# Spectrum Round Table

## Administered Incentive Pricing (AIP)

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# Outline

- Goals and Objectives
- Tools and Options
  - Finding the right mix
- Spectrum Pricing in Canada
  - Short history of nearly everything!
  - Are spectrum user charges working?
- Government Use Spectrum
  - Case study – UK Ministry of Defence
- Implementing AIP

# Goals

- What should we expect?
  - Competition and competitive markets:
    - Innovation, investment, competitive prices, service quality.
  - Effective regulators and compliance with regulation:
    - Characteristics of effective regulators include freedom from political influence, separate exercise of authority, appointments, budget setting and operational independence.
  - Spectral Efficiency – maximum utilization and efficient allocations (technical and economic efficiency):
    - Access, availability.

# Core Objectives for Spectrum Managers

- For any resource, including radio spectrum, the primary economic objective is to maximize the net benefits to society that can be generated from that resource:
  - the efficient distribution of resources resulting in maximum benefits to society.
- Several dimensions to being an effective spectrum resource manager:
  - Planning for future needs;
  - Improving upon the efficient and optimal use of the spectrum resource;
  - Ensuring flexibility, adaptability, and ease of access in response to social, economic and technological policy advances;
  - Promoting innovation and R&D;
  - Ensuring national interests while striving for harmonization.



3

# Tools and Options

- Administrative Policy and Authorization reform:
  - liberalization of management rights;
  - Flexibility on usage and technology;
  - Spectrum transfer – leasing, subleasing;
  - Spectrum Pricing – Spectrum User Charges, Administered Incentive Prices;
- Market-based methods such as auctions and trading;
- Technically enabled sharing – Ultra-wideband, spread spectrum techniques, smart antennas;
- Emerging technologies – Software defined and Cognitive Radio (agile radios), Dynamic Spectrum Access.



4

# Finding the right mix

| | Opportunities | Challenges |
|---|---|---|
| **Command and Control** | Centrally managed and planned<br>Low risk of interference | Slow<br>Requires managers to make technology choices<br>Suboptimal efficiency |
| **Market Mechanisms** | Promotes efficient usage.<br>Gets spectrum to the users who value it most | Possibility of hoarding<br>Windfall gains<br>Fragmentation |
| **Flexible Use** | Potentially efficient use of spectrum<br>Prevents artificial scarcity and high values of spectrum | Perceived increased risk of interference<br>Relatively untested |
| **Sharing** | More efficient use of spectrum that is already allocated | Requires some management<br>Potential for interference<br>Fragmentation |
| **Commons** | Promotes innovation<br>Lower cost of regulation | Potential interference<br>'Tragedy' of commons<br>Untested (except for short range applications) |

Source: Commission for Communication Regulation, 2007



5

# Spectrum Pricing - early reforms

- Beginning in the mid 1990's, Administrative Spectrum Management Practices are under review in Canada, US, UK, and Australia. Notably, New Zealand had already led the way.
  - 1996: the UK Telecommunications Act moves pricing from cost recovery to a managed price regime where administered incentive prices were set to reflect the value of spectrum in the UK economy.
  - 2002: In the US, the Spectrum Policy Task Force moves away from cost recovery to focus on spectrum auctions as a means to raise revenue from the resource as well as facilitate secondary markets.

# Spectrum Pricing – Canada

- Canada's early experience in resetting spectrum user charges can be traced to 1979. After this date a series of upward fee revisions took place. By 1985, full cost recovery was in full swing.
- Various other important changes to the fee schedule were implemented – fees based on services not users, system licensing, etc.
- Spectrum prices are recognized as a tool for ensuring spectrum efficiency as early as 1984. Policy discussions circa 1990 embodied the three principles:
  - Revenue to the CRF
  - Reasonable return for the use of the spectrum resource
  - Spectrum should be accessible on an affordable basis
- The Evaluation Report of 1991 called for an objective fee structure to promote efficient use moving to a system where optimal allocations are encouraged.

# Spectrum Pricing – Canada

- In 1996, the Radio Regulations were significantly modified:
  - distinguishing users and service providers;
  - services were redefined (aeronautical, fixed, satellite, land mobile, radio determination, etc.);
  - the fee schedule was adjusted.
- Since 1996 the Reg's have been adjusted to drop certain license fees, add new system license fees (LMCS, PCS, FWA, etc.), and auctions have now been conducted since 1999.
- Although recognized as an important spectrum management goal, the fee model has not be altered from it 1979 model to specifically address spectrum allocative efficiency.
- There have been some barriers along the way:
  - The User Fee Act which imposes an intentionally elaborate and exhausting change process;
  - Data and IS system are antiquated. The IC IT/IM system renewal in 2004-05 was intended to resolve but it did not get past the planning stage.

# IC Spectrum User Charges Today

**Base Station Communicating with Mobile Stations via a Repeater**

This example describes how to calculate your radio licence fee if the radio system that you intend to use is made up of a base station communicating with 8 mobile stations via a repeater. In this example, the stations are in the Land Mobile Service and **not** part of a radiocommunication service provider system. You intend to install your base station in June in an area that is **not** considered metropolitan under **Schedule IV**.

**(System Configuration)**


**Base Station**

1. From **Schedule III, Part II, Item 1**, the fee for a fixed station communicating with another fixed station is the sum of the issuance fee or $10 plus the monthly fee of $2.80 times 10 months, which covers the period from June to March the following year.

2. Since the fee is based on the number of assigned transmit and receive frequencies, and there is one transmit and one receive required, the total fee for the base station is:

($10 x 2) + (($2.80 x 2) x 10 months) = $76.00

| Frequency (MHz) | | | Channel | | License Fee Calculation | | |
|---|---|---|---|---|---|---|---|
| Transmit (TX) | Receive (RX) | Communicating with | TX | RX | Issuance | Renewal | Monthly / Short-term |
| 160.000 | 161.000 | mobile stations via repeater | 1 | 1 | $10 + $10 | $34 + $34 | $2.80+ $2.80 |

3. For a short-term licence **(one month duration)** the licence fee would be the issuance fee plus the monthly fee: ($10 + $2.80) x 2 = $25.60

4. The renewal fee for the following year will be $68.00

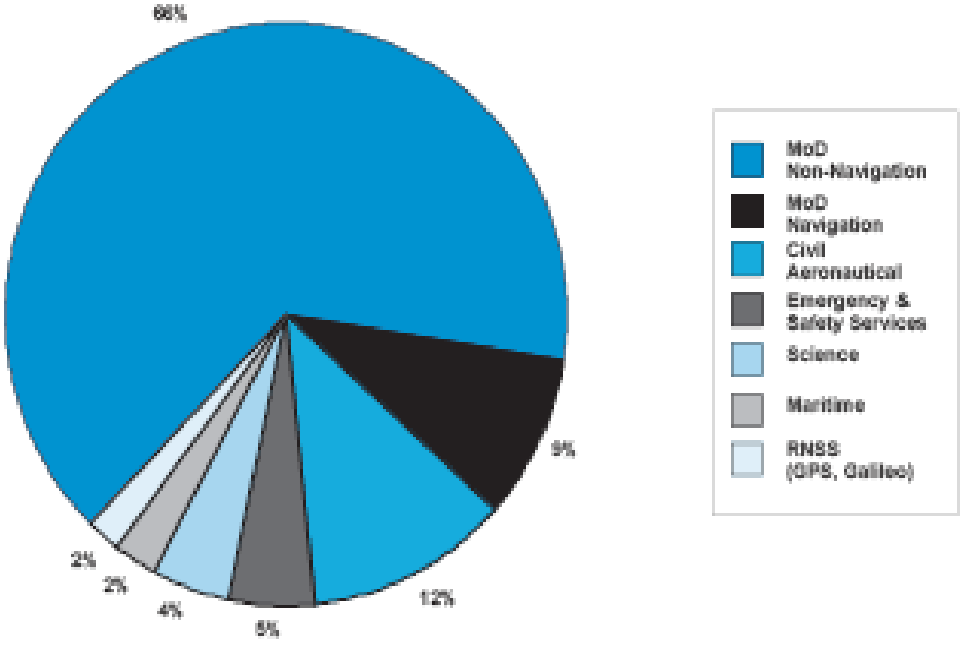
- **Canada: IC. Example of Spectrum Administrative Fees – Band fee and Service related fee.**



9

# Spectrum Scarcity and AIP

- The review of spectrum holdings determined how much spectrum government users held and attempted to determine how it was being used.
- Significant blocks of spectrum are allocated for government use often for military and other ministry communications systems. Government holdings of spectrum approximate 50% of the spectrum below 15GHz.
- AIP evolved from this study with the expectation prices would encourage efficiency.




Source: Independent Audit of Spectrum Holdings (the Cave Audit)



10

# Government Use Spectrum – UK MOD Study of Demand

- In 2008, the UK MOD completed a forward view of spectrum demand covering 80% of its allocations (2010, 2015, 2027) in accordance with its agreement with Ofcom to perform such a review every 2 years.

- The study is both illustrative and instructive.
  - It shows the depth of analysis involved in assessing demand across a range of services and spectrum bands;
  - It demonstrates how spectrum prices based on AIP have resulted in two important changes which are noted in the report:
    - Prior to AIP, the MOD did not factor in spectrum pricing as part of investment and operational decision making;
    - Prices reveal surpluses in spectrum leading to the another important change where MOD now sees itself managing spectrum needs and not existing allocations.

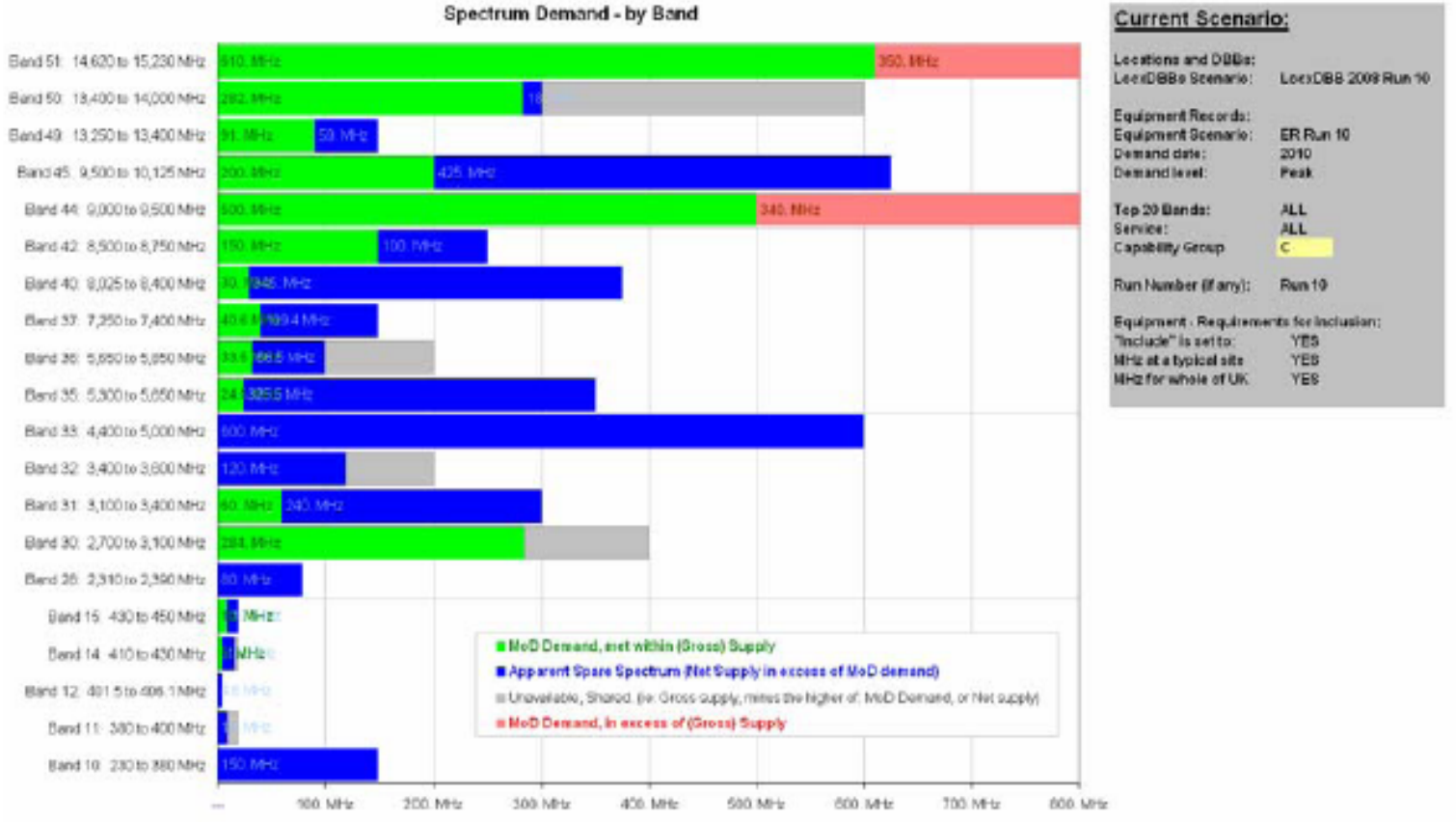
- There is an important lesson for regulators concerning the applicability of AIP. Certain (crucial)applications are insensitive to price, i.e., there is no viable alternative and so opportunity costs are irrelevant.

# Government Use Spectrum – UK MOD Study of Demand

- MOD as the single largest government user of spectrum has access to 30% of the spectrum between 100 MHz and 3.0 GHz. It's use is not exclusive – it administer civil applications and shares bands with other users.
  - Nonetheless, government users need to employ spectrum as efficiently as possible
- Spectrum contributes 3% of GDP – Ofcom Spectrum Framework Review.
- Economic drivers of demand have been historically weak.
- Equipment programme decisions in the future will balance:
  - Operational requirements
  - Investment Appraisals where spectrum has a cost

# Government Use Spectrum – UK MOD Study of Demand

- Assessed demand by requirement and by branch of service. The following the assessment of demand for "Defence and Weapons Radars" showing a shortfall in some cases and surplus in others. Spare spectrum is concentrated in the 3.0-6.0 GHz range.



# AIP Consultation – New Zealand 2009

- The Ministry of Economic Development completed a consultation on Spectrum Management in the Licensing Regime – Managed Rights Regime (MRR) and Radio Licensing Regime (RLR);
  - Specifically "the effectiveness of the RLR has received little attention since the enactment of the Radiocommunications Act of 1989".
- RLR does not employ market mechanisms or resource pricing so there is little incentive to use spectrum efficiently:
  - Users acknowledged RLR can result in underutilization and hoarding.
- The chief benefits of AIP are increased efficiency and transparency (particularly in relation to public sector users) of spectrum use.

# AIP Consultation – New Zealand 2009

- MoED conclusions concerning AIP:
  - RLR is meeting objectives since New Zealand is a small market and there are generally few cases of excess demand notably different than the situation in the UK;
  - Status quo will be maintained instead of generally applying AIP. It could be implemented on a case-by case basis;
  - The MoED's focus is on allocative and dynamic efficiency. AIP emphasizes technical or productive efficiency. While many suggested technical efficiency should be aimed for, other options are considered appropriate – technical planning and tighter rules.

# Administered Incentive Prices

- AIPs reflect the opportunity cost for spectrum in a particular use compared to alternative uses.
- AIP are explicitly intended to reflect the scarcity of the spectrum, not the administrative costs of managing it.
- AIP are a spectrum pricing tool used to ensure that:
  - all radio spectrum are priced regardless of who uses it;
  - spectrum is priced at a level that serves to encourage efficient use.
  - By combining targets with market proxy pricing, radio spectrum does becomes available and is used more efficiently.
- AIP are particularly relevant to government spectrum but can also apply to all users.

# Administrative Incentive Prices

- Administrative Incentive Prices (AIP) are intended to target economic efficiency which has three dimensions:
  - Productive efficiency – assigned to the lowest cost producer of services;
  - Allocative efficiency – assigned to users who best meet customer interests;
  - Dynamic efficiency – face incentives to innovate.
- AIP as a surrogate for markets emphasize productive efficiency – "opportunity costs and alternate uses"
- In practice AIP is useful in determining the opportunity cost of spectrum use in non-demand situation. Does require effort to obtain and maintain cost data such as comparative infrastructure costs:
  - e.g. land acquisition, base station, wire line costs, maintenance.

# Administered Incentive Prices

- AIP can be a useful first step towards secondary markets. In most cases prices will not exist since all spectrum has yet to be auctioned. AIP can establish a basis for prices to facilitate trading in secondary markets by helping users to determine surplus spectrum.

- Some cautionary notes.
  - AIP is not applicable to all spectrum – inelastic price sensitivity.
  - AIP can only address productive efficiency (allocative or dynamic efficiency).
  - AIP change over time and require periodic adjustment.
  - AIP requires a high level of data and system sophistication.
  - AIP are administered prices managed by the regulator.

# Implementing AIP – Basic Steps

1. Collect cost data for current inputs: land, equipment and maintenance. Note: It helps if the regulator is already collecting cost data in support of a Long Run Investment Cost model (LRIC) used in evaluating cost based interconnection tariffs.

   - This by the way, is the other main criticism leveled at AIP, the need to collect and maintain significant amounts of cost data.

2. Collect cost data for new scenario: land, equipment and maintenance.

   – Changes from an expansion of capacity in the existing network

   – Changes due to advanced more efficient technology.

# Implementing AIP – Basic Steps

3. Determine differences in cost for chosen scenario: same amount of data/voice traffic using either more spectrum or more efficient technology.

4. Standardize the savings for an increase in spectrum: say 2 X 1 MHz additional spectrum.

5. The savings are a measure of the opportunity cost and hence the marginal benefit of using the additional spectrum.


20

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