulatory regimes make it advantageous for companies in one utility sector to also provide

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[5] ITU BDT survey, 2001.

[6] For example, South Africa has justified the mandated participation of the government-owned energy and transport companies in fixed-access telephony on the basis of "optimisation of infrastructure" -- Gush, Hilary (2001, July 26), "South Africa plans two rivals to Telkom next year," *Total Telecom*. At: http://www.totaltele.com/view.asp?articleID=42260&Pub=TT&categoryid=627&kw=South+Africa

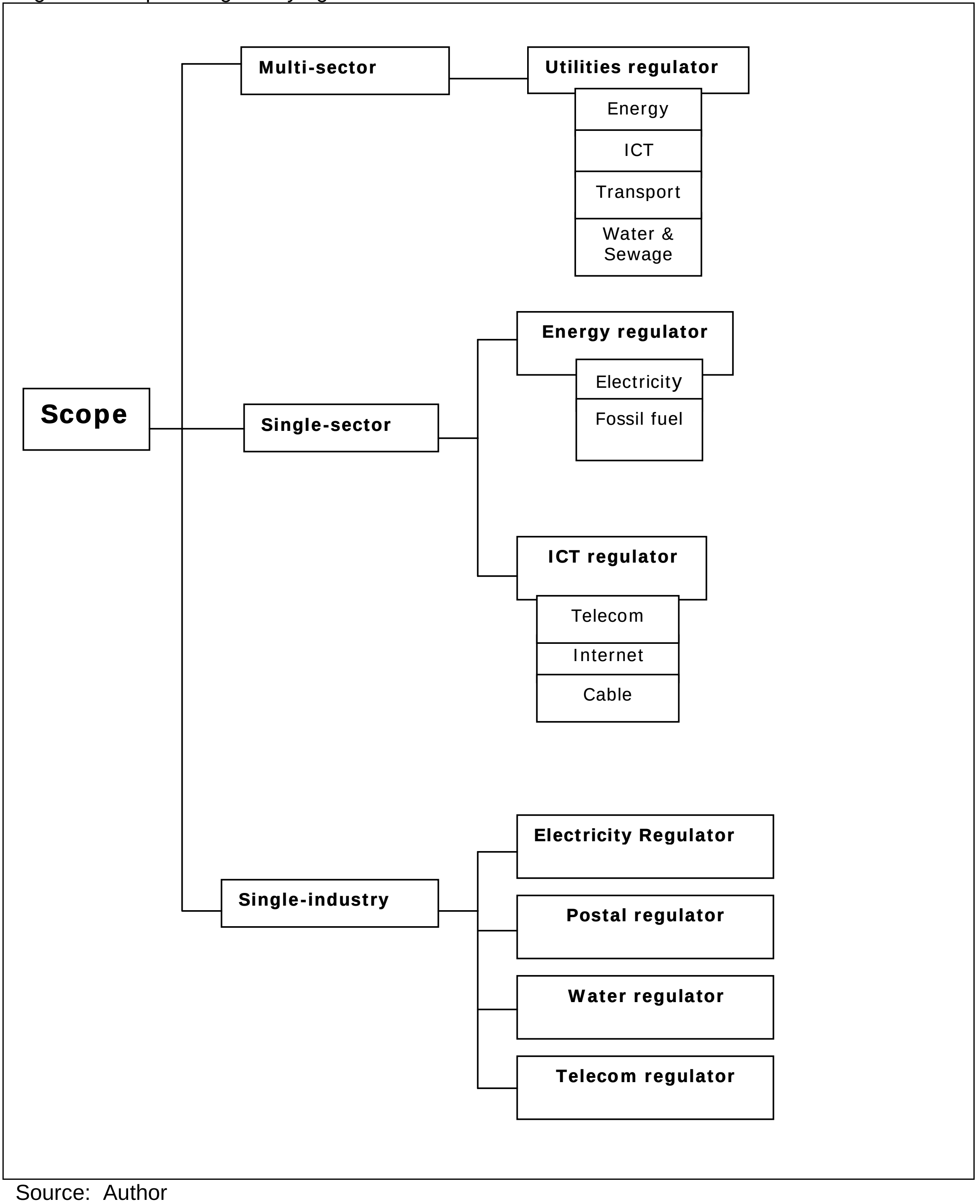
[7] "Any procedures for the allocation and use of scarce resources, including frequencies, numbers and rights of way, will be carried out in an objective, timely, transparent and non discriminatory manner. The current state of allocated frequency bands will be made publicly available, but detailed identification of frequencies allocated for specific government uses is not required." World Trade Organization (1997), *Fourth Protocol to the General Agreement on Trade in Services* (Geneva: WTO), Reference Paper, article 6. At: http://www.lanka.net/trcsl/wtodocs.html

services in another. Section 3 of this paper provides substantive detail on multi-utility company strategies.

Another possible explanation for the emergence of multisector regulatory agencies in the United States in the 19^{th} and 20^{th} centuries is the existence of commonalties of regulatory process. If the setting of tariffs in each of the sectors requires a common set of skills such as those needed for calculating the cost of capital and the use of a common set of procedures such as rate hearings, that may provide an explanation for the assignment of multisector responsibilities to the original railroad regulatory agencies. The commonalties of skill sets and procedures are discussed in Section 4 of this paper.

The historical approach has its limits. An argument can be made that there is nothing in common between a decision to convert a sector specific regulatory agency into a multisector regulatory agency in a country like Cape Verde in the past decade and the accretion of regulatory responsibilities in the regulatory agencies in the individual states of the US in the early part of the 20^{th} century. The rationales for multisector regulation that draw from the pragmatics of contemporary sector reform are discussed in Section 5.

Figure 1: Scope of regulatory agencies



Source: Author

2.0 Technological Trends

What specific trends in technology have a bearing on both actions by firms and on actions by government entities? All aspects of technologies that affect common use of conduits and rights of way: powerline transmission; fiber used for telemetry by energy firms; cities and highway managers making common use of conduits/rights of way; cities/others laying dark fiber, etc. may be discussed under this heading. This section focuses on the technical aspects in terms of the specific innovations related to physical conduit sharing between different infrastructure industries. With the exception of telemetry, nonphysical conduits are excluded from this discussion as they generally fall within the realm of content and information delivery.

This section provides an inventory of possibilities for common use of physical conduits. Given ownership of a particular right-of-way and corresponding conduit, how could one exploit this resource? Most of the examples of emerging and innovative uses are being deployed and trialed in developed countries. Developed-country initiatives may be educative for regulators and operators in developing countries.

2.1 Rights-of-Way

Discussion of conduit sharing must be preceded by an explication of rights-of-way-- the permission granted by a property owner or government to build or dig over a specific stretch of land to install some form of permanent infrastructure (a road, railway line, telephone line, underground pipe, and so forth), and subsequently to maintain (and upgrade) that particular infrastructure as required. Historically, rights-of-way have been granted to monopoly providers of infrastructure because that provision of the service was fundamental to the economy and society. The grant of rights of way was subject to an obligation that the provider would not abuse, nor exploit the rights of way beyond the extent that it served public interest of infrastructure provision and that necessary compensation would be paid to the affected property owner.[8] This regulatory framework has been evolving with the opening of infrastructure services to competition. The US Telecom Act requires non-discriminatory access to existing rights-of-way in specific instances between utilities – except when there is “insufficient capacity and for reasons of safety, reliability and generally applicable engineering purposes.”[9]

The US Telecom Act of 1996 reaffirms “the authority of a state or local government to manage the public rights-of-way or to require fair and reasonable compensation from telecom providers, on a competitively neutral and nondiscriminatory basis, if the compensation required is publicly disclosed by such government.”[10] Although subject to non-discrimination, municipalities are increasingly taking a hard line on the granting of permits due to considerations such as the cost of streets being torn up (in terms of inconvenience, safety and reduction in road life-span) and the sheer number of service providers wanting to lay cable and other conduits. In some US municipalities telecom conduit space is said to be saturated to the point of causing danger to other conduits such as gas.

Rights of way are a key asset for those who hold them, and access to rights of way is essential for new entrants. Historically granted at minimal cost to encourage infrastructure development,

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[8] Melody, W.H. and Møller, D. “Rights of Way as a Foundation for Infrastructure Competition” in W.H. Melody (Ed.), 1997, *Telecom Reform: Principles, Policies and Regulatory Practices*. Den Private Ingeniørfond, Technical University of Denmark, Lyngby. <http://www.lirne.net/library/tr/chapter10.pdf>

[9] FCC. “Telecom Act of 1996”. Sec. 703. Pole Attachments. <ftp://ftp.loc.gov/pub/thomas/c104/s652.enr.txt>.

[10] FCC. “Telecom Act of 1996”. Sec. 253. Removal of barriers to entry. <ftp://ftp.loc.gov/pub/thomas/c104/s652.enr.txt>.

they are becoming increasingly expensive and time consuming to acquire as more and more players vie for them. In the US, for example, rights-of-way permits can account for 20% of the cost of a fiber build, and can take over a year to acquire.[11] And, of course, discriminatory access to rights of way is a barrier to market entry. Thus, in conjunction with legislation targeted at leveling infrastructure playing fields,[12] there are also incentives for achieving viable technological solutions, in particular with regards to the last mile distribution to the end-user, and also for the lucrative municipal business sector.

Some small underserved municipalities in developed countries are now building their own fiber infrastructures because telcos are too slow to supply, being uninterested in low-density markets. Further, some municipalities already have some operations-related networks in place which are also being upgraded to better serve schools, hospitals, etc. In some instances, municipalities are in a position to lease capacity, thus financing the network, and attracting business to their areas that require broadband network access.

In terms of fiber networks, municipalities can serve as telecom and/or Internet service providers; conduit landlords; or fiber landlords. These different roles denote different levels of administration, network maintenance, etc. In each of these instances, the municipality retains control over rights of way resources, while providing citizens access to services. Where it does not actually supply service, the municipality supplies access on non-discriminatory terms to commercial suppliers.

2.2 Shared Conduits

This section describes technology developments which engender new means of mixed-infrastructure use of rights of way and their corresponding conduits. Utilities can share rights-of-way and conduits in two fundamental ways. *First*, companies can obtain rightsofway from other utilities. This can be achieved by piggy-backing the rights of way. This includes laying cable or conduits side-by-side; initiatives such as Sempra Communications (see more below) proposing that the national network of natural gas distribution pipelines be used to lay optical fiber for the last-mile problem); or using the actual infrastructure, such as in the case of Power Line Telecom (PLT, or Power Line Carrier [PLC]; see more below). *Second*, many non-telecom utilities have their own telecom infrastructure in place (installed for operations, monitoring, maintenance and billing) which can be leased for use by others. The technical features of optical transmission which make it immune to interference from electromagnetic fields generated by electric lines has contributed to the proliferation of telecom capacity owned and operated by electricity utilities. Fiber is installed because of the non-interference qualities, but once installed the electric utility can use only a minuscule portion of the capacity, creating the incentive to lease the extra capacity for telecom use.

Mixed-infrastructure use of conduits is not a new phenomenon. In Canada, for example, at the beginning of the 20th century, telephone rates and interconnection fell under the purview of the Railway Act – justified by telephone and telegraph lines being part of railway operations. Additionally, in 1932, Canadian National and Canadian Pacific Railways were jointly granted the national network contract of the Canadian Radio Broadcasting Commission. The connection between railways and telecom is prevalent in many countries. In the Netherlands, for example, Nederlandse Spoorwegen (NS), the national railway monopoly, was looking for ways to exploit its

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11 Gerwig, Kate. "Can They Dig It?", *tele.com*. March 19, 2001. <www.teledotcom.com/article/TEL20010319S0026>. Previously, rights of way accounted for about 10% of a fiber build. The author notes that the rule of thumb for building a network is each mile requiring a separate rights of way agreement.

12 See US Telecom Act of 1996, noted above; and for example Directive 90/388/EEC, <http://europa.eu.int/ISPO/infosoc/legreg/docs/90388eec.html> as amended by Directive 96/19/EC <http://europa.eu.int/eur-lex/en/lif/dat/1996/en_396L0019.html> which requires that telecom network operators be granted rights of way on a nondiscriminatory basis.

private network, resulting in the creation of Telfort – a joint NS and British Telecom (BT) venture. In the UK, Mercury laid fiber along British Rail lines; China Railway Telecom (CRT) will introduce domestic competition; Grameen, the largest provider of mobile services in Bangladesh, used the railway rights of way to build its national network, and so forth. In many developing countries, the railroad and electricity infrastructures may have more reach to rural areas than does the telecom network.

Non-telecom utilities are well positioned for entry into sectors of the telecom market because of their existing infrastructure, rights of way and consumer base. To-date, their participation in telecom network provision has mainly taken the form of subsidiaries serving as wholesale carriers' carriers – predominantly serving telcos seeking alternatives to the incumbent.

2.3 Telecom and Transport

As noted above, the common use of railway rights-of-way and roll-out of telecom infrastructure is a historical fact. The subsequent consolidation of these sectors provided an awakening of the potentials and possibilities for other sectors to enter the telecom industry.[13] There are many current examples of creating network backbones along railroad rights of way – one is of Qwest which used a rail plough to bury *two* plastic conduits along the rights-of-way: one carries fiber, the other is empty in anticipation of next generation technology. Installation of the latter should require no further digging as access is provided each mile along the route.[14]

Railway rights of way are not without problems. A spate of court cases in the US has led to settlements that may result in telcos having to pay royalties to landowners who claim not have given rights of way for telecom services, only for railway use.[15]

Traffic congestion and efficient management of highways are becoming important in terms of safety, the environment, and allocation of government resources in all parts of the world. In the US, initiatives are underway to create intelligent transportation infrastructures (or systems). These refer to a collection of technology systems deployed to collect, process and manage traffic information.[16] Examples of traffic management systems include: traffic signal control systems; freeway management systems; transit management systems; incident management systems; electronic toll collection systems; electronic fare payment systems; emergency response management systems; traveler information systems; and highway-railroad grade crossing management systems.[17] Intelligent traffic management will rely on networks – which will most likely result in collaborative infrastructure deployment and use of rights of way with established network providers.

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[13] See Falch, M. "Electricity Companies and Railway Networks as Newcomers in Telecom." Working Paper 29, Center for Tele-Information, Technical University of Denmark. <http://www.cti.dtu.dk>.

[14] Diamond, David, "Building the Future-Proof Telco". *Wired*, May 1998, pp.124-126. <http://www.wired.com/wired/archive/6.05/qwest_pr.html>.

[15] Borland, John, Bottleneck on the High Speed Highway, News.com, 29 May 2001. http://news.cnet.com/news/0-1004-200-6046529.html

[16] For a description of Intelligent Transportation Systems and Highway Infrastructure, see Transport Canada's report at: <http://www.tc.gc.ca/pol/en/Report/Highway_Intelligent_Transportation_Systems/Table of Contents.HTM>.

[17] See, Federal Transit Administration (FTA), "Transit Intelligent Transportation Systems Operation TimeSaver", 1996, <http://www.fta.dot.gov/research/fleet/its/optime.htm>.

2.4 Telecom and Energy

2.4.1 Optical Networks

Fiber for optical networks was first laid in the early 1980s, and is increasingly replacing traditional wires and cabling. For example, most transcontinental copper cables across North America have been replaced by fiber. The key advantages of optical networks are that they have much greater bandwidth capacity than coaxial cable and twisted pairs, do not have the delays associated with satellite transmission, and are cheaper than cable – fiber is cheaper to produce and requires fewer signal repeaters under current technology.

Single-mode fiber is typically used for long distances with only a single ray or mode of light beamed through it as a carrier of information. Multi-mode fiber has a larger core and can carry multiple light rays (or modes) concurrently at different wavelengths. Multi-mode transmission although yielding higher bandwidth per fiber is only used for relatively short distances because the modes tend to disperse over longer distances.

Wavelength Division Multiplexing (WDM) is used to divide the optical transmission spectrum into a number of non-overlapping wave-length bands for multi-mode transmission. This allows supply wavelengths as needed, and the assigning of hierarchy to different transmissions (i.e., for quality, speed of transmission, reliability). Each transmission is individually demultiplexed at the end of the transmission back into the original source, and thus different data formats can be transmitted together such as IP, Synchronous Optical Network (SONET[18]) data, and asynchronous transfer mode (ATM[19]) data. WDM technology is being used to address 'fiber exhaust' problems, in which demand for bandwidth exceeds that which is currently available from installed or accessible fiber.

Because the Internet is one of the main sources of demand for bandwidth, WDM is important for that platform. However, beyond addressing congestion, there are compatibility issues to be resolved between IP and WDM. For example, WDM systems function on the basis of point-to-point switching, rather than IP packet-switching. This means that information cannot be routed around trouble spots. Further, IP, which works well for data communication, does not ensure that packets are forwarded quickly enough for real-time applications. The solution to the IP / WDM interface problem lies in the development of other intermediary technologies. For example, Multi-Protocol Label Switching (MPLS) is a standards-based solution that establishes "connection-oriented" forwarding for IP networks. This negotiates the addressing difference of IP packet-switched networks where packets of information are sent into the network and delivered without establishing a prior connection with the recipient, as in telephony.

2.4.2 Shared conduits

Williams is the recognized pioneer of merging telecom and energy supply. In 1986 Williams ran fiber optic cable through a decommissioned petroleum pipeline creating what was to become the fourth largest long distance network in the US. The telecom business was sold a decade later for US$ 2.5 billion, with Williams retaining a portion of the larger network for Vyvx, a broadcast-video transmission network.

Recently, Sempra Communications have devised and are trialing a fiber-optic cable encased in a polyethylene conduit[20] that is inserted into active natural gas pipelines. Because the gas lines are

[18] SONET software translates a electrical signal into light that can be sent over fiber.

[19] ATM is a connection-oriented, packet-like switching and multiplexing principle.

[20] Sempra Cable Casing – a patent has been applied for process that "allow workers to tap into pressurized, functioning gas lines, install the glass fiber that is encased in polyethylene wrapping, and route it to specific office buildings where broadband services are desired. The cable is brought back out of the gas system outside the office buildings and is spliced into fiber cables that enter the office buildings."

already in place, and because the process does not require large-scale digging up roadways, it is a relatively cheap solution to laying fiber. It is anticipated that Sempra's process will be particularly useful for laying fiber to the home.[21]

The InfoWatt[22] Conductor project proposes replacing the core wiring used in power lines from steel to fiber optics. This would improve energy distribution, allowing more power to be transported along existing lines and broadband data transmission (several gigabytes per second). The solution was devised in part to address increased demand for energy transmission (such as in California) that could not be met with existing powerlines, especially where the steel cores could not be made larger both because of weight and heat. The fiber optic core eliminates the problematic sag (which creates transmission limitations).

2.4.3 Bandwidth Trading

"Point-to-point bandwidth" and "on-demand and real-time bandwidth" trading infrastructure offer opportunities for non-telecom companies to sell telecom infrastructure. Enron, the recently bankrupted US energy giant, was the first to recognize the opportunity and initiate trading bandwidth as a commodity. Energy companies with both gas and electricity conduits and rights of way are well positioned to lay fiber and supply bandwidth. Energy companies have been very active in entering broadband services.[23]

Bandwidth trading has significant implications for the telecom sector as it effectively unbundles the bandwidth cost that is typically buried in the overall price of a given service. There are barriers to entry to the bandwidth market. These barriers may be compounded by cross-industry alliances such as the Enron Intelligent Network formed by Enron Broadband Services and Sun Microsystems; or Williams which has acquired substantial European and North American connectivity from Teleglobe.

Bandwidth trading has been subject to the telecom downturn and the resultant losses. The collapse of Enron has been seen by some as the end of this market, at least for the time being.[24]

2.4.4 Utility Communication Infrastructure

Bonneville Power Administration (BPA) installed 2000 miles of fiber optic cable for its internal communication system. As noted above, not all of this is being used by BPA itself. In fact, by 2010, BPA only expects to be using 30% of the fiber now installed.[25]

Dark fiber is optical fiber infrastructure that has been laid but not lit. Many electricity utility companies such as BPA have installed optical fiber cable alongside power lines with the expectations of internal use or leasing the capacity to telephone or cable TV companies. In the meantime, the fiber lies, unlit and unused, as dark fiber. Telecom companies also have their

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[21] Sempra Energy Press Release, "Sempra Fiber Links Announces First Fiber-In-Gas Installation" Oct. 11, 2001. <http://www.sempra.com/news/news_releases.html>.

[22] The InfoWatt page is currently under construction. See the Project Brief, "Quantum Leap in the Manufacturing Line Speed of Thermoplastic Strength members for a 21st Century InfoWatt Conductor", October 2001, <http://www.atp.nist.gov/awards/00004528.htm>.

[23] Enron, Williams, Aquila Energy, El Paso Energy, Dynegy and Avista Energy.

[24] Glasner, Joanna, "Enron: A Bandwidth Bloodbath," *Wired News*, Nov 30, 2001, http://www.wired.com/news/ebiz/0,1272,48732,00.html; "Bandwidth Market Dries Up Following Collapse Of Enron Bandwidth Services Creating Yet Another Lesson For The Risk Management" Community," Today's Risk eNews, December 12, 2001, http://www.garp.com/newsfeed.asp?Category=9&MyFile=2001-12-12-4148.html

[25] Bonneville Power Administration, "Lighting the Way of the Future: An update on BPA's fiber optic program", *Keeping Current*, November 2000, <www.bpa.gov>.

share of dark fiber. "Dark fiber service" is capacity provision and maintenance of fiber between customer locations by local-access operators in which the light for the fiber is provided by the customer.

Similarly, gas, electricity and railway networks may have some form of communication infrastructure along their pipes & cables. The existence of these networks has not been necessarily noted in rights of way agreements.

2.5 Powerline Technologies & Powerline Communications

Powerline technology (PLT) developments which use the electricity grid to deliver telecom and data have been under research since the mid-1990s, with different versions currently on trial in some 30 countries.[26] In the UK, Nortel and United Utilities (formerly Norweb – water and electricity utility provider) embarked on one of the first ventures, trialing the technology during the late 1990s. This early testing of the market may have been influenced by the UK being one of the first European countries to abolish geographically based monopolies on power supply.[27] Although Norweb demonstrated that the technology was workable, they abandoned the project as unviable after a year of trials.

The underlying components of digital power-line technology involve adapters to change the data into frequencies to be carried along the electricity current, and a modem, which subsequently separates data from electricity. Thus, the network is as ubiquitous as energy provision. Potential applications span numerous service sectors including: security alarm and safety services, energy management and metering services, healthcare and patient monitoring, content and entertainment services, appliance monitoring and repair, and Internet access.[28] The biggest constraint on PLT developments has been interference.

Media Fusion[29,30] in 1998 introduced its "Powerline Area Network" in which advanced sub-carrier communications technology uses micrights of wayave frequencies to send data bits along the magnetic field around power cables (rather than through the wires), in theory delivering data at 2.5 GB per second. Although a patent[31] was awarded to the company, trials have not been completed – human element appears to have got in the way of further technology development.[32]

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[26] Plugtek.com maintains a website with links to current articles and company press releases about PLT developments. <http://www.plugtek.com/index.shtml>.

[27] Davies, G. "Power Couple", *tele.com*, September 17, 2001. <www.teledotcom.com/article/TEL2001091420009/2>.

[28] Toy, Arlan. "Digital Power-line Technology in Construction Business and Home Automation Application". *ASC Proceedings of the 36th Annual Conference*, Purdue University, 2000. <http://asceditor.unl.edu/archives/2000/toy00.htm>. This article provides a good overview of power-line technology development and prospects.

[29] The Media Fusion site is currently dormant <http://www.mediafusionllc.net/>. For a Media Fusion Network Overview see patent description (note 24, *below*); Jacobs, Steve, "Cable Modem? DSL? HAH! Here Come the Power Companies!, <http:www.gadgetboy.com/gbpast/hdtv/mediafusion.htm>; and Ratliff, E. "The Electric Kool-Aid Bandwidth Test", *Wired* 9.11 – November 2001. <http://www.wired.com/wired/archive/9.11/media_pr.html>.

[30] For an overview and inventory of similar systems, see North, Greg. "A Review of Residential Computer Orientated Energy Control Systems". Department of Heat and Power Engineering, Lund University, Sweden. 2000. < http://www.vok.lth.se/EEP/abstract/Gregreport01.htm>.

[31] Media Fusion Patent:
United States Patent 5,982,276
William L Stewart, November 9, 1999
Magnetic field based power transmission line communication method and system
Abstract: A method and system for communicating information between subscribers over power transmission lines which normally convey electrical power to a plurality of diverse electrical sites for providing electrical power to electrical devices disposed at these diverse electrical sites. The subscribers on the communication network are located at these electrical sites. The electrical power conveyed over the power transmission lines is in the form of electromagnetic radiation which has an electrical field component and an associated magnetic field component. The information, such as telephonic voice

In 2001, Germany's RWE, EnBW and MVV Energie have begun to provide Internet access using powerline communications, which transmits data over low-voltage electricity lines.[33] Also, Brazil (RWE & Copel forming Tropico), and Korea (Ziemax and Domosys;[34] PolyTrax Information Technology and Planet System[35]) have begun to offer the service. The US has small-scale trials. There are problem with powerline technologies with 'noise' interference caused most commonly by power surges and proximity to appliances. There are differences in electricity grid infrastructures such those between Europe, where several hundred homes are connected to one transformer, and in the US, where there are only 10 to 20 homes to a transformer, meaning that additional 'points of aggregation' are required;[36] additionally, in the European market, electricity is sent to the home at between 220 and 240 volts, but only at 110 volts in the US. Like Media Fusion technology, powerline communications can transmit data at 30 times the speed of ISDN.

2.6 Electricity and Gas[37]

The side-by-side distribution of electricity and gas (described as "pipes & wires distribution") is increasingly common. This does not require new technologies *per se*, but exploits existing infrastructure and rights of way which can be shared between the two operations. New technologies however do come into play, such as computer controlled technologies for "sideways directional drilling" which is superior in terms of flexibility and precision for conduit installation.[38]

A recent electricity grid enhancement study notes the importance of new information management, acquisition and processing technologies as key for power management.[39] In

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communication or other data, is transmitted in the magnetic field component of the electromagnetic radiation carried over the power transmission line, such as by exciting the field with a MASER, in order to enable communication between the subscribers at the various electrical sites. The MASER provides an inverted atomic population by pumping directly, through a Q-switch and a synthetic aperture lens, into the atomic population of the electromagnetic wave carried over the power transmission line to produce acoustic wave oscillation at the appropriate atomic transition frequency. The MASER output is transmitted within the existing magnetic flux envelope created by the magnetic field of the electromagnetic radiation carried over the power transmission line and the power transmission line acts as a magnetic waveguide for the coherent magnetic frame emissions from the MASER. Inductive coupling is used to receive the transmitted information.

[32] William Stewart, inventor of the technology was ousted from his position of chairman of the company, in February 2001, for conduct involving misappropriation of company funds. The Media Fusion website has remained permanently "under construction" since then.

[33] *Broadband*, "Europe's electricity utilities - The shocking truth", *no date*, <http://www.broadbandmag.co.uk/features/euroutilities/utilities.htm>.

[34] See Domosys press release, "Exclusive representation agreement with Ziemax Technology Inc. covering the Korean market" Quebec City, Canada, October 22, 2001. <http://www.domosys.com/news/news/index.asp?newsid=15>.

[35] See PolyTrax press release, "PolyTrax agrees tie-up with Planet System", Munich June 2001. <http://www.polytrax.com/5press/5_ne20.html>.

[36] Bryce, Robert, "Division of Power", *ZDNet News*, April 25, 2001, <http://www.zdnet.com/zdnn/stories/news/0,4586,2711292,00.html>.

[37] See the online Utility Connection which provides a listing of 438 international electric and gas utilities as well as other resources specific to these utilities <http://www.utilityconnection.com/page3.html>.

[38] Noted in Crews, Clyde Wayne, "Rethinking Electricity Deregulation: Does Open Access Have it Wired – Or Tangled? Testimony of Clyde Wayne Crews Before the House Subcommittee on Water and Power Resources, June 24, 1999"" Competitive Enterprise Institute (CEI). <http://www.cei.org/RemarksReader.asp?ID=769>.

[39] Center for the Advancement of Energy Markets (CAEM), "'CHIPS, HITS, and BITS': The Grid Enhancement Evaluation Project", 2001, <www.caem.org>.

particular, the development and use of telemetry[40] for remote meter reading and network maintenance is important. The main application of telemetry is remote and automatic meter reading. Metering is a particularly important application because of utility competition which creates a degree of consumer churn, creating the need for meter reading each time a consumer changes utilities, rather than twice yearly for correcting monthly estimates.

Telemetry – using telecom to send information from machine-to-machine for control purposes, is also important for efficient maintenance of underground, rural and remote network infrastructure. Telemetry allows for the pinpointing of the location of a particular problem, and for reducing the need for redundant routine maintenance and thereby increases reliability.

3.0 Market Trends and Strategies of Utility Companies

Mergers, acquisitions and asset divestitures currently characterize the energy sector. As a consequence, energy utility companies are consolidating into larger operating companies within all utility sectors as well as across industry divides. The entry of utility companies into the telecom market is considered by many to be a natural evolution. The prospect of expanding income and profits from existing assets has prompted energy utility executives to seek synergies with telecom companies. In general telecom provide energy utility companies with rights of way and other existing telecom assets, revenue growth potential, diversification, brand loyalty, customer care, customers, cash and regulatory expertise, etc.[41]

The objective of this section is to examine market strategies of utility companies in relation to participation in the telecom market. These strategies will be presented within a three-level strategic framework. This enables an assessment of the energy utility company strategies from a corporate strategic level, business strategic level and functional strategic level.

3.1 Rationales for Telecom Participation by Energy Companies

The rationales for participation by energy utility companies in telecom are varied. The primary reasons given for penetrating the telecom space range from the need to improve operational efficiencies to the overall strategic objectives of the company. It is generally assumed that improved efficiencies include economies of scale, eliminating redundant or overlapping activities, efficiencies in procurement, production, marketing, and administration. Strategic objectives include remaining competitive in a rapidly changing environment, building core competencies, acquiring additional managerial and technical expertise, etc. When energy utility executives were questioned on the actual reasons for entering into the telecom market, however, the three reasons provided were "sharing of infrastructure, bundling of opportunities and gaining experienced people."[42]

3.2 Corporate strategic approach

The corporate strategic question as to whether energy utilities should be active in the telecom business has by and large been answered. Most energy utility companies view telecom as "a

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[40] For an introductory description of Telemetry, see "Mobile Telemetry: Introduction Zone" at <http://www.mobiletelemetry.com/whatis.asp>

[41] Klein, Steve. "Electric utilities in the telecom business". Western Conference of Public Service Commissioners, 2001.

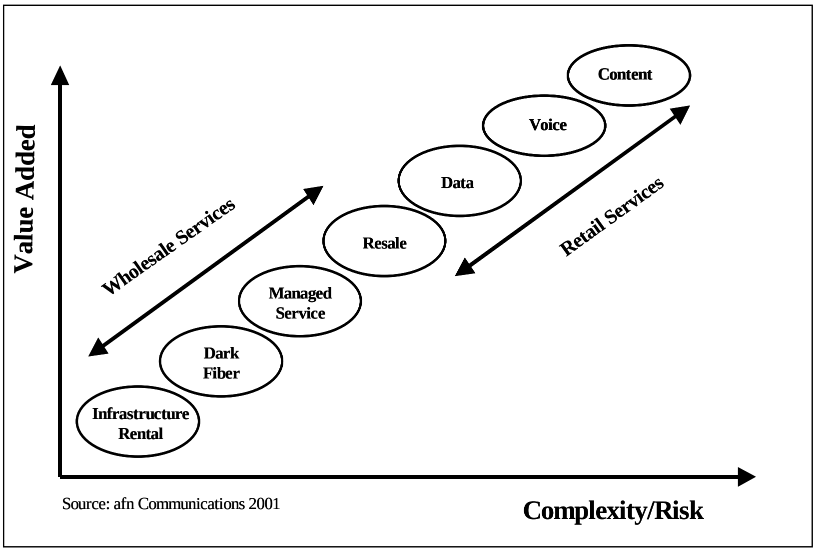
[42] Woods, Bob. "Most Energy, telecom firms converging – KPMG", April 2001, http://www.opticallynetworked.com/features/article/0,,10516_745781,00.html.

natural opportunity to diversify without going too far afield from the core energy business"[43] or as "a natural expansion for utilities."

Most energy utilities became active in the telecom business by leveraging their often under-used internal telecom assets (network, rights of way, construction expertise, etc.) and selling bandwidth to telecom service providers. The more adventurous companies look beyond mere wholesale provisioning and fiber leasing to direct participation in more profitable services.

This approach seems consistent with the communication value chain[44] in which energy utility companies typically migrate from providing wholesale services (little value addition with least complexity/risk) to providing retail services (greater value addition with higher complexity/risk). The entry strategies adopted by energy utility companies are illustrated in Figure 2.

Figure 2: Communication Value Chain



In its White Paper on Telecom ventures for utilities,[45] Nortel Networks argues that energy utility companies should build on their existing internal telecom networks and asset bases to provide more than just wholesale bandwidth and fiber leasing. Nortel Networks identifies business opportunities in the form of backbone services, local access and data center provisioning that would offer higher values.

[43] Emmett, Arielle, "Branching out or out on a limb", pp.1, <http://www.fiber-exchange.com/archives/coverstory.cstory_1199.html.

[44] Sessions, Bunker. "Designing successful business models for energy and telecom companies", *FutureNet Summit*, June 2001. www.afncommunications.com/news/archive.asp.

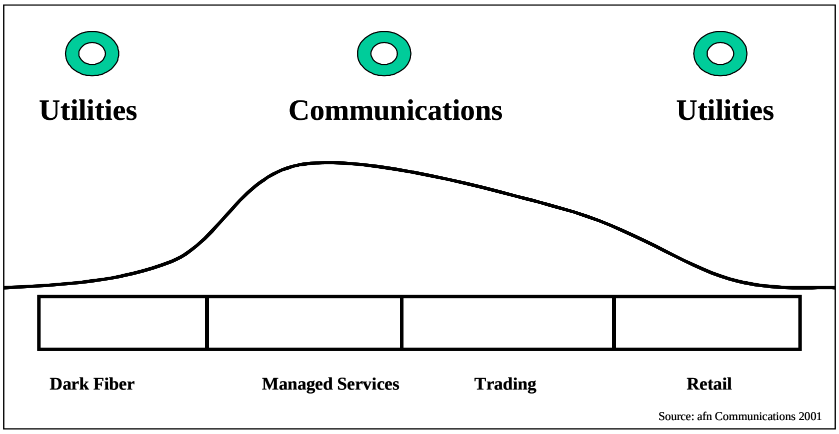
[45] See Nortels White Paper on "Telecommunications: Ventures for Utilities, 2001. http://www.nortelnetworks.com/products/library/collateral/56053.25-06-01.pdf.

3.2.1 Business models

Bunker Sessions, Chief Technology Officer of AFN Communications identifies four business models[46] employed by energy utility and telecom companies within the US market. These he refers to as the AFN model (AEP, Allegheny, First Energy, etc.), the trading model (Williams Communications and Enron), the active asset play model (Duke Energy, Florida Power & Light, Nisource, etc.) and the diversified utility model (Conectiv, Montana Power, Reliant Energy, etc.).

Using the classical strengths, weaknesses, opportunities, threats (SWOT) analysis, Sessions positions US energy utilities on the communication value chain.[47] According to Sessions, energy utility companies have by and large moved into provisioning of dark fiber (bottom end of chain) and retail services (top end of chain) while telecom companies have maintained dominance within managed services and trading (see Figure 3).

Figure 3: Communication Value Chain



Sessions further identifies three additional alternative utility models; one-way transformation (Williams, The Montana Power company and Touch America), traders (Dynergy, Enron and El Paso), and those going it alone (Dominion). According to Sessions these utilities choose to operate where risk is considerable higher (see Figure 4).

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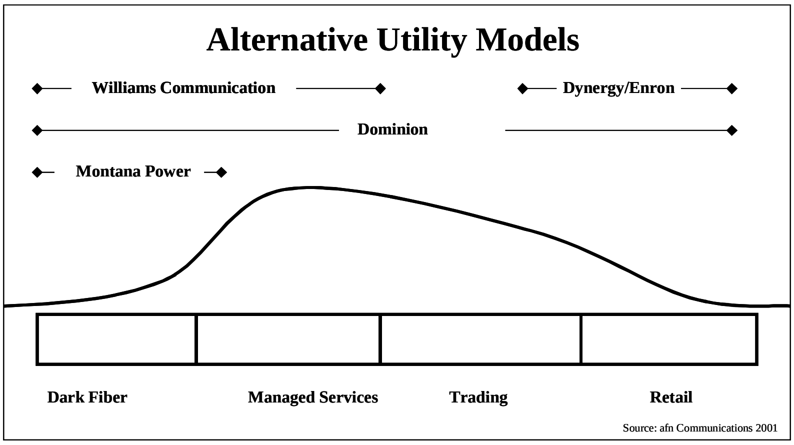
[46] Sessions, Bunker. “Designing successful business models for energy and telecom companies”, *FutureNet Summit*, June 2001.

[47] Sessions, Bunker. “Designing successful business models for energy and telecom companies”, *FutureNet Summit*, June 2001.

Figure 4: Alternative Utility Models[48]



Stratecast Partners[49] identifies four business models each for utility and energy companies. The business models for energy companies identified by Stratecast Partners include the Dynegy model, El Paso model, Enron model and back offices model. The business models identified for utility companies include the regionally focused model, Touch America model, Utility Corp model and back offices and service level agreement model.

3.2.2 Expansion Strategies

The present form of expansion strategy adopted by most utilities could best be described as "conglomerate diversification."[50] Unlike the conglomeration of heterogeneous companies in the 1970s, this form of conglomeration includes a fair measure of synergies such as "managerial, financial, technology, operational"[51] competencies. Within the energy sector in particular, a utility company would enter new product areas, which would be related to its existing areas. This diversification strategy seeks to "utilize assets and capabilities that reside within the utility"[52] and have resulted in expansion into domestic and international "activities more closely related to their core business."[53] As a consequence of assessing their respective strengths and weaknesses[54]

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48 Sessions, Bunker. "Designing successful business models for energy and telecom companies", *FutureNet Summit*, June 2001.

49 See "Assessment of utility and energy company telecom service strategies", ????? Volume 1, Number 10, August 2001.

50 Bauer, Johannes M. "The regulatory treatment of utility diversification", *Land Economics*, v71(3), Aug 1995. p.386-400.

51 Tarzijan, J y J. Rivera. "Reasons for conglomeration: Empirical analysis of management responses in Chile", *Revista Abante* 2(2) p.203-26.

52 Canning, Gordon. "Survey of energy utility new business development", *The electricity Journal*, v10(10), Dec 1997. pp. 94-101.

53 Bauer, Johannes M. "The regulatory treatment of utility diversification", *Land Economics*, v71(3), Aug 1995. pp.386-400.

54 According to AFN Communications potential strengths could include strong balance sheet, rights of way/building access, construction experience, own retail customers, strong brand, risk management while weaknesses could include lack of telecom experience and risk adverse shareholders.

some utilities may decide to "go it alone" while more conservative utilities may opt for partnering in an attempt to capitalize on telecom opportunities.

3.2.3 "Go it Alone" Strategy

The "go it alone" strategic approach includes the utility building on to what telecom assets and capabilities it already has and investing further into extending its assets and capabilities. This is accomplished by rolling out a complete network or outright acquisitions. This option is favored by the more aggressive utilities with a higher than average appetite for risk. Arielle Emmett refers to this option as a "re engineering towards a high-growth, diversified model."[55] This option can be understood as creating value from the ground up.

3.2.4 "Seek Partnerships" Strategy

The partnership approach involves acquiring the necessary assets or capabilities in a particular field by establishing joint ventures or acquisitions. According to Arielle Emmett this option includes "engaging in partnerships, developing fiber wholesaling strategies to become a carriers carrier or subsidiary deals."[56] Ernest Liu[57] refers to an increasing number of companies forming joint ventures with telecom companies "as part of a bundled retail energy and related services marketing."

3.3 Business Strategic Approach

At a business strategic level the question as to how energy utility companies might compete in the telecom business has to date been answered by some companies choosing a differentiation strategy with other companies choosing a more focussed strategy.[58] Options in this regard range for providing backbone services to providing local access.

With regards to market opportunities, Stratecast Partners[59] have identified four market opportunities for energy and utility companies. These include market opportunities in bandwidth services (bandwidth trading, bandwidth brokering and online exchanges), wholesale long-haul transport, wholesale metro/local market and longer-term market opportunities.

With regards to business opportunities, Nortel Networks identifies three business opportunities in telecom for energy and utility companies.[60] These business opportunities include provisioning of backbone services (becoming a carriers' carrier), providing local access and provisioning data centers.

3.3.1 Becoming a Carriers' Carrier

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[55] Emmett, Arielle, "Branching out or out on a limb", pp.1, <http://www.fiber-exchange.com/archives/coverstory.cstory_1199.html

[56] Emmett, Arielle, "Branching out or out on a limb", pp.1, <http://www.fiber-exchange.com/archives/coverstory.cstory_1199.html

[57] Liu, Ernest S. "Diversification: Extending the core business", *Institutional Investor*. V31(10) Oct 1997. p.E9.

[58] Generic strategies in this regard include cost leadership, differentiation and focus strategies.

[59] See "Assessment of utility and energy company telecom service strategies", Volume I, Number 10, 2001.

[60] See See Nortels White Paper on "Telecommunications: Ventures for Utilities, 2001. http://www.nortelnetworks.com/products/library/collateral/56053.25-06-01.pdf.

The option of providing a backbone service is the most favored by US based energy companies. This takes the form of dark fiber leasing and becoming a carriers' carrier. In this option, the fiber asset[61] that was initially built for internal telecom purposes is made available for inter-exchange carriers and competitive access providers.[62] Carriers' carriers essentially sell a range of transport products and services (conduit, dark fiber, lambdas, large capacity bandwidth and small capacity bandwidth) as well as a range of value added services (data storage, managed hosting, wholesale applications, streaming, content delivery, professional services and OSS [Operations Support Systems] interfacing).

According to a report by Elizabeth Moore,[63] the entry of energy companies into the carriers' carrier market was significantly influenced by the emergence of competitive local exchange carriers and the ensuing demand for rights of way to build new capacity around 1996. As a consequence, electric and gas transmission networks and distribution networks became popular sources of rights of way, and energy companies with existing fiber began to sell or lease excess capacity to telecom carriers. By 1998 most energy companies had established their own unregulated telecom subsidiaries to build and operate carrier networks. Moore concludes that the growth of the segment could be attributed to the ability of the energy companies "to leverage their rights of way, fiber assets, construction skills and network monitoring and maintenance capabilities successfully into the new line of business."

Moore's also notes key strategic decisions faced by energy companies wishing to participate in the carriers' carrier market[64] and provides an overview of the different strategies chosen. Five strategies are identified: global end-to-end, national end-to-end, national long haul, regional end-to-end and regional long haul (see Box 1).

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[61] This could also include selling dark fiber, capacity, ATM, dark fiber, lit fiber and frame relay.

[62] Montana Power and Williams were considered the first movers in this regard when rolling out its first telecom networks in 1983 and 1985 respectively.

[63] Moore, Elizabeth. "Strategies for energy companies to enter the carriers' carrier market", *Energy Communications*, October 2000.

[64] Will they actively enter the business or only sell/lease rights of way? Will they be operators or just construction partners? Will they offer conduit, dark fiber, lambdas, and bandwidth? Will they build the business themselves or partner with another operator? Will they integrate value-added services into their offerings, including collocation, IP services and professional services.

Box 1: Carriers' Carrier Strategies

Strategy	**Description**	***Example***
Global End to End	• Uses national network, international undersea cable and local access to provide end-to-end solutions to global service providers and enterprises. • Usually partners for some capacity, also owns a fiber optic backbone, • Products and services include core transport as well as data centers and a broad offering of VAS.	Williams
National End to End	• Uses a combination of owned and leased network capacity to provide national end to end solutions to service providers and end users. • Usually partners for some capacity and VAS offerings • Operates chiefly in the US.	Enron
National Long Haul	• Uses a combination of wholly owned and leased network capacity to provide long haul connectivity between cities. • Network connects into POP sites in each market. • Provide core long haul transport services and is moving toward VAS.	Touch America
Regional End to End	• Uses a combination of owned and leased network capacity to provide end to end connectivity for service providers and enterprises within operating regions. • Products and services include core transport as well as data centers and an expanding range of VAS. • Strives to differentiate by targeting regional demand for products and services.	FPL Fibernet
Regional Long Haul	• Uses a combination of wholly owned and leased network capacity to provide long haul connectivity between cities within its operating region. • Network connects into Points of Presence (POPs) in each market often times with colocation facilities. • Provide core long haul transport services and is moving toward the VAS realm with a focus on regional demand for products and services.	Progress Telecom

Source Elizabeth Moore, 2000

3.3.2 Competing as a Local Carrier

This option of competing as a local carrier includes building out the metropolitan optical core network and then leveraging this network to support local access applications. More aggressive utilities are laying additional fiber to do business themselves. According to Nortel Networks, energy utility companies develop partnerships with cable operators or local exchange carriers to provide transport services. Strategies for competing as a local carrier include entering into partnerships to provide transport services in the form of cable TV, telephony and Internet and partnerships to provide digital subscriber line (DSL) services using the switched network. Other strategies include acquisitions to provide transport services and value-added services or building own transport services and value-added services.

3.3.3 Competing as a Multi-service Provider

This venture includes offering ATM, Frame Relay, Optical Data Services, Gigabit Ethernet or Optical Wavelength Leasing.

3.4 Functional Strategic Approach

The third level of strategy (functional strategy) addresses questions as to which value activities the energy utility should be engaged in the telecom business. Strategies in this regard include consolidating services, diversifying offerings, making customers more profitable, outsourcing services, developing Internet strategies, etc.[65]

3.5 Challenges Facing Utilities

Several high profile utility telecom ventures have failed in recent times. Reasons cited for these failures include the pace of deregulation (too slow or too fast) as well as the financial outlay exceeding envisaged return on investment. It is claimed that changes in US federal and state regulation have aggravated the problems.

According to AFN Communications challenges facing energy utility companies include funding from assets sales, price erosion, market consolidation at medium scale (too big to niche, too small to reach profit), slow market momentum and location of assets.[66]

Concerning future trends, Elizabeth Moore envisages market expansion to be both upstream into international markets and downstream into metropolitan markets. Although most revenue currently generated by carriers' carriers are from provisioning of transport services it is expected that the provisioning of value added services would supercede the provisioning of transport services. Consolidation amongst big and small utilities as well as amongst big utilities are expected.

The objective of this section was to examine market trends of international energy companies and in particular to provide an overview of the strategies employed by energy companies. It was found that amidst the upheaval of mergers, acquisitions and assets divestiture, the energy utility sector is entering the telecom industry. The primary rationale for participation in the new sector appears to be the desire to improve overall efficiencies and accomplish strategic company objectives. The corporate strategic approach views telecom services as a natural expansion for utilities where most energy utilities venturing into telecom become active by leveraging their existing assets primarily for bandwidth reselling. It was also found that the business models adopted by energy utility companies were largely determined by an analysis of their company strengths, weaknesses, opportunities and threats. This adoption was also influenced by the company's appetite for risk. Expansion strategies primarily take the form of conglomerate diversification ranging from going it alone to partnership formation. Business strategic approach ranges from differentiation to focus strategies and includes provisioning of backbone services, local services provisioning and provisioning of value added services.

4.0 Common procedures and skill-sets

The classic case for multisector regulation in developing countries is presented by Schwartz and Satola:

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[65] See http://www.nortelnetworks.com/products/library/collateral/clarify_industry_solution_data_sheets/utilities1.pdf.

[66] Sees www.afncommunications.com.

BOX 2: The pros and cons of single-sector versus multi-sector regulation:[67]

Advantages and Disadvantages of Multi-sector Regulators	
Key Advantages ❖ Reduce risk of "industry capture" because the creation of a regulator with responsibility for more than one sector can help avoid the rule-making process being captured by industry-specific groups. ❖ Reduce risk of "political capture" because a regulator with responsibility for more than one sector will necessarily be more independent of the relevant line Ministries. The broader range of entities regulated by such a regulator will be more likely to resist political interference in a decision on, say, price regulation in one sector since that could set a precedent for other sectors. ❖ Create more precedents, and therefore less uncertainty, for investors because a decision by an MSR in relation to one sector on a regulatory issue common to other sectors (e.g. the application of price cap regulation or cost accounting rules) will set a precedent that is valuable to potential investors in those other sectors. ❖ Economies of scale in use of one set of high-calibre professionals (e.g. economists, lawyers, financial analysts). Such economies are particularly important during the early stages of liberalization and privatization in a TDC when there is likely to be a scarcity of regulatory experience. Other Advantages ❖ Economies of scale in administrative and support services (e.g. computers, office	Key Disadvantages ❖ Increase risk of "industry capture" by a dominant industry player not only of the single sector regulator but of the entire MSR body. ❖ Increase risk of "political capture" by a dominant ministry of not only the single sector regulator but of the entire MSR body. ❖ Increase the risk that a precedent set in relation to one sector could be applied inappropriately in another sector (although this can also be mitigated by creating strong sector-specific departments underneath a central cross-sectoral decision-making body). ❖ Dilution of sector-specific technical expertise required where, for example, the skills of a tariff expert for one sector are not transferable to similar tariffing issues in another sector, or, for example, of a frequency engineer. Other Disadvantages ❖ Failure by the regulator, cascades to other sectors. ❖ Difficulty in achieving acceptance by relevant line Ministries of the concept of having an MSR. ❖ Subsequent difficulty in achieving consensus from the relevant line Ministries on the type of MSR to be established.

67 Schwartz, T. and Satola, D (2000). *Telecommunications legislation in transitional and developing economies*. World Bank Technical Paper No. 489. Washington, DC: The World Bank Group. At: http://global011.worldbank.org/site/products.nsf;

space, support staff), particularly important where the costs of regulation can have a real impact on the affordability of basic services. ❖ Flexibility in dealing with “peak load” periods, such as periodic prices reviews, where intensive regulatory expertise is needed which may spread across sectors if a multi-sectoral approach is adopted.	
❖ Economies of scale in the development and implementation of the regulatory agency whereby, for example, uniform rules on license award or dispute settlement procedures can extend to more than one sector and, therefore, avoid the need to “reinvent the wheel” for each sector. ❖ Transfer of regulatory know-how between regulators responsible for different sectors; again, this is particularly important when a country has limited experience in regulation. ❖ Effective means of dealing with converging sectors (e.g. telecoms and broadcasting where it is increasingly difficult to decide what is telecoms and what is a broadcasting service, for example video-on-demand, or telecoms and posts, for example email and fax re-mailing. ❖ Effective means of dealing with the bundled provision of services (e.g. provision of both telecoms and electricity by the same company) and with the co-ordination requirements between sectors (e.g. where companies from number of different sectors all need to dig up the same roads to construct their networks.	❖ Greater complexity in establishing the legal framework for the MSR, including the level of independence and allocation of functions as between the Minister and the regulator. ❖ Potential delays in the reform process due to the disadvantages mentioned above. ❖ Merging existing agencies may be problematic.

❖ Avoidance of market distortions due to the application of different rules to competing sectors (e.g. electricity and gas, or road and rail).	

This section addresses the issues of economies of regulation raised by Schwartz and Satola. The basic argument is that regulatory skills and the money needed to obtain the skills are in short supply in developing countries (and were possibly in short supply in the US states where multisector regulation first emerged in the 20th century). In light of this scarcity of regulatory resources, it is claimed that multisector regulatory agencies are necessary.

4.1 Are regulatory resources in short supply?

The market for regulatory skills is no different from other markets; the price is set by the interaction of supply and demand. Given the explosion of regulatory activities across the world in the last decade of the 20th century, it is reasonable to expect that

- Persons with the necessary regulatory skills are in short supply worldwide, the educational system not having geared up for increased production in the short term; and
- The prices for the persons with skills have been bid up by increased demand.

In addition, there is no worldwide market for regulatory personnel, except in the case of consultants and in a few exceptional countries such as Bosnia-Herzegovina, Hong Kong SAR and Singapore that have purchased skills, in the form of regular employees of regulatory agencies on the world market. Regulation being considered a part of government, many governments have sought to staff their agencies with citizens and at local market rates rather than at international rates. When the market for regulatory skills is conceptualized as a series of insulated national markets, the mismatch between supply and demand becomes exacerbated, especially in developing countries where the educational systems are slower to respond and the pool of skilled human resources is shallow. The proportionately smaller number of persons with regulatory skills will be able to demand much higher wages. The regulatory agencies can pay these high wages and recruit these persons, if they are allowed to. Alternatively or in addition, regulatory agencies can invest in fast-track training to build up a skilled cadre. For this option to be sustainable, the trained persons would have to be paid adequate wages subsequent to training. Otherwise, they are likely to be attracted by higher-paying employers, depriving the regulatory agencies of the benefits of their investment in training. Another alternative is to purchase regulatory skills on a short-term basis from international consultants through outsourcing. Again, the sustainability of the solution depends on a complementary effort to build up a permanent cadre through recruitment and/or training. All three solutions require money.

Liberalized infrastructure markets result in dramatically higher levels of investments and generate significant revenues both for the investors and for the governments. It could be argued that a small proportion of the revenues can be set apart for regulatory outlays, which are after all what makes the investment feasible, without burdening the general treasury funds. The favored method of funding regulatory agencies worldwide, a levy on operator revenues, reflects this thinking. If this method of funding is adopted, the regulatory agency will have the resources to purchase the necessary skills even in the national market, through direct recruitment, training combined with adequate salaries, and short-term outsourcing.

While many regulatory agencies have the revenues or can be given access to adequate sources, there are barriers to spending the funds. Most governments constrain the levels of government salaries with the good intentions of reducing expenditures on unproductive sectors of the economy and preventing inflationary wage spirals. Regulatory agencies being seen as part of government, the wages they can offer tend also to be constrained. Elaborate procedures intended to prevent corruption as well as the generally archaic systems of public administration found in most countries hinders the use of outsourcing, except in cases where multilateral or bilateral technical assistance funds are available.

In sum, the scarcity of regulatory resources in developing countries is real, but it is caused by retrograde government procedures and policies that prevent relatively simple market-based solutions from being applied. In the absence of a short-term government reform, designers of regulatory instruments for developing countries must take scarcity of regulatory resources as a given.

4.2 Shared Use of Regulatory Resources Across Sectors

Examination of the actual organization of US state–level multisector regulatory agencies, the Public Utility Commissions (PUCs), does not provide much evidence of economies of regulation, except at the level of the decision-makers, or Commissioners. Generally, staff specialize in a particular sector such as telecom or water and work within distinct divisions that are devoted to sector-specific regulation. Resources are shared at the levels of commissioners, who hear cases pertaining to all sectors, the senior staff who manage the agency as a whole, and the legal staff responsible for hearings and related procedural matters. Generally, the different divisions are located in common facilities and use common amenities such as libraries, which may yield certain savings. The massive training and information sharing apparatus organized under the National Association of Regulatory Utility Commissioners (NARUC) is organized on a multisector basis, which also may yield certain economies. For example, the basic two-week course that is offered at the Michigan State University every August has plenary sessions that address topics that are of interest across all sectors and breakout sessions that deal with items of sectoral interest.[68] Most of the research reports that are generated by the National Regulatory Research Institute at the Ohio State University are sector-specific, but in a small number of cases, researchers from different divisions within the Institute collaborate to produce multisector reports.[69] It must also be noted that US PUCs do not have jurisdiction over frequency management, cable and broadcasting.

The US PUC model may be useful if there is a shortage of persons suited to be decision makers at the top of the regulatory agencies. Careful analysis of the backgrounds of the approximately 200 commissioners of PUCs is likely to show that they are not selected primarily on expertise in the various sectors, though there is a strong representation of former staff members and lawyers who have spent their careers engaged in regulatory activities.

The crosscutting skills of lawyers may indeed be used in multiple sectors. However, it is not evident that legal skills are those that are most in short supply in developing countries. The case for multisector regulation is strong if it can be shown that skills such as those of economists and accountants engaged in cost studies and tariff approvals can be used across sectors. The problem here is not only whether the needs are common across sectors, but also whether the workload patterns allow staff engaged in tariff reviews, usually an activity that exhibits peak-load characteristics, to engage in multiple tariff reviews that are evenly distributed across a year.

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[68] http://www.ipu.msu.edu/Camp%20NARUC.htm

[69] http://www.nrri.ohio-state.edu/

The US PUC experience shows that there may be significant economies in areas such as use of buildings, libraries, and training facilities in common. This does not, however, justify multisector regulation as such, only close collaboration among sectoral regulatory agencies.

The other problem with the cost-savings rationale for multisector regulation is the difficulty of actually realizing the promised savings from the common supply of regulation to the different sectors. Unless several infrastructure sectors are reformed simultaneously, which is unlikely in most countries, a multi-sector regulatory agency would not be created from scratch, but would have to be the result of merging several existing agencies. In most countries it is not possible to dismiss employees in the course of such a merger, negating the realization of the hoped-for economies of regulation. In addition, a merger of two going concerns would create significant morale problems. The significant increases in the expenditures of the merged UK regulatory agency OFGEM, which combined the former Office of Electricity Regulation (OFFER) and the Office of Gas Regulation, suggests that the costs may not be limited to morale.[70]

Schwartz and Satola recognize practical difficulties of achieving economies of regulation through a multi-sector agency. They propose either that a multisector regulatory agency be established in the first instance, even if only one sector is reformed, or that the first sector-specific agency that is established, be given added responsibilities and resources as the other sectors are reformed. They recognize the negative aspects of merging sector-specific agencies.

Despite these weaknesses, the multi-sector solution should not be rejected out of hand, particularly in countries where existing sector regulatory agencies are performing poorly and where there are serious shortages of regulatory expertise. It may be possible to devise informed and innovative solutions such as keeping the regulatory staff separate but sharing decision-making bodies; co-locating sector regulatory agencies and allowing and encouraging mutual learning and resource sharing; and creating a new category of regulatory organizations within government that would be subject to a different set of administrative and financial regulations.

5.0 Pragmatics of Contemporary Sector Reform

One of the main advantages of multisector regulation, according to Schwartz and Satola, is the shield it provides against capture, both by industry and by political forces. The argument is that a multisector regulatory agency is more likely to be independent and therefore give more certainty to investors through good governance.

In approaching the problem of workable independence from government for the regulatory agency, it is useful to begin by asking whether the desirability of insulation from political pressures is unique to regulatory agencies. Efficient and unbiased public administration requires a degree of protection from day-to-day political pressures. The civil-service protections written into many constitutions and laws around the world testify to this. Clear separation of the policy-setting function and the implementation function, with political accountability for the former, and administrative/legal accountability for the latter, is a basic element of sound public administration. Additional insulation from political pressure is provided in certain exceptional cases such as investigative bodies dealing with corruption, attorneys general and central banks. So do infrastructure regulatory agencies warrant such protection?

Added insulation from political pressure is critical where the government as a whole does not work too well. In effect, the independence that is called for serves as a dike to protect the island of good governance that the regulatory agency is intended to be, from the surrounding of ocean of bad governance. So, for example, a firm investing in the telecom sector in the Nordic countries

[70] WS Atkins Management Consultants (2001). *External efficiency review of utility regulators for HM Treasury: Final report*. (February).

or in Singapore does not demand the creation of an independent regulatory agency because there is adequate trust that the government as a whole works well and will not engage in administrative expropriation. By contrast, the independence of the regulatory agency was considerably strengthened in Sri Lanka in 1996, at the same time that two fixed wireless operators made major new investments in the telecom sector.

Experience has shown that there are two major threats to the independence of sectoral regulatory agencies. One is the "line" ministry, which previously combined the functions of policy setting, regulation and operation, but following liberalization has been left with only the task of policy setting, if anything.[71] The second is the ministry of finance or equivalent, which is engaged in the privatization of the incumbent operator or is the major shareholder of the partially privatized incumbent.[72] The multisector solution, by definition, takes the regulatory agency out of the control of one line ministry (because there will be more than one) and will give it a reporting relationship to either a ministry devoted to economic reforms or the overall subject of finance, or the president, or the prime minister, or the legislature. An alternative solution to the problem of line ministries is to abolish them altogether, as Senegal has done.[73] Following liberalization, it is difficult to see the rationale for maintaining an entire ministry solely for policy setting.

However, the solution to the line-ministry problem should not aggravate the finance-ministry problem. Unless proper safeguards are set in place, the multisector regulatory agency may be interfered with by other parts of government with vested interests in multiple incumbent infrastructure suppliers.

The question of how the regulatory agency is structured cannot be divorced from a realistic assessment of the process by which reform occurs. A comprehensive sector reform package requires one or more champions—those who will make the public case for it; engage in debate with its many opponents and shepherd it through the appropriate governmental processes. Generally, infrastructure reform is championed by either the Minister or by the senior civil servant in the line ministry. In cases of privatization, the Privatization Agency may assume a key role, but even here, the process requires the participation of some actors from the line Ministry. Not all reform champions are pure altruists. Even those intellectually committed to the reforms think about their positions in the new order. In some cases, opponents of reform are converted to supporters on the basis of assurances of future roles.

The post-reform roles for the reform champions could be in the operating entity, the regulatory agency or in the Ministry. Reform of the operator usually results in greatly reduced powers of direct involvement by the Minister. Therefore, it is natural for the Minister to seek authority over a specialized entity that will exercise oversight over the entire sector, namely the new regulatory agency. Generally, reform requires the installation of professional specialist managers from outside at the helm of the operational entity, limiting the opportunities for generalist civil servants. Therefore, it is also normal for the civil servants at the helm of the reforms to position the new regulatory agency in a way that would enhance their career paths. These factors create conditions that are conducive to the creation of sector-specific regulatory agencies, rather than

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[71] See for example the continuing struggle between the Moroccan telecom regulatory agency, ANRT, which has been recognized as one of the exemplary regulatory agencies in the world and the Ministry, SEPTI. Bouzerda, Ali. Head of Morocco telecoms watchdog resigns. *Totaltele.com*. 11 Jan 2002. http://www.totaltele.com/view.asp?ArticleID=47597&Pub=TT&CategoryID=627; and Bouzerda, Ali, Moroccan regulator signals resignation, *Totaltele.com*. O3 December 2001. http://www.totaltele.com/view.asp?ArticleID=46417&Pub=TT&CategoryID=627

[72] See for example, the tensions in Sri Lanka between the Public Enterprise Reform Commission of the Ministry of Finance and the Telecom Regulatory Commission after the partial privatization of the incumbent in 1997. Samarajiva, Rohan. The role of competition in institutional reform of telecommunications: Lessons from Sri Lanka, *Telecommunications Policy*, 24(8/9), 2000: 699-717. At: http://www.tpeditor.com/contents/2000/24-8+9.htm

[73] Pan African News Agency (May 24, 2001). "Workers in Communication Ministry ill at ease." At: http://allafrica.com/stories/200105140793.html

multisector agencies. They do not determine the ultimate outcome, which is the result of multiple forces, but tilt the balance toward agencies defined in terms of the pre-reform department/agency.

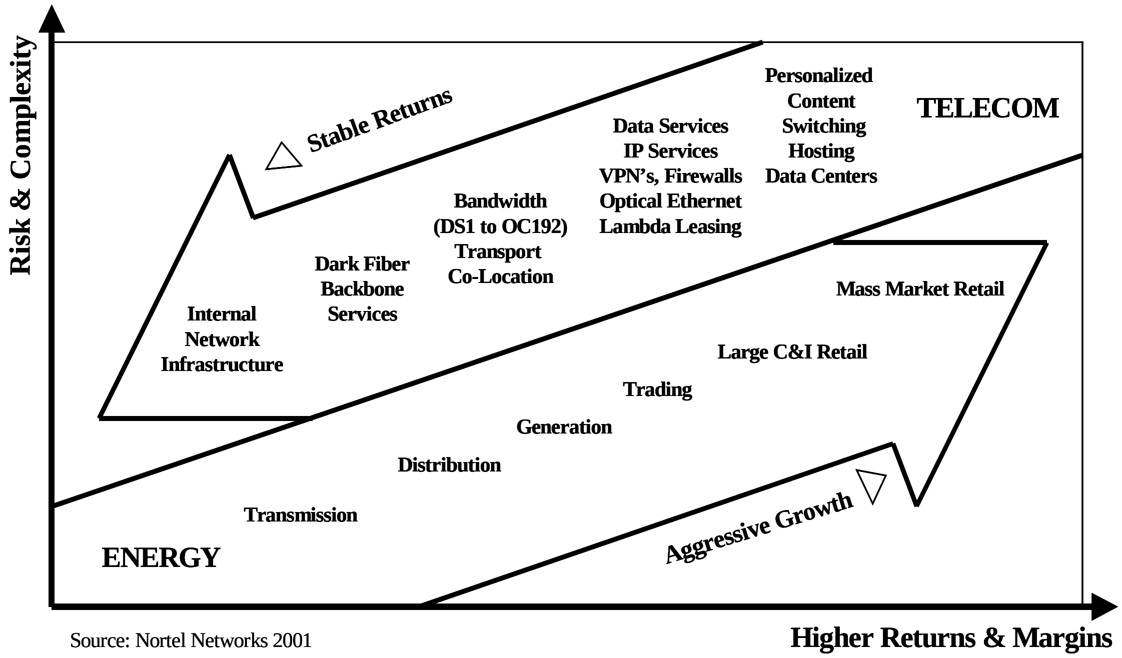
If a government were serious about effective sector reform, it could give the lead responsibility for the task to a reform, and not a privatization, authority. The reforms would be championed by a Minister and officials who would see reforms of other sectors as their future, and would therefore be free of a vested interest in the regulatory agency. In this kind of context, it is more likely that a decision to create a sectoral or multisector agency would be both more "rational" and be more likely to ensure independence from day-to-day government interference.

6.0 In Lieu of an Conclusion

Given the purpose of the present paper, which is to initiate informed discussion and debate on the relative merits of information and communication technology (ICT) convergence regulation and multisector utility regulation, a conclusion would not be appropriate. A conclusion can be written after the participants of the World Dialogue on Regulation for Network Economies have shared their insights. Instead, a set of indicative questions are proposed:

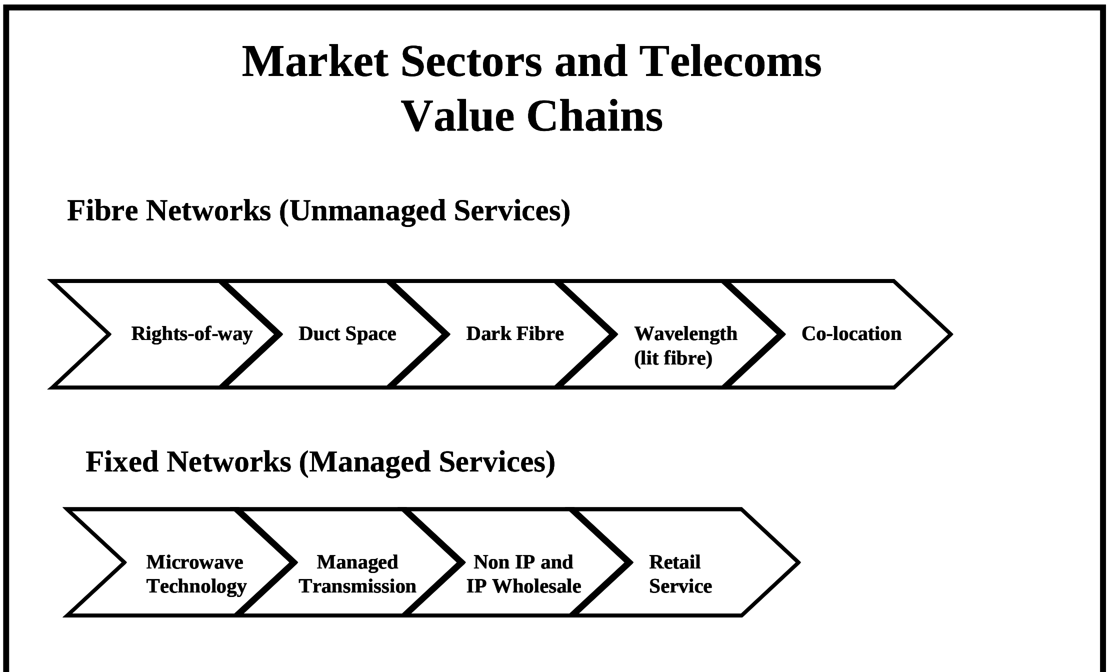
1. What criteria should be used to assess the relative superiority of ICT convergence and multisector utility regulation? What relative weight should be given to each of the adopted criteria?
2. Is there justification for a right-of-way/conduit regulator?
3. Does common use of conduits require a single regulator, or is the priority a workable system of non-discriminatory access with safeguards against cross-subsidies?
4. Is evidence of firms adopting multi-utility strategies indicative of underlying technological convergence, or could this be a result of pecuniary benefits from manipulating regulatory, taxation and other rules?
5. If operators in individual sectors are moving to operate across sectors, does that require the regulator to follow? Or is regulatory cooperation adequate?
6. What proportion of regulatory skills, in what agencies, are fungible?
7. Is workload distribution such that the same staff member can do multiple tasks (e,g, preparation of tariff decisions has peaks and lulls)? Or would multisector organization simply result in larger numbers of staff engaged in similar tasks?
8. Can resources such as legal expertise and administration be used in common? Or will it simply mean larger legal and administrative units?
9. Do the above savings exceed the diseconomies of coordination and merger?
10. Are there forms of cooperation short of merger that may be more effective? Common facilities, i.e., location in same building? Economies of capacity building? A "regulatory service" with administrative and financial regulations and salary scales different from government service?
11. Does multi-sector regulation allow for the balancing of influence of one incumbent? Or will all incumbents gang up on regulator?
12. Multi-sector regulation necessarily changes reporting relationship from "line" ministry. Does this reduce line ministry influence? Does this allow it to be balanced by multiple line ministry influences? Will line ministries combine efforts to unduly influence the regulatory agency?
13. Does multi-sector regulation address the finance-ministry influence problem? Can this problem be better addressed by means other than multi-sector agencies?
14. Sector reforms do not occur simultaneously. How can multi-sector agencies be created in this context?
15. Will reforms have champions if multi-sector agencies are the objective? What do Ministers and civil servants do after the reforms?

APPENDIX 1**:** Energy and Telecom Paradigms



Source: Nortel Networks 2001

Market Sector and Telecom Value Chains



Source: Mason Communications 2001

APPENDIX 2: International Energy Utility Company Profiles

Williams Communications (US Based)

USA based Williams Communications was the first telecom company formed by an energy company in 1985 when it pioneered the placement of fiber-optic cables in decommissioned pipelines. It boasts the largest U.S. next generation network with local-to-global connectivity, connecting 125 cities and reaching five continents (Over 33,000 lit miles). Its focused business model is grounded in broadband market grights of wayth and non-competitive relationships with bandwidth-centric customers. Williams also owns largest broadband network in the US serving both domestically and abroad while its customers include incumbent local exchange carriers, inter-exchange carriers, ISPs, application service providers, utilities, media companies. It operates the largest independent integrator of data, voice and video systems for enterprises throughout North America and through its subsidiaries connects business to energy and communications. The company delivers products and services through its networks of energy-distributing pipelines and high-speed fiber optic cables. It has annual revenues of $2 billion and has 9400 staff in North America with offices in Europe, Asia, South America and Australia.

Williams essentially leverages its strengths in North America to pursue energy and communications infrastructure projects, investments and operations around the world. This strategy suggests synergies rather than conglomerations behavior.

Its acquisitions of Manquehue Net in Chile[1] and Southern Cone Communications in Chile and Argentina[1] suggest a linkage of products (extension of its products to another geographic region) as well as some intangible linkages (shared managerial know how, etc.). Its acquisition of PowerTel in Australia[1] also suggests a linkage of products as the companies have agreed to work together to develop a complete set of data and voice products to send traffic to each other's network on a "preferred vendor" basis. Its acquisition of Silica Networks (19.9 percent suggests a linkage of technologies as Silica uses leading edge technologies in its 4,300 km fibre network to connect cities in Argentina and Chile.

Singapore Power (Asian Based)

Asian based Singapore Power ($5.1 billion turnover for 2001) participates in generation and transmission activities (electricity, steam and water) in Singapore, Korea, Indonesia and Australia.

It recently formed Singapore Telecom to spearhead diversification into telecom with the express aim of leveraging off infrastructure assets and utility infrastructure roll-out experiences as well as to into SP's network operations and maintenance expertise. To date SP Telecom has installed and leased about 1400 kilometers of underground duct network to StarHub and installed about 1200 kilometers op optic fiber cables for StarHub. SP was recently awarded a facilities based operator license. SP also trailing out powerline communications technology (broadband communications signals over underground low voltage cables).

The business linkages demonstrated by Singapore Power includes linkages to markets (same buyers in customer base, same path to the user and transference of brand name), technological linkages (research into new product technologies) and intangible linkages like sharing managerial know how.

United Utilities (UK Based)

UK-based United Utilities is involved in multi-utility operations (renewable energy generation). Its turnover from multi-utility operations (£ 1202 million), asset management services (£ 198 million), customer management outsourcing (£ 211 million) and telecom (£ 120 million).

Recently changed the name of its subsidiary from Norweb Telecom to Your Communications and offers a full range of business communications services covering voice, mobile, data and Internet services from phone lines to the creation of advanced networks. Your Communications operates nationally using specialist sector teams and indirect sales channels or by purchasing, leasing or swapping fiber optic cable. The company has invested heavily in network infrastructure enabling it to expand its national network and improve the quality of its service. Its highly resilient national fiber optic network now reaches 2,838 kilometers in length. Last year the company successfully bid for Broadband Radio Access Licenses giving it the rights to offer broadband services in Greater Manchester, the West Midlands, Yorkshire and the North of England. Key customers include small and medium sized enterprises and specialist sectors such as Storage Transportation & Travel, Public Sector, Manufacturing and Business Services. It has an annual turnover of £79 million with offices in Manchester, Sheffield, Chelmsford, Birmingham & Leeds.

United Utilities demonstrates both conglomeration and synergies behavior. It links seemingly unrelated businesses while at the same time forms strong business linkages with regard to market linkages (targeting the same customer base and distribution channels).

MVV Energie AG (German Based)

German-based MVV Energie AG is one of the ten largest German municipal utilities with stakes in energy trading, renewable energy and additional participation at home and abroad (electric power, natural gas, water, district heating). MVV Energie has implemented limited powerline technology for fast Internet access via electricity lines through residential wall sockets. (Seen as a strategy for offsetting recent losses due to shrinking retail power margins.) By 2004, MVV Energie AG expects to have approx. 30 000 Powerline customers in Mannheim and sees a significant potential for developing attractive, value-added services.

The establishing of a separate investment-funds corporation, MVV Innovationsportfolio AG & Co. KGaA, with headquarters in Mannheim suggests conglomeration behavior. With this new corporate venture-capital company, MVV Energie AG will continue its successful grights of wayth strategy via pinpointed investments in selected technologies of the future and will thus be able to take advantage of an additional module with respect to innovative products and services.

Centrica (UK based)

UK-based Centrica was created in 1997 following the demerger of British Gas plc. The group comprised the gas supply, services and retail businesses of British Gas, together the gas production business of the North and South Morecambe gas fields. It also retained ownership of the Goldfish brand. Centrica is a leading provider of energy and other essential services (telecom, roadside recovery and financial services). In Great Britain, consumer brands includes the AA, British Gas, Goldfish and One.Tel whiles in North America Centrica is the market leader in the unregulated sector of energy supply with more than a million customers through its subsidiary in Canada, Direct Energy, and in the USA through its Energy America business. Principal operations includes energy supply, home and road services, financial services, e-commerce, telecom and business development. Its telecom operations in particular includes British gas communications (fixed line , mobile and internet services and One.Tel.). Most recent activity includes big investment in Belgium.

Centrica demonstrates both real synergies (telecom, e-commerce) and conglomeration behavior (home and road services, financial services, etc.).