Maximum Impact for Minimum Subsidy: Reverse Auctions for Universal Access in Chile and India

Irene S. Wu

Federal Communications Commission
FCC Staff Working Paper 2
October 2010

Maximum Impact for Minimum Subsidy: Reverse Auctions for Universal Access in Chile and India

Irene S. Wu

FCC Staff Working Paper 2
Federal Communications Commission
Washington, DC 20554
October 2010

Revised November 15, 2010

Abstract

U.S. government funding for universal service and broadband support programs could be quicker and more efficient. To improve efficiency and speed in delivering subsidies, several countries successfully use reverse or minimum subsidy auctions to support universal service programs. This paper discusses the implementation of such auctions in the last 15 years in Chile and India. The programs ranged from rural public telephones to wireless broadband networks. While there can be drawbacks to such auctions, the advantages are that they can be quicker and more transparent than other approaches.

In a minimum subsidy auction, the government identifies a project and a maximum subsidy. Companies compete for the project by bidding down the value of the subsidy. The bidder requiring the lowest subsidy wins. Based on these case studies, minimum subsidy auctions include the following elements:

- Setting clear policy targets and methods for identifying projects;
- Establishing a method for calculating maximum subsidy available per project;
- Specifying minimum technical and financial requirements for bids and regulatory advantages or requirements;
- Specifying procedures for awarding and disbursing of funds;
- Maximizing the number of competitors; and
- Implementing the auction by evaluating bids in terms of technical quality and selecting the lowest bid.

In contrast to the request-for-proposals approach to contracts, with minimum subsidy auctions the government *in advance* states very clear criteria for technical evaluation; all qualified bids then move on to the auction. Two auction design challenges are defining projects and maintaining transparency in technical evaluation. A third design challenge is seeing that bidders comply with their commitments; in Chile and India, in early auctions rounds the incumbent won and then failed to build the infrastructure.

Maximum Impact for Minimum Subsidy: Reverse Auctions For Universal Access in Chile and India

Irene S. Wu[1]

U.S. government funding for universal service and broadband support programs could be quicker and more efficient. To improve efficiency and speed in delivering subsidies, several countries successfully use reverse or minimum subsidy auctions to support universal service programs. This paper discusses the implementation of such auctions in the last 15 years in Chile and India. The programs ranged from rural public telephones to wireless broadband networks. While there can be drawbacks to such auctions, the advantages are that they can be quicker and more transparent than other approaches.

Introduction

In a minimum subsidy auction companies compete to win a subsidy from the government by placing the lowest bid. The government identifies the contract to be auctioned; establishes a maximum subsidy level; and outlines any requirements on the bid proposals. The bidder with the lowest subsidy requirement wins. The objective is to use competitive forces to minimize the government subsidy required to achieve public objectives.

Minimum subsidy auctions use the market to determine the subsidy level needed to make policy goals commercially attractive. Furthermore, a well-executed auction increases the incentives for government to release selection criteria in advance, which should enhance the transparency and efficiency in the award of subsidies. For example, in India, minimum subsidy auctions were used to disburse universal service funds that had been languishing for some years, collected but unspent.[2]

Need for Minimum Subsidy Auctions in the United States

First, in general, auctions offer a quick and more economically efficient way of distributing resources. The current federal fiscal stimulus package includes funding for broadband networks that needs not only to be spent well but also to be spent quickly.[3] Also, if universal service reform shifts funds toward broadband projects, now may be a good opportunity to consider a new way of disbursing subsidies. Indeed, looking back at the history of the Federal Communications Commission, speed of implementation was

---

[1] Acting Chief Data Officer, International Bureau, FCC. While the views in this paper are my own, I benefited from the comments of Mindel De La Torre, Jerry Duvall, Carrie-Lee Early, Evan Kwerel, Patrick Boateng, Lily Hughes, Robert Tanner, Sharon Gillett and Carol Mattey. Thanks also to outside reviewers Bjorn Wellenius, Philip N. Howard, and Rekha Jain. I may be contacted at Irene.Wu@fcc.gov.

[2] Malik 11-13.

[3] See American Recovery and Reinvestment Act, 2009. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h1enr.pdf

one of the primary reasons for shifting away from comparative hearing to auctions for spectrum licenses.[4] Second, as auctions are notable for increasing transparency of action, using a decidedly different technique such as auctions to disburse funds may mitigate the likelihood that old problems will arise again.

Previous research

While there is a considerable research literature generated in the United States focused on auctions in general, the vast majority of the literature focused on auctions for communications services public projects lies in the field of international aid and development economics. Most influentially, Bjorn Wellenius' 2002 report written for the World Bank, describes in detail Chile's successes in implementing minimum subsidy auctions starting in 1995. Following the precedent set by Chile, other countries such as Peru, Colombia, Kenya, Uganda, and India have implemented minimum subsidy auctions for universal service objectives. In a recent article, Scott Wallsten also provides an excellent overview of universal service subsidy auctions in Australia, Chile, Columbia, India, Nepal, and Peru. [5]

The World Bank and regional development banks have recommended minimum subsidy auctions. In 2004, the Organisation of Economic Cooperation and Development (OECD) issued a paper, "Leveraging Telecommunications Policies for Pro-poor Growth: Universal Access Funds with Minimum-Subsidy Auctions."[6] Through its aid funding, the U.S. has recommended other governments implement minimum subsidy auctions; it seems reasonable that the U.S. government also consider the policy option for itself.

On April 13, 2009, 71 economists signed a statement proposing that the United States government use reverse auctions to award funds allocated to stimulate broadband deployment. Their proposal heavily emphasizes using the lowest price as the main criteria for the auction and seeks to minimize government discretion in evaluating other aspects of bids.[7] Both their proposal and the evidence gleaned from foreign countries' actual implementation demonstrate that the gains in transparency come from the government making clear in advance its policy goals and bidding criteria. The bulk of the government's decision making work is before the auction, not after, as would be expected with a request-for-proposals process.

Relevance of auctions in Chile and India

Minimum subsidy auctions have been used in a number of different countries. This paper discusses two countries. First, Chile has the longest history of using auctions for universal service and recently has embarked on auctions for fiber optic and other broadband networks, which are directly relevant to the United States. Second, India has been using auctions with both success and challenges. The size of India's US$5.8 billion universal access fund and the scale of its programs make it an interesting example for the

[4] Cramton on the history of spectrum auctions in United States.
[5] See Wallsten.
[6] See Perset, OECD.
[7] See Milgrom, Paul; Gregory Rosston; Andrzej Skrzypacz; Scott Wallsten.
http://www.techpolicyinstitute.org/files/procurement_auctions_for_bbd_stimulus%20final.pdf

United States. This paper discusses in detail the challenges and problems Chile and India experienced in preparing, organizing and staging their auctions.

The Chilean section of this paper includes a discussion of how the government identifies potential projects through proposals submitted at the grassroots level. Also, there is a detailed discussion of the technical and economic requirements for bids, thus putting a brake on the tendency of bidders to minimize performance in an effort to offer the lowest bid. Through three phases of development starting in 1994, Chile has used auctions for public payphones, for community telecenters and, starting in 2006, to build out Internet infrastructure.

India began minimum subsidy auctions in 2002 due to political pressure to spend quickly and effectively a substantial universal service fund that had remained underutilized for many years. Initially, the auctions ended up awarding subsidies to the incumbent. Later, a revised design that opened up bidding to a larger set of competitors and a variety of technologies ameliorated this problem.

Lessons for the United States

Implementing minimum subsidy auctions in the US for universal service and broadband subsidy programs would require several actions:

- *Set clear policy targets and methods for identifying projects.* Specific policy targets clarify which projects are eligible for support. Projects can be identified top-down by the government, from grassroots recommendations, or both.
- *Establish method for calculating maximum subsidy available per project.* Clarity in calculating the maximum subsidy increases transparency of the auction process.
- *Specify minimum technical and financial requirements for bids and regulatory advantages or requirements, if any.* These can include the prices for the services offered, minimum quality of service requirements, and any regulatory advantages that may apply.
- *Specify how funds are awarded and disbursed, with a timeline.* These rules should be designed to encourage bidders to follow through with their commitments. For bidders, predictability of how they will receive subsidies is also crucial to success.
- *Maximize the number of competitors.* Allowing a range of technical options and types of companies attracts more bidders and improves the auction outcome.
- *Auction implementation.*
    - *First, technical evaluations create incentive for high performance.* Some evaluation of the minimum technical quality of a bidder's proposal is necessary to ensure quality.
    - *Second, selecting the lowest financial bid.* A commitment to select the lowest financial bid from among the technically qualified bids enables the government to discover better the true cost of subsidizing a project.

Chile

Beginning in 1995, Chile has used auctions for public payphones and community telecenters. As a result of the minimum subsidy auctions, the population living in localities without any access to public payphones was reduced to 1% in 2002 from 15% in 1994. Starting in 2006, auctions were used to build Internet infrastructure. Auctions are administered by the regulator Subtel's Fund for Telecommunications Development. The Fund was created in 1994 under Title 4 of the General Telecommunications Law.[8]

Setting clear policy targets

Initially, the types of projects that were typically subsidized were public pay telephones, but subsequent programs expanded to include call centers, information community telecenters, and broadband network infrastructure. The universal service fund has passed through three historical phases, as Table 1 shows below.

Table 1: Chile's History of Minimum Subsidy Auctions

Goals	Dates	Funds
Rural public telephones	1994-2000	US$15.4 million
Community telecenters for information	2000-2006	US$10.8 million
Access infrastructure: deploying fiber, mobile phones and broadband to the last mile.	2006- present	US$75.3 million

Today, the Fund's goal is to develop service in localities now have either no service or prohibitively expensive Internet service. The goal of the auction is to develop Internet services in rural areas in 1400 localities, which represent 20% of the population, at a price equivalent to other areas of the country and at a basic connecting speed of 1 mbps downstream. Hospitals and schools in those regions will get broadband access. The total subsidy is estimated at US$54 million for a total investment of US$116 million.[9]

Identify projects eligible for subsidy

To identify projects, every year until July, the regulator Subtel, collects requests for payphones from local governments, neighborhood associations, telecommunications companies, and the general public.[10] To identify a potential project, applicants file a

[8] Chile, "*Ley General de Telecomunicaciones,"* No. 18.168, http://www.leychile.cl/Navegar?idNorma=29591 and http://www.subtel.cl/prontus_subtel/site/artic/20090806/pags/20090806105001.html.
[9] Bello.
[10] Subtel. "Fondo".

simple form available on the Subtel website.[11] Subtel collects these forms from local governments and groups them into projects, usually consisting of 20-50 locales that are geographically close and have technical solutions likely to be cost-effective.[12] Subtel decides which projects will be subsidized and also defines key issues such as the maximum tariff and the maximum subsidy level.[13]

When it first began auctions, Subtel faced some challenges in implementing this grassroots call for project proposals. In the early 1990's before the Fund was established, surveys of Chile had been conducted that identified 600 rural localities needing payphones. However, in the first round of requests in 1995, the Fund received payphone requests for 2429 localities. In 1999, to better screen requests, Fund administrators developed a more specific definition of the targeted population, namely, rural communities (i) with more than 60 people in the three lowest quintiles of income distribution and (ii) located at least 30 minutes away from the nearest public telephone.

Even with this more targeted definition, however, problems remained in screening locales. Income distribution data were not always disaggregated enough, resulting in poor pockets of well-off communities becoming ineligible. For those who were submitting requests, information on population and distance to payphone was often unreliable and inconsistent. As a result, the Fund had identified 1.5 localities for every 1 locality in the population census.[14] To avoid these kinds of problems, substantial local data on population, geography, and other socioeconomic indicators should be collected in advance of making policy decisions.

Estimating subsidy cost

Once projects are identified, Subtel carries out a cost-benefit analysis to identify and prioritize projects eligible for subsidy and to set a maximum subsidy to be made available for each project. To obtain a net present value for each project, costs and revenues for the ten years of required service were forecast and discounted at prevailing interest rates.[15]

For each project, both market value and social value were calculated. Market value indicates whether a private company is likely to undertake a project. If the market value is negative, it is unlikely; if the market value is zero or positive, profits are possible, and it is likely private firms would undertake them, and therefore, ought not to be subsidized, as shown in Table 2. Social value indicates the benefit accrued to the whole economy, not just to a private firm. Projects with negative social value should not be undertaken, but those with zero or positive social value would benefit the whole economy.[16]

---

[11] See discussion at http://www.subtel.cl/prontus_subtel/site/artic/20061229/pags/20061229173735.html.The form itself is "Formulario Solicitud de Servicios de Telecomunicaciones"
[12] Wellenius 2002.
[13] Subtel. "Fondo".
[14] Wellenius 2002.
[15] Ibid.
[16] Ibid.

Table 2: Process for Identifying Projects to Subsidize

Market Value	Social Value	
	High	*Low*
High: Profitable or Break Even	Not Eligible for Subsidy	Not Eligible for Subsidy
Low: Not Profitable	**Eligible for Subsidy**	Not Eligible for Subsidy

Eligible projects were those with a negative market value, but a positive social value. The projects were ranked in priority in terms of their social value. Maximum subsidies were set at absolute value of the (negative) market value.[17]

Setting interconnection regulations favorable to new entrants was also a key factor in the success of Chile's auctions. Rural companies' access charges are higher than in non-rural areas, but lower than that of mobile operators. Initially, access charges for rural companies were calculated based on the costs of new entrants as they began operation in a competitive environment. Later, the industry voluntarily adopted common access charges for all rural companies.[18]

Implementing minimum subsidy auctions

This section will discuss two separate auctions in Chile. The first is an auction held in 2007 for a fiber optic network in Chiloé and Coyhaique, remote regions in southern Chile. Only one bidder participated; the network began providing service in January 2008. The second is the largest auction run by the Fund in its history to build telecommunications and Internet centers (TIC) in about 1,500 rural areas throughout the country. The auction attracted four bidders and the winner, a new entrant, agreed to implement the project without any government subsidy. This auction concluded in March 2009. While the winner's financing fell apart, the license was given to the runner-up and mobile broadband service began in September 2010.

Chiloé and Coyhaique: auction for service in a remote area. The auction documents specify the minimum characteristics of the project such as the minimum service area, the quality of service, the maximum tariff, including necessary indices, the milestones for implementation, and the maximum subsidy. Details include the following auction characteristics:

- Communities to be served by the fiber network.
- Minimum standard quality of service.

[17] Ibid.
[18] Ibid.

- Technical solution, timeframe for work, details of equipment, and necessary certifications.
- Financial issues: such as amount to be invested in infrastructure, projected income, details of costs for administration, operation, and interconnection.
- Formula for converting proposals into points – based on the amount of subsidy requested.
- Proposed tariffs, in this case for 64 kbps, 2 mbps, and 155 mbps service.
- Maximum amount for subsidy is specified, payout procedures, and guarantees. Penalty for not reaching milestones.
- Indication of what spectrum is available to provide the service.
- Specification of minimum capacity of nodes in the fiber network.
- Timeline – 3 months from auction to certification of payout.[19]

The documentation sets out three main stages for implementation of the auction. In the opening stage, Subtel evaluates the bids according to the minimum requirements. Proposals are assessed pass-fail. Proposals that pass then move on to the next stage. In some of Subtel's past auctions, the bids are then simply ranked and the lowest subsidy wins.

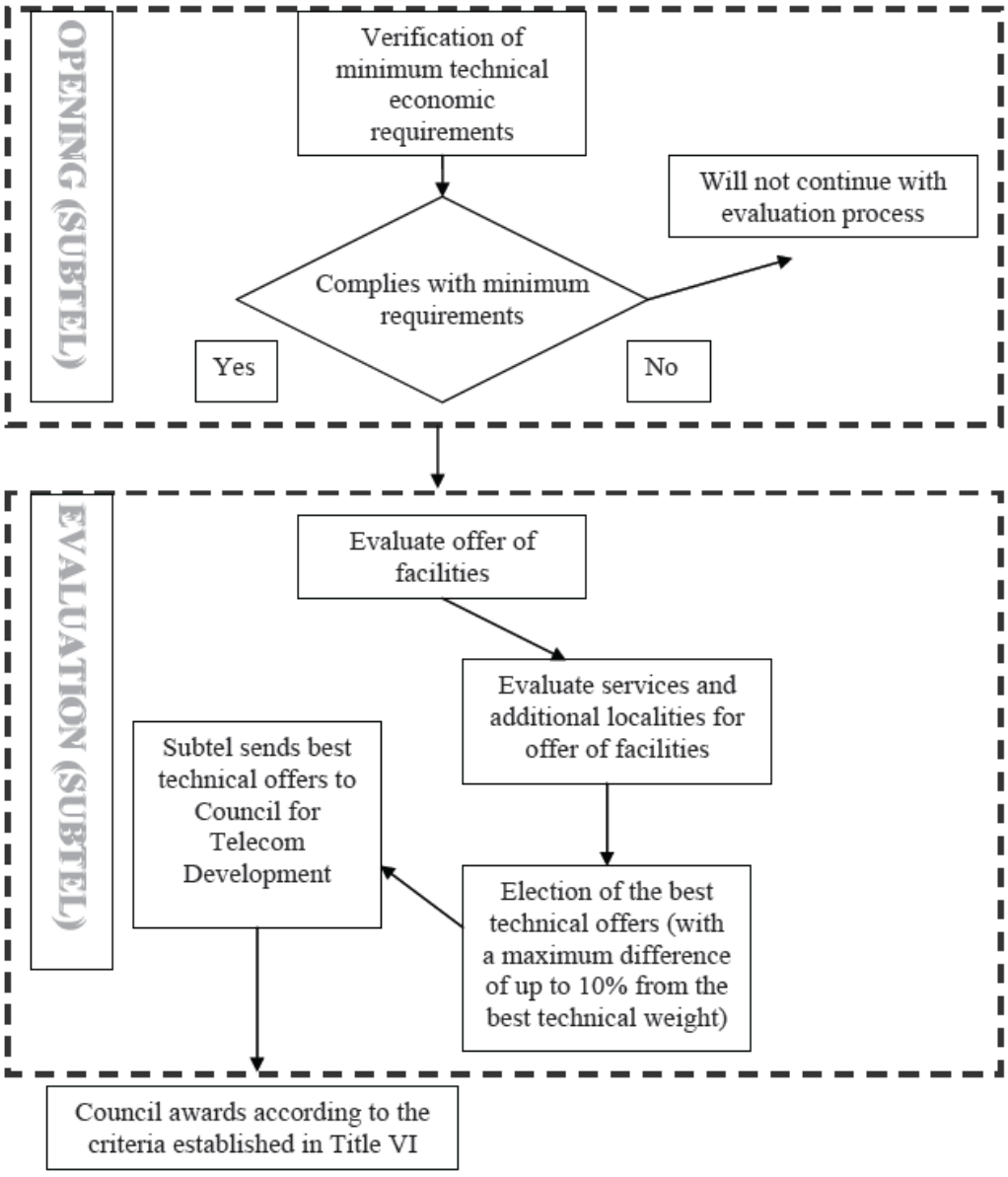
In this auction, however, the bids moved on to a second, evaluation stage. Technical experts review the bids in terms of the conditions such as the facilities offered and service area coverage. The bids that qualify in this round are sent to the award stage when the bid with the lowest subsidy requirement wins.[20]

This three-stage process is shown below in Figure 1, which was translated from the auction documents. For this auction, there was only one bid, submitted by Telefónica del Sur. The auction was conducted in March 2007. According to local news site *Patagonia Digital*, service began in January 2008.[21]

[19] Subtel. "Bases específicas del concurso público para la asignación del proyecto de transmisión por fibra óptica para Chiloé y Coyhaique y su respectivo subsidio, correspondiente al programa anual de proyectos subsidiables del año 2007 del fondo de desarrollo de las telecomunicaciones."
[20] Subtel "Fondo."
[21] Patagonia Digital.

Figure 1

Minimum Subsidy Auction Process as Implemented by Fondo de Desarrollo de las Telecomunicaciones in Chile



Source: Subtel. "Bases específicas del concurso publico para la asignación del proyecto de transmisión por fibra optica para Chiloé y Coyhaique y su respectivo subsidio, correspondiente al programa anual de proyectos subsidiables del ano 2007 del fondo de desarrollo de las telecomunicaciones." See Annex 6. http://www.subtel.cl/prontus_subtel/site/artic/20070420/pags/20070420115905.html Accessed April 9, 2009.

Telecommunications and Internet Centers: auction for service in rural areas. In 2008, the Fund conducted a major auction to provide Internet service to 1,470 rural localities throughout the country, called the "Digital Infrastructure for Competitiveness and Innovation Auction."[22] The project is expected to benefit three million people, around 850,000 households, and more than 800 schools in rural areas. Chile expects to jump from 71% to 92% population reached by telecommunications and information centers.[23]

The main document outlining the requirements for proposals was released in conjunction with the 15 local governments.[24] It includes a variety of details such as the following:

- The winner has differing obligations in three types of areas. The Service Zone is the area where the winner is authorized to provide service. The Coverage Zone is the area within the Service Zone where the winner is allowed to install systems. The Obligatory Service Zone is the area within the Service Zone where the winner is obliged to offer service according to the terms of the auction. [25]
- The Obligatory Service Zone is a defined geographic area; the service must meet technical requirements such as service to customers should be Internet service of at least 1 mbps downlink and 512 kbps uplink with quality specifications. Other aspects of the offer are specified. For example, if Internet service is bundled with other services, a stand alone Internet service must also be offered. Also, a prepaid offer should be considered.[26]
- The price of the Internet service is priced at about US$26 per month.[27]

The calendar detailed in the document shows a quick completion of the auction process starting from October 2008 and concluding in January 2009. As Table 3 shows below, the call for bids was issued in October. The public had one week in which to submit questions. A public document detailing all questions and answers was released within two weeks. Businesses had about three months to develop bids. Once bids were submitted, a news conference to announce the winner was held within three months. Service to customers was expected to begin in October 2009, one year from the initial call for bids.

[22] *Concurso Infraestructura Digital Para La Competitividad y la Innovación*
[23] Subtel. "Comienza proyecto de Internet rural que permitirá accesso al 92% de las personas del país."
[24] Subtel. "Bases específicas concurso público para la asignación del proyecto infraestructura digital para la competitividad e innovación y su respectivo subsidio correspondiente al programa anual de proyectos subsidiables de ano 2008 del fondo de desarrollo de las telecomunicaciones." See title page.
[25] Ibid, See Artículo 3, paragraphs 27-29.
[26] Ibid, See Artículos 40-41.
[27] Nixon.

Table 3: Auction Calendar[28]

Activity	Start	Finish
Publication of call for proposals	October 1, 2008	October 1, 2008
Receive questions from the public	October 8, 2008	October 8, 2008
Reply to questions	October 22, 2008	October 22, 2008
Receive proposals	January 15, 2009	January 15, 2009
Opening for proposals for 3 groups	January 15, 2009	January 15, 2009
Subtel evaluation for 3 groups	January 15, 2009	January 25, 2009
Opening for proposals for 4th group	January 26, 2009	January 26, 2009
Winner returns the license and subsidy		December 2009
Runner up begins service delivery		August 2010

Four businesses competed and the winner was Chilean-Malaysian joint venture Inverca Telecom. They bid to invest US$93 million with zero subsidies. Competing bids were from Telefónica Chile for US$49 million of subsidies, Entel for US$38 million, and Comunicación y Telefonía Rural (CTR) for US$54 million. Telefónica and Entel proposed using 3G networks; CTR and winner Inverca proposed to use WIMAX. The government's maximum subsidy offer was US$61 million.[29]

Unfortunately, Inverca lost its Malaysian partner and the funding for the project fell apart. By December 2009, Inverca returned its license to the government. Subtel then gave the license and the subsidy to Entel, the runner-up in the auction. By September 2010, Entel was offering 500 localities a 1 mbps mobile broadband service using advanced 3G technology at 14,900 pesos (US$31) per month. A remaining 1000 localities should be connected over the next two years.[30]

Chile has used minimum subsidy auctions for universal service programs longer and more consistently than any other country. Particularly striking is the clarity of each stage of the auction. Compared to other countries' universal service programs, Chile's auctions are well documented, transparent, and predictable. Even in the midst of a global financial crisis when international financing slipped for the telecommunications and information

[28] Subtel. "Bases específicas concurso público para la asignación del proyecto infraestructura digital para la competitividad e innovación y su respectivo subsidio correspondiente al programa anual de proyectos subsidiables de ano 2008 del fondo de desarrollo de las telecomunicaciones." See Annex 8.
[29] Nixon.
[30] Espinoza, Cristina. "Internet para todos," *La Nacion.* August 20, 2010. Accessed www.lanacion.cl September 24, 2010. Cony Sturm, "Chile: gobierno y Entel lanzan plan para llevar internet a localidades rurales." www.fayerwayer.com August 29, 2010. Accessed September 24, 2010.

centers program, the auction process appeared resilient enough to recover and allow the selection of another company that successfully implemented Internet service around the country.

India

Years of stalled progress toward achieving universal service objectives spurred the Indian government toward implementing minimum subsidy auctions. In 1999, in its National Telecom Policy,[31] the government of India set very clear universal access and began amassing a universal service fund. By 2002, it was apparent that politically important goals, such as connecting a phone in every village, would not be achieved with the original plan to rely on competition in the market with universal access obligations attached to licenses.

Progress in services related to minimum subsidy auctions

India turned to auctions to push forward the development of telecommunications in rural and remote villages and to accelerate the disbursement of universal service funds which had been languishing for a time. Between 2002 and 2009, an estimated US$1.7 billion was disbursed through auctions.

The government of India established overall goals in its 1999 National Telecom Policy. The Telecom Regulatory Authority of India (TRAI) ensures that licensees comply with universal service obligations.[32] After the government's Universal Service Support Policy came into effect in 2002,[33] funds collected from operators went into the national treasury and, therefore, were difficult to disburse. Not until 2004, when the Indian Telegraph Act was revised and the Universal Service Fund received statutory non-lapsable status, were funds releasable in practice.[34]

In October 2004, TRAI released its consultation document "Growth of Telecom Services in Rural India: the Way Forward," which sets out the framework for "least quoted subsidy bidding process." [35] While TRAI makes policy recommendations, it is the Department of Telecom that decides on implementation. An office attached to the Department of Telecom administers the Universal Service Fund.[36] The Department of Telecom is also responsible for overseeing the state-owned telecom operators.

Role of minimum subsidy auctions

The government of India turned to minimum subsidy auctions when it was criticized for collecting universal service fees, but failing to spend the money to achieve its goals. Between 2002 and 2007 there were five sets of minimum subsidy auctions with varying levels of success.

[31] See India, "National Telecom Policy 1999."
[32] TRAI, "Consultation Paper on the Growth of Telecom Services," 3.
[33] Malik 2008, 11.
[34] Malik and Da Silva 2005, 9.
[35] TRAI, "Consultation Paper on the Growth of Telecom Services," 3.
[36] Malik and Da Silva 2005, 9.

In some cases, all subsidies were won by the incumbent wireline telecommunications operator. However, the most recent auctions in 2007 resulted in bids from companies for zero or negative subsidies. The Indian experience underscores the effect of auction design on outcomes. Table 4 below shows the difference between the collection and disbursal of funds since 2002. One of the successful aspects of the auction is the speedy disbursement of funds and implementation of projects, particularly in comparison to the years prior.[37]

Table 4: Disbursement Schedule for USO Funds in India[38]

Funding Period	Amount Collected	Allocated and Disbursed
2002-2003	RS 16.53b (US$ 367 m)	RS 3.00 b (US$66 m)
2003-2004	RS 21.43b (US$ 476 m)	RS 2.00 b (US$ 44m)
2004-2005	RS 34.58b (US$ 768 m)	RS 13.14 b (US$ 266m)
2005-2006	RS 35.33b (US$ 785 m)	RS 17.67 b (US$ 392m)
2006-2007	RS 42.11b (US$ 935m)	RS 15b (US$ 333m)
2007-2008	RS 54.0b (US$ 1.2v)	RS 12.9b (US$291m)
2008-2009	RS 57.6b (US$1.3b)	RS 16b (US$361m)
Total	RS 262b (US$5.8b)	RS 79.7b (US$ 1.8b)

Setting clear policy targets

India's 1999 New Telecom Policy identified several universal service goals:

- Voice and low speed data service to all villages by 2002.
- Internet access to all district headquarters by the year 2000.
- Telephone service on demand in urban and rural areas by 2002.
- Teledensity of 7 out of 100 by the year 2005 and 15, by the year 2010.
- Increase rural teledensity from the current level of 0.4 to 4 by the year 2010 and provide reliable transmission media in all rural areas.
- Encourage development of telecom in rural areas, making it more affordable by suitable tariff structures and making rural communication mandatory for all fixed service providers.[39]

TRAI's 2004 consultation paper on rural telecommunications development is clear that universal access obligations placed on licensed voice operators had gone largely unmet. Most of the village public telephones continued to be provided only by the incumbent operator BSNL. While competition had increased access to telephones in

[37] Malik and Da Silva, 9-10.
[38] Jain 2010.
[39] TRAI 2004, 11.

general, development of rural phones and the Village Public Telephone program had actually slowed.[40]

The universal service goals were based on the 1999 National Telecom Policy. By 2004, TRAI described the remaining, unfulfilled targets:

- A village public telephone in all 6 million villages.
- A second public telephone to be installed in villages with greater than 2000 people.
- Replacement of unreliable current village public telephones.
- Upgrade 35,000 village public telephones to public telecom and info centers. The goal is one center within 5 kilometers of every village and in every village that has a post office.
- Installation of 128 kbps high speed public telecom and info centers for tele-education and tele-medicine.
- Install household phones in high cost areas.

To address these gaps, the government implemented minimum subsidy auctions, summarized in Table 5 below. The next sections will describe in more detail the early auctions for village payphones and the 2007 auctions for mobile phone infrastructure and service.

[40] Ibid, 9.

Table 5: India's History of Minimum Subsidy Auctions[41]

Goals	Dates	Details
520,000 village public telephones – operate and maintain.	March 2003	Installed by incumbent BSNL and about 10,000 by six other operators. Operator bid and won exactly the benchmark.
180,000 village public telephone - maintain.	September 2003	The subsidy went to BSNL with a zero cost reduction, bid exactly the benchmark.
46,253 rural community phones – install new in villages that already have one public phone.	September 2004	Incumbent BSNL won 184 service areas; Reliance Infocom, 97. Competitive bidding in 115 of the 300 areas. The project price fell 17% below the benchmark.
66,822 village public telephones – install new in villages without phones.	November 2004	Incumbent BSNL won all 12 bids. In the 3 service areas where Bharti Cellular competed, the subsidy was reduced 15-20%.
Rural household phones - install.	March 2005	Incumbent BSNL won 171 areas; Reliance Infocomm, 61; and Tata Teleservices, 4. The cost of the project was reduced by 60-75%.
Part A: Build passive infrastructure for mobile telephone service in rural and remote areas. Rules require that competitors may access infrastructure.	March 2007	BSNL won about 80% of the tenders to install 6,125 mobile towers. Reliance and others won the remaining tenders.
Part B: Provision of mobile services in specified rural and remote areas by sharing the infrastructure created by part A of the scheme; open only to licensed service providers	March 2007	Government offered subsidy of up to US$187 million, but most bids committed to generating revenue for government instead. Based on the operators' bids, the government will receive US$23,000 a year.

[41] Adapted, Malik 2008.

Village payphones

Identify main criteria for eligible bidders. The TRAI originally restricted who could bid in the auctions. The government divides the Indian telecommunications market into 20 circles and companies are issued licenses to operate within these circles. For the universal service auctions, only those companies with a license in a circle were allowed to bid for subsidies in that circle. Furthermore, only fixed line operators were permitted to bid until 2007 when mobile operators were also permitted to participate.[42]

Identify regulatory requirements. For the village public telephone and information centers, the main characteristics required of the service were:

- Availability: service had to be whenever and wherever required by customers, even in remote and rural areas.
- Accessibility: Non-discriminatory tariff in the service area regardless of geographic location. Also, non-discrimination in terms of service quality.
- Affordability: Price had to be reasonable from the users' perspective.[43]

Estimate subsidy cost. In general, the fund is designed to reimburse the net cost of providing rural telecom service. To account for varying costs among regions, separate auctions determine the actual reimbursement in different areas.[44] For the goals related to installation, replacement, and upgrading of village public telephones, the universal service fund supports both capital and operational costs. For installation of household phones in high cost areas, funds support capital and operational costs of the access network with more limited support of individual lines.[45]

*Implementing the auction***.** Within each of the 20 telecom circles, operators bid for a subsidy. The firm with the lowest bid won, as long as the bid was no higher than the benchmark established with cost information from the incumbent telecom operator. For the first auctions in 2003, for support for village public telephones, in 19 of the 20 circles, the incumbent BSNL was the only bidder, and the bid was for the benchmark amount. The subsidy is for seven years, with the possibility of a three-year renewal.[46]

Noll and Wallsten in their analysis of this first set of auctions identify several problems with these auctions. First, by limiting participation to those companies already serving a particular circle, possible innovations by other operators were excluded and new entry foreclosed. Second, since the incumbent BSNL receives cross-subsidies through an access deficit charge program, it had the opportunity and incentive to distort the cost data it gave to the TRAI to calculate the benchmarks. Consequently, it is difficult to see how the benchmarks could be set appropriately.[47]

[42] TRAI 2004, 38-41.
[43] Malik and da Silva 2005, 8-9.
[44] Noll and Wallsten, 9.
[45] TRAI 2004, 39-41.
[46] Noll and Wallsten, 9.
[47] Ibid, 10.

A second auction in 2003 related to maintaining already installed village public telephones was also entirely won by incumbent BSNL at the benchmark subsidy level. In 2004, there were two auctions that attracted more bidders. These auctions were to provide new village public telephones and also to install a second phone in some villages with already one public telephone. While incumbent BSNL still won most of the auctions, the competitive bidding did decrease the subsidy level awarded.

This also proved true for an auction held in 2005 to install rural household phones. BSNL won nearly two-thirds of the areas auctioned, but subsidy cost was reduced 60-75% below the benchmark level. The prominent competing bidders in these auctions were primarily Reliance Infocom, Bharti Cellular, and Tata Teleservices.[48]

Mobile phone infrastructure and service subsidies

Setting policy goals. In 2007 India designed an auction to subsidize construction and operation of 7871 cell towers in 500 districts across the country. Part A of the auction subsidized infrastructure; Part B subsidized service for five years. The cell tower sites were grouped into 81 clusters. There was a separate auction for each cluster.

Identifying the projects. The government identified the location where subsidized towers would be built by mapping the coverage of existing tower sites, as of March 31, 2006. Any village qualified for a subsidized cell tower site if it had more than 400 households and was not within five kilometers of a CDMA tower or within ten kilometers of a GSM tower. The government used a radio propagation model to plan the precise location of the tower site.[49]

Estimating cost of the subsidy. The government calculated a benchmark subsidy for each cell tower site which took into consideration the cost of building and operating infrastructure to provide basic telecommunications service. The calculation also took into consideration existing towers and population. The same benchmark applied to all towers within a single cluster.[50]

Regulatory requirements. The winner of an infrastructure subsidy was required to have 50% of the sites operational within eight months, and all sites operational within a year. Winners of the service subsidy were required to begin providing service within two months of time the towers were operational. There were some provisions to allow infrastructure and service providers to negotiate the precise location of sites. Service providers charge the lower of two tariffs – either tariffs set by the regulator or the prevailing tariff of the incumbent operator. If there are interruptions to service, the government can deduct subsidies.[51]

[48] Wallsten, 13-14. Malik 2008.
[49] Jain 2008.
[50] Ibid.
[51] Ibid.

Identify main criteria for eligible bidders. In 2007, the rules limiting participation only to fixed line operators already in rural areas were changed, and wireless operators were permitted to participate.[52]

Implementing the auction. The auction was sealed bid with multiple rounds. For each cluster the government specified a starting benchmark subsidy per site. Participants put forward an earnest money guarantee for each cluster they intended to bid on. Participants then submitted two bids for each cluster they were interested in – a pre-qualification bid and a financial bid.[53]

In the first round, pre-qualification bids were opened first. Then, for all who pre-qualified, their financial bids were open. For the infrastructure subsidy (Part A), only half the bids – up to a maximum of four bids – moved on to the second round. For the service subsidy (Part B), a maximum of four bids moved on to the second round. Since for the service subsidy there were three separate providers allowed for each cluster, if there were fewer than four bids, all would be declared winners.[54]

For the second round, the new benchmark was the lowest bid from the first round. Rounds continued until there was one lowest bidder for the infrastructure subsidy, or the three lowest bidders for the service subsidy. For any particular cluster, the infrastructure subsidy would not be finalized unless there was at least one successful winner of the service subsidy.[55]

The contracts for these auctions were finalized in June 2007. For the Part A infrastructure subsidy, 21 companies participated, of which seven won subsidies. Incumbent BSNL won over 75% of the clusters; Reliance was next with 6% of the clusters. The subsidy committed was 69% less than the benchmark originally set for the auction. For Part B, 18 companies participated, 12 of which won service subsidies. Table 6 below shows results for service subsidy auctions for selected clusters.[56]

[52] Ibid.
[53] Ibid.
[54] Ibid.
[55] Ibid.
[56] Jain 2010.

Table 6: Sample of Service Subsidy Auctions (Part B), Selected Clusters[57]

State	*Cluster Number*	*Number of Sites*	*Number of Bidders in Round 1*	*Number of Bidders in Round 2*	*Bench-Mark Subsidy per Site (US$)*	*Reserve Price-Second Round (US$)*	*Winning Bid (US$)*
Maha-rashta	51	113	6	4	3424	0	-36
	52	125	5	4	3961	0	-34
Andra Pradesh	1	96	6	4	3218	0	-0.27
	4	101	6	4	3068	0	-0.32
Kerala	33	46	5	4	2356	0	0
Jammu and Kashmir	24	88	3	3	4568	NA	2284
	25	90	3	3	5163	NA	2593

In the immediate aftermath of the auction, the actual construction of cell tower sites has been good for all operators except BSNL, as Table 7 below demonstrates. A year after the auction, all operators had substantial progress in building sites except BSNL. Fifteen months later, however, BSNL's progress appears to have accelerated.

Table 7: Results of Infrastructure Auctions (Part A)[58]

Company	*Towers awarded 2007*	*Towers in operation 10/31/2008*	*Towers in operation 2/28/2010*
BSNL	5794	790	5481
Reliance	407	251	396
GTL	412	390	409
KEC	377	153	373
Vodafone Essar	309	262	309
QTIL	88	88	88

[57] Adapted from Jain 2008.
[58] Jain 2010.

Jain and Raghuram speculate that had bidders been able to combine clusters, both infrastructure and service providers could have leveraged economies of scale to offer lower bids.[59] Also, the Telecommunications Regulatory Authority of India is considering whether operators outside the auction process should also have access to the passive infrastructure built in Part A.[60]

India continues to face a range of universal access challenges today. One of the major issues is that the Universal Service Obligation Fund is a unit that reports to the government's Department of Transportation, the same department that oversees the state-owned incumbent operator BSNL. Consequently, critics argue the Universal Service Fund does not sufficiently incorporate the views of the independent regulator, users in rural areas, and other industry members. Under these constraints, the minimum subsidy auctions at least has improved the government's ability to discover the subsidy level required to meet some of its rural targets and, especially in the area of mobile services, leverage public funds to encourage private investment.[61]

Discussion

The experiences of both Chile and India with their minimum subsidy auctions for universal service highlight a range of challenges. Among the most important of these challenges are (1) how to identify which projects to subsidize, (2) handling risk, and (3) potential effect on competition.

Identifying which projects to subsidize. The minimum subsidy auction process places a premium on good project selection and definition. Projects can be generated top-down or bottom up. In Chile, while the government takes into account demand information collected from localities, decisions are still made top-down by government staff. In India, if the government had consulted industry more thoroughly before the cell tower site auctions, perhaps the government would have focused more on the sites less likely to be commercially profitable and reduced the number of clusters that went to zero or negative subsidies. Governments can first build partnerships between community service organizations and companies with technical expertise, and then consult them on projects to be subsidized. Such a bottom-up approach might not only improve project selection, but also support stronger adoption of the technology once it is built.[62]

Allocation and mitigation of risks. With minimum subsidy auctions, the government shoulders some of the risks normally borne by private investors. These risks include:

- Construction risk – if the winner fails to follow through with commitments.
- Quality of service risk – if the winner provides inferior service while taking subsidy.
- Commercial risk – if the winner abandons service if finances falter.

[59] Jain 2008.
[60] Malik 2008 and Wallsten, 13-14.
[61] Jain 193.
[62] I am indebted to comments from Bjorn Wellenius, Philip Howard, and Rekha Jain.

These are risks that should be taken into account when the auction is designed and the contracts drawn up between the government and the subsidy winners. Another tension to consider is whether the auction design should encourage new competitors to enter the market. For example, requiring financial guarantees tends to favor established players over new ones. On the one hand, new competitors without past records of reliability may be considered riskier. On the other hand, in both Chile and India, incumbent telecom operators won subsidies in the early days of subsidy auctions and then failed to implement their commitments. [63]

Potential effect on competition. Subsidizing a new broadband service undermines existing providers of dial-up Internet service, for example. The subsidy available to one operator constitutes a barrier to entry for others willing to compete in the market. Sometimes even the potential of a subsidy can change behavior. In India, the long-expected prospect of universal service subsidies may have delayed mobile operators entry into some regions that were just marginally commercially viable, as companies waited in hope of government support. Another alternative to consider, for example, is subsidizing demand rather than supply.[64]

On a final note, this paper was conducted entirely on the basis of documents collected from governments and academic research; further investigation through field interviews and site visits would no doubt bring further clarity to what works and does not work with minimum subsidy auctions. Furthermore, there are minimum subsidy auctions in other countries that have not been covered in this paper that would be worth exploring in detail.

Conclusion

A review of Chile and India's experience with minimum subsidy auctions for communications service projects reveals certain key elements for successful implementation.

- *Set clear policy targets and methods for identifying projects.* For India, targets were identified in its National Telecommunications Policy. For Chile, in addition to objectives established at the national level, local authorities and civil society groups were able to ask for projects through a process that is simple and quick.
- *Establish method for calculating maximum subsidy available per project.* Each country developed and publicized a method for calculating maximum subsidy available for each project. If winning bids for projects are below the maximum subsidy allocated for them, there may be subsidy funding left over. Therefore, it would be useful to develop a prioritized list of projects that could be funded from this remainder.

[63] From comments by Wellenius and Howard.
[64] From comments by Wellenius and Jain.

- *Specify minimum technical and financial requirements for bids and regulatory advantages or requirements, if any.* Chile and India all had specific details for infrastructure and service performance requirements. In Chile's projects for Internet infrastructure, bidders are asked to specify the prices consumers will be charged for levels of service. Time frames for project completion are also specified and disbursement of funds can be tied to these milestones.
- *Maximize the number of competitors and range of technical options*. In India, the first minimum subsidy auctions were open to a limited number of operators, which contributed to the result that the incumbent won most of the bids. Opening up the pool of bidders and allowing inclusion of wireless as well as wireline proposals increased competition in later auctions and contributed to downward pressure on the subsidy awarded for projects.
- *Auction implementation*. Chile's public documents detailing the requirements for bids give a picture of how auctions can be designed to encourage high performance investments at low cost.
    - *First, technical evaluations create incentive for high performance*. Before bids go into the auction, they are reviewed by technical experts at the regulator. It appears that only the bids ranked as performing the highest from a technical perspective are forwarded to the auction. This may give bidders an incentive not only to minimize the requested subsidy, but also at least achieve and perhaps exceed the technical and service requirements for the project at hand.
    - *Second, the minimum subsidy auction method creates incentive for lower subsidies*. Once the best proposals, on a technical basis, are forwarded to the auction, the final selection is based on the bid with the lowest subsidy requirement. This encourages bidders to create proposals that balance high technical performance with cost-effective strategies.

The primary difference between minimum subsidy auctions and the current request-for-proposals method often used by government is that with auctions the review of the technical and financial specifications for a project takes place earlier, before bids are placed. The cases of Chile and India suggest that the minimum subsidy auction can be a useful technique to disburse funds quickly for a targeted list of communications services projects in a manner that captures the advantages of competition to minimize the subsidy.

References

Bello Arellano, Pablo. Subtel. "El Futuro de los Servicios Inalábricos en Chile." Presentation at workshop, Universidad Tecnia Fernando Santa Maria, "Aplicación de Tecnologías Inalámbricas Modernas", Santiago, January 7, 2009. http://wireless.elo.utfsm.cl/presentaciones/2_Sr._Subsecretario.pdf (accessed April 3, 2009)

Cramton, Peter. "Spectrum Auctions" in *Handbook of telecommunications economics, Vol. 1: Structure, regulation, and competition* by Martin Cave, Sumit Majumdar, Ingo Vogelsgang, eds. Elsevier: Amsterdam, 2002. pp. 606-641.

De Silva, Harsha and Ratna Kaji Tuladhar. "Smart subsidies – getting the conditions right: the experience of expanding rural telecoms in Nepal." January 2007. Regulateonline.org, WDR Dialogue Theme 3rd cycle Discussion Paper WDR0606. http://www.regulateonline.org/content/view/642/71/ (accessed April 3, 2009).

Espinoza, Cristina. "Internet para todos," *La Nacion.* August 20, 2010. Accessed www.lanacion.cl September 24, 2010.

Federal Communications Commission. "Office of the Inspector General, Semiannual Report to the Chairman." April 26, 2002. http://www.fcc.gov/oig/oigreportssemiannual.html (accessed April 2, 2009).

GSM Association. "Universal access: how mobile can bring communications to all." http://www.gsmworld.com/documents/universal_access_full_report.pdf (accessed April 3, 2009).

Ghosh, Shymal. "Reverse auction mechanism for universal services." Progress and Freedom Foundation, "Universal Service Reform: Are Reverse Auctions the Answer?" March 1, 2007. Washington, D.C. http://www.pff.org/events/pastevents/030107usfreverseauction.asp (accessed April 3, 2009).

India, Government of. "National Telecom Policy, 1999." Available at http://www.trai.gov.in/TelecomPolicy_ntp99.asp

India, Government of. "Telecom Regulatory Authority of India Act, 1997." http://www.trai.gov.in/trai_act.asp.

Intelecon. "Universal access and universal service funds: insights and experience of international best practice." July 2005. http://www.inteleconresearch.com/pdf/050713%20-%20universal%20access%20and%20universal%20service%20funds%20v3.pdf (accessed April 3, 2009).

Jain, Rekha and G. Raghuram. "Application of descending auction bidding model to telephony in rural India." In *Business Models of the Future.* P. Kalra and A. Rastogi, eds. Oxford: New Delhi, 2008. http://www.iitcoe.in (accessed October 1, 2010)

-----. "The role of the Universal Service Obligation Fund in rural telecommunications services: Lessons from the Indian experience." *Journal of Telecommunications Management.* Vol. 3 (2) 2010: 181-196.

Malik, Payal. "India's universal service obligation for rural telecommunications: issue of design and implementation." June 2008. http://www.indicus.net/media/index.php/2008/1245-indias-universal-service-obligation-for-rural-telecommunications (accessed April 3, 2009).

Malik, Payal and Harsha da Silva. "Diversifying network participation: study of India's universal service instruments." LIRNEasia. September 2005. (accessed March 2009, http://www.learnasia.net/2005/11/study-of-indian-universal-service-instruments/

Milgrom, Paul; Gregory Rosston; Andrzej Skrzypacz; Scott Wallsten. "Comments of 71 concerned economists using procurement auctions to allocate broadband stimulus grants." Submitted to the national Telecommunications Information Agency (NTIA) and the Rural Utilities Service (RUS). April 13, 2009. http://www.techpolicyinstitute.org/files/procurement_auctions_for_bbd_stimulus%20final.pdf (accessed May 5, 2009)

Nixon, Patricia. "Chilean-Malaysian JV wins rural broadband project." Business News America. Wednesday, March 18, 2009. http://www.bnamericas.com/news/telecommunications/Chilean-Malaysian_JV_wins_rural_broadband_project (accessed April 3, 2009).

Noll, Roger and Scott Wallsten. "Universal telecommunications service in India." *The India Policy Forum 2005-2006.* The Brookings Institute: 2006. http://www.brookings.edu/global/~/media/Files/Programs/Global/india_policy_forum/2005_noll_wallsten.pdf (accessed April 3, 2009).

Patagonia Digital. "Aysén se conecta a Chile y el mundo mediante fibra óptica." January 16, 2008. http://patagoniadigital.cl/blog/?p=38#more-38 (accessed May 5, 2009).

Perset, Karine. "Leveraging telecommunications policies for pro-poor growth: universal access funds with minimum-subsidy auctions." Organisation of Economic Cooperation and Development (OECD). DCD/DAC/POVNET(2004)13. October 22, 2004.

Proenza, Francisco J. "The road to broadband development in developing countries is through competition driven by wireless and Internet telephony." *Information Technologies and International Development*. 3(2): 21-39. Winter 2006.

Cony Sturm, "Chile: gobierno y Entel lanzan plan para llevar internet a localidades rurales." www.fayerwayer.com August 29, 2010. Accessed September 24, 2010.

Subtel. "Fondo de Desarrollo de las Telecomunicaciones (FDT)." http://www.subtel.cl/prontus_subtel/site/artic/20061229/pags/20061229173735.html Accessed March 27, 2009.

Subtel. "Bases específicas del concurso público para la asignación del proyecto de transmisión por fibra óptica para Chiloé y Coyhaique y su respectivo subsidio, correspondiente al programa anual de proyectos subsidiables del año 2007 del fondo de desarrollo de las telecomunicaciones" 2007. http://www.subtel.cl/prontus_subtel/site/artic/20070420/pags/20070420115905.html (accessed May 5, 2009).

Subtel. "Comienza proyecto de Internet rural que permitirá accesso al 92% de las personas del país." http://www.subtel.cl/prontus_subtel/site/artic/20090131/pags/20090131161833.html (accessed May 5, 2009).

Subtel. "Bases específicas concurso público para la asignación del proyecto infraestructura digital para la competitividad e innovación y su respectivo subsidio correspondiente al programa anual de proyectos subsidiables de ano 2008 del fondo de desarrollo de las telecomunicaciones." FDT-2008-4. http://www.subtel.cl/prontus_subtel/site/artic/20081001/asocfile/20081001172617/refundido_bases_espec_idci.pdf (accessed May 5, 2009).

TRAI. "Consultation paper on growth of telecom services in rural India: the way forward." October 27, 2004. http://www.trai.gov.in/WriteReadData/trai/upload/ConsultationPapers/17/27octconspap.pdf (accessed March 25, 2009).

TRAI. "Recommendations on infrastructure sharing." April 11, 2007. (accessed www.trai.gov.in March 25, 2009).

Wallsten, Scott. "Reverse Auctions and Universal Telecommunications Service: Lessons from Global Experience." *Federal Communications Law Journal.* 61 (1): 373-94. December 2008. http://www.law.indiana.edu/fclj/pubs/v61/no2/9-WALLSTENFINAL.pdf (accessed May 5, 2009).

Wellenius, Bjorn. Closing the Gap in Access to Rural Communications: Chile 1995-2002. World Bank:2002. http://rru.worldbank.org/Documents/PapersLinks/1222.pdf (accessed April 3, 2009).

Wellenius, Bjorn; Vivien Foster; and Christina Malmberg-Calvo. "Private Provision of Rural Infrastructure Services: Competing for Subsidies." World Bank Policy Research Working Paper. August 2004.

Other Recent Staff Papers

All Titles Can Be Downloaded at
http://www.fcc.gov/papers/

"Transformative Choices: A Review of 70 Years of FCC Decisions," Sherille Ismail, FCC Staff Working Paper 1, October 2010.

"A Market-Based Approach to Establishing Licensing Rules: Licensed versus Unlicensed Use of Spectrum," Mark Bykowsky, Mark Olson, and William Sharkey, OSP Working Paper 43, February 2008.

"Modeling the Efficiency of Spectrum Designated to License Use and Unlicensed Operations," Mark Bykowsky, Mark Olson, and William Sharkey, OSP Working Paper 42, February 2008.

"Enhancing Spectrum's Value via Market-Informed Congestion Etiquettes," Mark Bykowsky, Kenneth Carter, Mark Olson, and William Sharkey, OSP Working Paper 41, February 2008.

"Competition Between Cable Television and Direct Broadcast Satellite - It's More Complicated Than You Think," Andrew S. Wise and Kiran Duwadi, Media and International Bureaus, January 2005.

"The Scarcity Rationale for Regulating Traditional Broadcasting: An Idea Whose Time Has Passed," John W. Berresford, Media Bureau, March 2005.

"A Survival Analysis of Cable Networks," Keith S. Brown, Media Bureau, December 2004.

"Traits of an Independent Communications Regulator: a Search for Indicators," by Irene Wu, International Bureau, June 2004.

"The Limits of Economic Regulation: The U.S. Experience," Peyton L. Wynns, International Bureau, June 2004.


FEDERAL COMMUNICATIONS
COMMISSION