ISSUE BRIEF

Considering a Carbon Tax: Frequently Asked Questions

Joseph E. Aldy, Timothy J. Brennan, Dallas Burtraw, Carolyn Fischer, Raymond J. Kopp, Molly K. Macauley, Richard D. Morgenstern, Karen L. Palmer, Anthony Paul, Nathan Richardson, and Roberton C. Williams III

Considering a US Carbon Tax: Economic Analysis and Dialogue on Carbon Pricing Options
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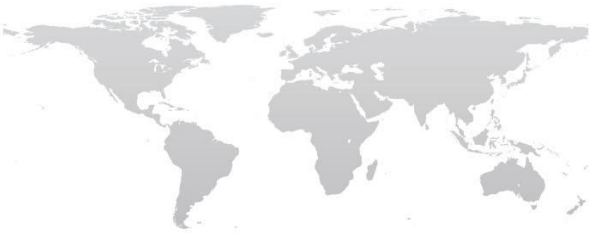

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For the past several decades, RFF experts have helped decisionmakers understand climate policy challenges and assess the costs and benefits of possible solutions, such as a clean energy standard, the Clean Air Act, and various state-level programs, among others. This extensive history gives RFF experts a unique perspective in being able to objectively and comparatively assess the effectiveness of these policies. As always, the goal at RFF is to identify the most effective ways—from an economic perspective—to meet environmental objectives through regulation, policy, or market mechanisms. To that end, RFF continues to serve as an active resource for decisionmakers who are interested in these issues.

As part of that body of work, this collection of Frequently Asked Questions addresses the important design elements and potential economic impacts of a carbon tax policy. The questions below were compiled by RFF experts in response to questions and issues raised in extensive dialogues with policymakers, industry stakeholders, and academic experts. The answers were developed by RFF experts, reflecting their individual research and informed opinions; however they do not necessarily reflect the views of RFF as an organization. It is important to note that these answers offer a preliminary view of ongoing research at RFF. RFF experts are continually engaged in analysis of climate options, including a carbon tax, and answers may be updated to reflect new research findings.

The RFF research team appreciates any questions or feedback. Comments can be directed to Ray Kopp at kopp@rff.org.

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REVENUE, EMPLOYMENT, AND GROWTH

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*Aldy: associate professor of public policy, Harvard University, and RFF visiting fellow; Brennan: RFF senior fellow; Burtraw: RFF Darius Gaskins Senior Fellow; Fischer, RFF senior fellow; Kopp: RFF senior fellow and co-director of RFF's Center for Energy and Climate Economics; Macauley: RFF vice president for research and senior fellow; Morgenstern: RFF senior fellow; Palmer: RFF research director and senior fellow; Paul: RFF center fellow; Richardson: RFF visiting fellow; and Williams: RFF senior fellow and director of academic programs.

1. What is a carbon tax?

A carbon tax is a tax imposed on releases of carbon dioxide (CO_2), which is emitted largely through the combustion of fossil fuels used in electricity production; industrial, commercial, and residential heating; and transportation.

A carbon tax may be a tax per ton of carbon or, more commonly, per ton of CO_2. A $1 tax per ton of CO_2 is equal to a $3.7 tax per ton of carbon because carbon constitutes roughly 3/11 of the weight of CO_2. Because CO_2 is usually the substance of interest rather than carbon itself, the usual meaning of a "carbon tax" is a tax on CO_2.

The most common proposal for a carbon tax calls for the tax to start low and rise over time. There are many options for how this tax would be applied, all of which have different impacts (on overall cost, effectiveness of raising revenue and reducing CO_2, etc.) depending on what is taxed, where the tax is implemented, and how the revenue is used.

Related Publications

- RFF Discussion Paper 11-46: The Promise and Problems of Pricing Carbon: Theory and Experience
- Congressional Testimony, June 12, 2012: Tax Reform: Impact on US Energy Policy

2. How much revenue might a carbon tax raise?

The amount of revenue raised depends on the level of the tax, how broadly it is applied, and other factors. Most experts suggest a tax of around $25 per ton of CO_2, which would raise

approximately $125 billion annually. To put this in context with current considerations on other issues[1]:

- Eliminating the home mortgage interest deduction would raise an average of $120 billion annually from 2013 to 2017.
- Eliminating the tax deduction for employer payments for health insurance would raise an average of $337 billion annually from 2013 to 2017.
- Foregoing a "fix" to the Alternative Minimum Tax would save an average of $239 billion from 2013 to 2021.
- The Budget Control Act of 2011 imposes automatic cuts ("sequestration") of $55 billion annually in defense spending and $36 billion in discretionary domestic spending from 2013 to 2021.
- Financing the current 2 percent reduction in payroll taxes paid by workers requires about $110 billion annually.

Related Publications

- RFF Issue Brief 12-03: The Variability of Potential Revenue from a Tax on Carbon
- Resources 176: Is a Carbon Tax the Only Good Climate Policy? Options to Cut CO_2 Emissions

3. How could a carbon tax affect the economy, employment, other taxes, and the deficit?

Various perspectives have been offered about how a carbon tax could affect the economy and in-depth analysis on this topic is currently underway at RFF. Experts generally agree that how the tax is designed and how revenues are used will be the largest determinants of the effects of the tax on the economy.

A carbon tax would increase the cost of fossil fuels, encouraging companies to switch to currently more expensive (albeit cleaner) fuels and leading households and companies to reduce energy use. These factors could make the economy less dependent on fossil fuels and thus less likely to be hurt by energy price shocks.

While a carbon tax could slow the growth of industries that emit large amounts of CO_2, the tax could also boost other industries, particularly clean energy. A carbon tax could slightly reduce economy-wide employment due to lower demand for workers in carbon-intensive industries and weakened incentives for labor force participation (because the tax would lead to higher prices, reducing workers' buying power).

A carbon tax could lead to overall economic growth, if the tax revenues are used in a way that promotes economic growth, such as cutting other taxes or reducing the deficit. Reducing personal and corporate income taxes would promote growth because these taxes distort employment, savings, and investment. The $125 billion in annual revenues from a $25/ton carbon tax could allow federal personal income tax reductions of about 15 percent or corporate income tax reductions of about 70 percent, if all carbon tax revenues were used to replace current tax

revenues. Alternatively, the federal deficit could be reduced by approximately $1.25 trillion over 10 years—about the same reduction that the 2011 Joint Select Committee on Deficit Reduction would have had to agree on to avoid mandatory spending cuts. Other ways that the revenue could be used to promote growth include funding essential infrastructure, basic research, or investments in human capital. Any of these uses—funding tax cuts, deficit reduction, or productive government spending—could promote growth.

However, if revenue is not recycled in an efficient way, the annual costs of a $25/ton carbon tax would be substantially higher and could approach $50 billion, or about $90 per ton of CO_2 reduced.

Related Publications

- RFF Discussion Paper 11-02: Moving US Climate Policy Forward: Are Carbon Taxes the Only Good Alternative?
- RFF Discussion Paper 12-27: Carbon Pricing with Output-Based Subsidies: Impact on US Industries over Multiple Time Frames
- RFF Discussion Paper 03-46: Fiscal Interactions and the Case for Carbon Taxes over Grandfathered Carbon Permits

4. Could higher energy prices hurt US competitiveness? If so, what can be done about it?

A carbon tax could raise costs for industries that consume large amounts of energy, but some sectors are better positioned to recover the cost increases than others. In sectors that are both energy-intensive and exposed to international trade, such as metals and chemicals, product prices are driven by international market forces. Such industries could be disproportionately burdened if a carbon tax affects their operations but not those of their international competitors. Also, some environmental benefits could be eroded if increases in US manufacturing costs cause economic activity and carbon emissions to "leak" to nations with weaker or nonexistent carbon-pricing policies (see question #9 for more information about carbon leakage).

Effects on industry (production and employment) depend on a number of factors, including the carbon intensity of producers, the degree to which they can pass costs to consumers, their ability to substitute with less carbon-intensive energy, the strength of competition from imports, and consumers' ability to substitute other, less carbon-intensive alternatives.

Various policy options may help offset these impacts. For example, because these industries tend to be capital-intensive, lowering capital taxes or enhancing depreciation allowances could reduce their costs. However, these measures are not usually well-targeted. Another option is to reduce the burden of the carbon tax in these sectors. The challenge is to do so in a way that does not undo the incentives for reducing carbon intensity or seem to offer direct subsidies that violate World Trade Organization obligations.

Another option is to give firms a tax rebate based on their output. Per-output emissions above a sector-specific baseline would generate a tax liability, and emissions below the baseline would generate a refund. This would preserve most incentives for emissions reductions while reducing the overall tax burden. It makes the tax more complex, however, possibly creating opportunities

for tax avoidance, rent seeking, or protectionism. This approach must be carefully designed and preferential treatment must be phased out as trade partners undertake their own climate regulations.

Related Publications

- RFF Discussion Paper 10-47: The Impact on US Industries of Carbon Prices with Output-Based Rebates over Multiple Time Frames
- RFF Discussion Paper 08-37: Impact of Carbon Price Policies on US Industry
- Congressional Testimony, March 18, 2009: Competitiveness and Climate Policy: Avoiding Leakage of Jobs and Emissions
- RFF Discussion Paper 09-12: Combining Rebates with Carbon Taxes: Optimal Strategies for Coping with Emissions Leakage and Tax Interactions

5. Could import and export adjustments level the playing field for US industries?

One potential option for "leveling the playing field" is to implement carbon border adjustments—a tax levied on imported goods according to the emissions associated with their production. This would ensure that consumers pay for the carbon associated with the goods they purchase, regardless of where the goods were produced, and would encourage them to seek lower-carbon substitutes, as opposed to substitutes that have lower carbon prices. Energy-intensive exports to countries without climate policies could also receive a refund of carbon payments at the point of shipment. Adjustments for imports and exports could be combined, creating destination-based carbon pricing.

No countries currently apply carbon border adjustments to manufactured goods. Trade law is unclear about whether such measures would be legal, although many experts suggest they could be allowed if they are necessary to protect the integrity of the emissions regulation.

Related Publications

- RFF Discussion Paper 09-02: Comparing Policies to Combat Emissions Leakage: Border Tax Adjustments versus Rebates
- RFF Climate Policy Forum Issue Brief 8: Addressing Competitiveness Concerns in the context of a Mandatory Policy for Reducing US Greenhouse Gas Emissions
- RFF Discussion Paper 11-34: Cost-Effective Unilateral Climate Policy Design: Size Matters
- RFF Discussion Paper 12-19: Climate Policy and Fiscal Constraints: Do Tax Interactions Outweigh Carbon Leakage?

6. Do other countries have a carbon tax, and if so, how are they using the revenue?

At least 10 countries currently have a carbon tax, along with a number of local and regional governments. These governments are using the revenue generated by carbon taxes in three general ways: investing in climate mitigation programs, offsetting revenue to lower taxes in other areas, or as general government income.

Table 1. Countries with Carbon Taxes

Country	Year Implemented
Finland	1990
Netherlands	1990
Norway	1991
Sweden	1991
Denmark	1992
Costa Rica	1997
United Kingdom	2001
Switzerland	2008
Ireland	2010
Australia	2012

Table 2. Other Governments with Carbon Taxes

Country	Year Implemented
Quebec, Canada	2007
Boulder, Colorado, USA	2007
Bay Area Air Quality Management District, California, USA	2008
British Columbia, Canada	2008

Related Publications

- RFF Discussion Paper 11-46: The Promise and Problems of Pricing Carbon: Theory and Experience
- RFF Policy Commentary, March 21, 2011: A Carbon Price for Australia: From Tax to Trading
- RFF Discussion Paper 08-26: A Tax-Based Approach to Slowing Global Climate Change

7. What is the environmental objective of a carbon tax?

The primary environmental objective of a tax on carbon is to set a price that reflects the "real" costs such emissions impose—accounting for the damages that are expected to arise from global warming, including effects on agricultural productivity and human health, coastal inundation, and other changes. Experts suggest that a carbon tax will produce the most efficient carbon reductions throughout the economy—whether from electricity production or transportation—because as a uniform price on CO_2 emissions, the tax is the same regardless of source of the emissions.

Related Publications

- RFF Discussion Paper 11-20: Reforming the Tax System to Promote Environmental Objectives: An Application to Mauritius
- RFF Discussion Paper 12-26: Alternative Climate Policies and Intertemporal Emissions Leakage: Quantifying the Green Paradox
- RFF Discussion Paper 97-18-REV: When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets
- Resources 176: Is a Carbon Tax the Only Good Climate Policy? Options to Cut CO_2 Emissions

8. How might a carbon tax affect the development of clean energy technologies?

A carbon tax would result in higher prices for carbon-intensive goods and services, potentially rewarding innovation and investment in renewable energy, energy efficiency, carbon sequestration, and other technologies. Some energy experts recommend an increase in spending for clean energy research and development, which could be financed from carbon tax revenues.

Related Publications

- RFF Backgrounder: Modeling Policies to Promote Renewable and Low-Carbon Sources of Electricity

9. How might a US carbon tax affect global carbon emissions?

Because the US emits significantly more CO_2 than most other countries, reducing US emissions can contribute to reducing total global emissions. However, imposing a carbon tax or other policy to reduce emissions in one country can lead to increased emissions elsewhere—a phenomenon known as carbon leakage. This occurs for a variety of reasons. First, production of some carbon-intensive goods is likely to move abroad to avoid the tax. Second, reduced US demand for fossil fuels would result in lower global prices for those fuels, making them more attractive in unregulated countries. Research finds that, on average, a 10 percent reduction in carbon emissions in the United States would be partially offset by a 1 to 3 percent increase elsewhere. (See questions #4 and #5 for measures that could reduce carbon leakage.)

Related Publications

- RFF Discussion Paper 10-47: The Impact on US Industries of Carbon Prices with Output-Based Rebates over Multiple Time Frames

10. How might a carbon tax affect energy prices?

A carbon tax would increase energy prices—the amount of increase would depend on the size of the tax and the extent to which it is passed forward to consumers. For example, research shows that a tax of $25 per ton of CO_2 could add about 21 cents per gallon to the price of gasoline and about 25 cents per gallon to the price of diesel fuel. The price of natural gas could increase by

about $1 per thousand cubic feet, the price of coal by about $40 per short ton, and the price of electricity by about 1.2 cents per kilowatt-hour.

Related Publications

- RFF Issue Brief 12-03: The Variability of Potential Revenue from a Tax on Carbon
- Resources 176: Is a Carbon Tax the Only Good Climate Policy? Options to Cut CO_2 Emissions

11. How might changes in energy prices vary across the country?

Changes in energy prices would vary by region, depending on the source of electric power (and its carbon content) used in the region. Regions of the country that consume relatively greater amounts of fossil fuels, and coal in particular, could feel a greater price increase from the introduction of a tax on carbon. However, other regions of the country could bear much of the change in cost because electricity generated and goods manufactured with fossil fuels are transported to consumers across great distances.

In general, a carbon tax would tend to raise prices for everyone, but less so for those currently facing the highest prices. The West Coast and Northeast currently face some of the highest electricity prices in the country, largely because they have already made investments that have reduced the carbon emissions of their electricity production. In these regions, the price effect of a carbon tax should be modest and consumers should continue to pay the highest prices nationwide. The Midwest and Southeast stand to face the highest electricity price increases under a carbon tax, though these regions should still continue to pay the lowest electricity prices in the country.

Related Publications

- RFF Issue Brief 12-03: The Variability of Potential Revenue from a Tax on Carbon

12. How might changes in energy prices affect low-income households?

A tax on carbon would increase the price of energy. Low-income households spend less on energy in total (relative to high-income households), but they spend a relatively larger share of their household budget on energy. Consequently, a carbon tax is regressive in that it would have a relatively larger impact on low-income households than on high-income households. How the revenues from the carbon tax are used could mitigate this regressivity.

13. How might a carbon tax affect the mix of electricity generation technologies?

Research suggests that the most significant effect of a carbon tax on electricity generation technology would be less use of coal and greater use of natural gas. If the tax is substantial, natural gas might serve as a bridge to an increased use of non-emitting technologies over time, including renewables and nuclear power. However, a substantial tax might also bring about the widespread introduction of carbon capture and storage technology, which might enable a new wave of investment in coal-fired generation.

Related Publications

- RFF Issue Brief 12-03: The Variability of Potential Revenue from a Tax on Carbon

14. How might a carbon tax impact the natural gas market?

A carbon tax is likely to increase the use of natural gas in the electricity sector because natural gas is the less carbon-intensive fossil fuel. This would raise natural gas prices, though recent increases in natural gas production suggest that the change in gas prices would be moderate. Because power plants fueled by renewable and nuclear energy do not emit CO_2, natural gas demand may decline relative to demand for these fuels. The net effect depends on the level of a carbon tax. For a relatively low tax, it is likely that natural gas would replace coal and oil. As the tax goes higher, natural gas may be increasingly displaced by renewables and nuclear power.

Related Publications

- RFF Issue Brief 12-03: The Variability of Potential Revenue from a Tax on Carbon
- RFF Discussion Paper 10-41: Abundant Shale Gas Resources: Long-Term Implications for US Natural Gas Markets

15. How might a carbon tax rate be set?

There are several approaches that Congress might consider when setting a carbon tax rate: using the real cost of emissions, setting a price designed to achieve a revenue goal, or setting a price to achieve an emissions target. The most common approach discussed by experts is to set a tax equal to the real cost of emissions, basing the price on the global environmental damages from emissions, or the "social cost of carbon." The social cost of carbon is the discounted monetary value of future climate change damages due to additional CO_2 emissions (for example, the costs of adverse agricultural effects, protecting against rising sea levels, health impacts, species loss, risks of extreme warming scenarios, and so on).

For example, a recent US federal interagency assessment recommended a value of $25 per ton for 2015 (in 2010$) with the tax rate rising at a rate of about 2 to 3 percent per year in real terms (roughly reflecting growth in world output potentially affected by climate change). Research shows that a tax of $25 per ton of CO_2 would reduce emissions by roughly 10 percent per year (based on projections that energy-related CO_2 emissions would be about 5.5 to 5.8 billion tons annually for the next decade). Experts recommend that once in place, a carbon tax would need to be flexible so it can be updated in response to future learning about climate change.

Alternatively, there has been discussion about designing a carbon tax to achieve a revenue goal, in which case the rate would depend on fuel prices (for example, the price of natural gas relative to coal).

Some suggest setting a carbon tax to achieve an emissions-reduction target. For example, a recent study by experts at Resources for the Future and the National Energy Policy Institute suggests that a carbon tax reaching about $30 per ton of CO_2 by 2020 would be needed to reduce domestic, energy-related CO_2 emissions by approximately 10 percent. To achieve this, the tax should rise at approximately the risk-free rate of interest (near zero right now, but roughly 5

percent in the long run) to balance the value in today's terms of making adjustments in the future.

Related Publications

- RFF Discussion Paper 11-02: Moving US Climate Policy Forward: Are Carbon Taxes the Only Good Alternative?
- RFF Discussion Paper 08-26: A Tax-Based Approach to Slowing Global Climate Change
- RFF Issue Brief 09-05: Should the Obama Administration Implement a CO_2 Tax?

16. How might a carbon tax be implemented?

There are various approaches that could be examined when implementing a carbon tax. For example, one approach is to implement the tax "upstream"—that is, as an extension of existing fuel taxes already applied to petroleum refineries, coal mines, and natural gas operators. Such a tax would affect approximately 2,000 companies. Alternatively, the tax could combine taxes on transportation and home heating fuels with a downstream charge on power plants and major industrial facilities. However, this could increase administrative costs (as it would cover about 13,000 companies), would be less comprehensive (as small-scale emitters are likely too costly to include), and possibly lead to greater pressure for exempting certain industries.

In addition, Congress may face several challenges in designing the tax. For example:

- Taxing only a limited share of carbon emissions—from a specific sector or only large sources of emissions—could significantly lower revenue. A \$25/ton CO_2 tax could raise less than \$40 billion per year if applied only to the electricity sector, compared to \$125 billion per year if applied to all emissions.
- Exempting some sectors or categories of emissions sources may create perverse economic incentives that lower tax revenue while increasing greenhouse gas emissions. A carbon tax targeting the electricity sector but exempting manufacturing could result in an increase in on-site power generation at manufacturing plants.
- Increases in the tax rate would not necessarily lead to proportional increases in revenues. A higher tax creates incentives to use lower-carbon alternatives, reducing emissions and reducing carbon tax revenue.

Related Publications

- RFF Issue Brief 09-05: Should the Obama Administration Implement a CO_2 Tax?

17. Would a carbon tax make regulation of carbon dioxide under the Clean Air Act redundant?

Despite the availability of flexible market-based regulatory tools under the Clean Air Act, a carbon tax has significant advantages. A tax could generate federal revenue, which the US Environmental Protection Agency (EPA) cannot do under the act (although states might be able to). EPA must also regulate sector-by-sector, whereas a tax could uniformly apply to the entire economy, likely increasing its relative cost-effectiveness. Nevertheless, there are some reasons why regulation

might remain useful. For example, it might be politically expedient to exclude road vehicle emissions from the tax. If so, EPA fleet fuel-economy standards might be preserved, as they are already accepted by industry. Also, the regulatory process is organized to incorporate new scientific information and update standards based on information about benefits and, in some cases, costs. In contrast, legislative action to adjust a tax in response to new information may take decades (as seen with the sulfur dioxide trading program, for example). It is also possible that some emissions sources are hard to tax but relatively easy to regulate. If policymakers aim for aggressive reductions in carbon emissions, but for political or other reasons it is only possible to implement a small or limited carbon tax, broad regulation to limit emissions may be justified. In principle, it would likely be more cost-effective to achieve this result with a larger and/or broader carbon tax, but in practice that outcome is not certain.

Related Publications

- RFF Issue Brief 11-08: Greenhouse Gas Regulation under the Clean Air Act: A Guide for Economists

18. Are a carbon tax and subsidies/tax breaks for renewable energy redundant?

If the rationale for subsidizing renewables and other clean energy sources is reduction of greenhouse gas emissions, then these policies are largely redundant. If subsidies have other motivations, the answer is not so simple. Other market failures may come into play. For example, many renewable energy sources are new and evolving technologies. If associated research and development benefits spill over to other technologies, policies to encourage technological innovation may be justified. Nonrenewable electricity sources may also impose costs on society from water use or pollution and may justify subsidies for some renewable alternatives.

Related Publications

- RFF Policy Commentary, July 21, 2008: Taking a Closer Look at Energy Subsidies in the Federal Tax Code

19. How might a carbon tax affect existing US transportation policies?

A carbon tax would have different effects depending on the policy. For example, a carbon tax could be applied along with current taxes on gasoline and diesel. Existing fuel taxes are intended to fund infrastructure investment but have been insufficient for that goal and do not address other issues of vehicle traffic such as congestion, accidents, local pollution, and contributions to climate change. For these reasons, some experts make the case for higher taxes on vehicle fuels. A carbon tax on vehicle fuels could possibly supplant other existing transportation policies, such as biofuel subsidies and fleet fuel-economy standards that target greenhouse gas emissions—though these policies could be continued to meet other goals.

Related Publications

- RFF Discussion Paper 11-20: Reforming the Tax System to Promote Environmental Objectives: An Application to Mauritius

20. What role would state-level programs play in the presence of a nationwide carbon tax?

Unless federal legislation preempts state policies, decisions whether to continue them would be up to the states. Some states may have more ambitious environmental goals (or a greater desire for revenue sources) than those embodied by a national carbon tax, and might maintain their state-level policies. States might even strengthen or expand their policies. Other states may decide that a national carbon tax addresses their policy aims and abandon independent policies.

[1] *References for these figures are as follows:*

1. Office of Management and Budget, Budget of the United States Government Fiscal year 2012, Analytical Perspectives, Table 17-1. Available at www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/teb2013.xls.
2. Ibid.
3. Urban-Brookings Tax Policy Center Microsimulation Model (version 0411-1). Available at www.taxpolicycenter.org/numbers/displayatab.cfm?DocID=3012.
4. Congressional Budget Office, Estimated Impact of Automatic Budget Enforcement Procedures Specified in the Budget Control Act, Table 1. Available at http://cbo.gov/publication/42754.
5. JCT score for the 2-month extension passed in Dec 2011 available at https://www.jct.gov/publications.html?func=startdown&id=4376. 10-month extension passed in early 2012 available at https://www.jct.gov/publications.html?func=startdown&id=4399.