Renewable Bioenergy Systems in Germany and Sweden
BE 475/ME 491: 4 Credits
Course Instructors: David Hodge, Dana Kirk, Luke Reese
Program Dates: May 10-28, 2014 (Depart US May 9)

Web Site: https://www.msu.edu/course/be/475/sweden

Course Overview

Sweden is nearly completely lacking in fossil energy resources and has positioned itself as a world leader in renewable energy, particularly bioenergy. An ambitious overhaul of their energy infrastructure and policy beginning in the 1970s allowed the country to significantly increase their energy independence and energy efficiency, and has for example, decreased the total current petroleum usage to only 2/3 of their 1970s level. The U.S., by comparison, has increased petroleum use by more than 1/3 which is now primarily imported.

Germany, the industrial leader of the European Union, also lacks sufficient fossil energy resources to meet the demand. To address the supply needs and growing social concerns related to energy, in the late 1990’s the German government implemented several policy changes. Biogas, or anaerobic digestion, was the primary technology impacted by the “feed in tariff” policy. Largely due to this policy, today there are close to 10,000 biogas plants in Germany with approximately 6,000 using energy crops as feedstock. Solar energy is also an important part of the landscape in Bavaria.

Specifically, in this course we will focus on the German and Swedish case study and how this perspective on the development of energy can be compared with the trajectories other countries have taken through the relationship between:

1. Biomass Resources: Potential, Quality, Geography, Sustainability
2. Private Industry: Markets, Supply Chain, Commercialization, IP
3. Research: Technology Development
4. Government/Policy: Policy and Market Development

and how these fit together in the overall energy structure (source, end use) of a region, a country, or the
planet. You will learn (through case studies and plant visits) the technologies and processes required for
the conversion and/or upgrading of biomass feedstocks to fuels, heat, and power. You will have the
opportunity to visit with some of the companies involved in various aspects of bioenergy including its
collection, generation, and distribution and hear lectures from researchers at universities involved in
developing new technologies for biomass conversion.

Bioenergy Vocabulary
All of these terms will be used extensively throughout this course and you will need to know what these me
how they are used. Be prepared to explain the following terms in your own words:

- Primary Energy
- Fuel
- Co-generation (CHP) *
- District Heating *
- Compressed Natural Gas (CNG)
- Wood Pelletization *
- Anaerobic Digestion *
- Biogas
- Fuel Ethanol
- Energy Crops *
- Biodiesel
- Gasification *
- Synthesis Gas

* Site visits planned

Program Instructors
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Note: Email is the official means of communication at MSU. Instructors will communicate with you
before and after the program using email and the D2L system. You are responsible for following
this correspondence and ensuring that you meet deadlines as they arise.

Courses
Students going on this program can take 4 credits from amongst the options listed below. Students who
want more than 4 credits or honors credit must consult with a faculty member for approval.

BE 475  International Studies in Biosystems Engineering  4 cr.
ME 491  Sel. Topic in ME - available only to ME majors  4 cr.

Academic Integrity
Plagiarism is a serious issue in college. Plagiarism happens any time you take an image, idea, or phrase
from another source without citing it. Citations are needed for more than quotations; ideas taken from
other sources should be cited. If you have questions about making citations, you should talk with your
instructor. In general, citations should follow APA format.

This program follows the MSU Academic Integrity statement, Article 2.3.3 of the Academic Freedom
Report, as detailed on the MSU Ombudsman page, which states that
http://www.msu.edu/unit/ombud/dishonestyFAQ.html: “The student shares with the faculty the
responsibility for maintaining the integrity of scholarship, grades, and professional standards.”

In addition, the program adheres to the policies on academic honesty specified in General Student
Regulation 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See Spartan Life: Student Handbook and Resource Guide using the MSU Web site at http://www.msu.edu.)

Unless authorized by your instructor, you are expected to complete all course assignments, including homework, lab work, quizzes, tests and exams, without assistance from external experts or peers. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the www.allmsu.com or similar Web site to complete any work in this course.

Students who violate MSU rules may receive a penalty grade, including but not limited to a failing grade on the assignment or in the course. Also note that plagiarism can be reported in your academic and student files, and can result in disciplinary action if it is habitual.

Program Schedule
Prior to departure, the faculty members will provide students with a general itinerary for the program. Please note that this itinerary will be subject to change for a variety of reasons, including—but not limited to—weather, emergencies, host needs, etc. Students should view all schedules as drafts.

Generally, the program will start each day with breakfast and conclude with dinner. On some occasions, there will be group discussions or activities at night. During scheduled time with the group, students should conduct themselves as representatives of the university and refrain from drinking alcohol, unless otherwise noted (e.g., we visit a winery or the host provides a drink to us).

At the start and end of each day, instructors will make announcements relevant to the program’s itinerary, weather, meals, expectations, etc. Students are responsible for these announcements, and failure to show up prepared and on-time will result in deductions from students’ participation grades (see participation and engagement).

At this point in time, the general itinerary for the 2014 program is below. Additional information about the exact field visits and readings will be given Spring 2014.

- Friday, May 9 - Depart from United States / Arrive Stockholm, Sweden
- May 10 - 12 - Stockholm, Sweden
- May 12 - Transfer to Luleå, Sweden (train)
- May 13 - 20 - Luleå area, Sweden
- May 20 - Transfer to Stockholm, Sweden (train)
- May 21 - Transfer to Frankfurt, Germany (air)
- May 21 - Transfer to Munich, Germany (ground)
- May 21 - 25 - Munich area, Germany
- May 25-26 – Freiburg, Germany
- May 26 - 28 – Frankfurt area, Germany
- Wednesday, May 28 - Depart from Frankfurt, Germany / Arrive United States

Holidays, Observances, and Special Needs
Per the Ombudsman’s web site (http://www.msu.edu/unit/ombud/excuses.html), the Policy on Religious Observance asks that faculty and staff "be sensitive to the observance of [religious] holidays so that students who absent themselves from classes on these days are not seriously disadvantaged. . . .It is the responsibility of those students who wish to be absent to make arrangements in advance with their instructors.”
Hence, if students have needs related to religious holidays, observances, or customs, they should let the instructors know as soon as possible. Please note we will be in-country for Memorial Day and have academic activities planned.

For physical or cognitive disabilities and/or special needs while abroad, students should also follow the MSU Policy. Per the RCPD (http://www.rcpd.msu.edu/): Students and employees requesting accommodations must provide appropriate documentation of their disability. Students will meet with a Disability Specialist for an individual needs assessment to determine reasonable accommodations. After meeting with their supervisor, employees may contact the Disability Resource Coordinator for assistance with the accommodation request process.

Michigan State University is committed to providing equal opportunity for participation in all programs, services, and activities. Accommodations for persons with disabilities may be requested by contacting the program instructor as soon as possible after acceptance into the program. Requests received after this date will be honored whenever possible.

If you have special dietary needs for religious, health, or medical reasons, you need to let the instructor know prior to departure. You also should make arrangements with the airlines to ensure that they will have food to meet your needs on the flight. The instructors will make every effort to accommodate special dietary needs by communicating such needs to the persons handling our food in-country. If you find the food unacceptable due to a special dietary need while in-country, you should contact the instructor immediately.

**Attendance and Tardiness**

Attendance for all academic sessions and activities is mandatory.

Prior to departure, absences should be the exception not the rule and result from extenuating circumstances. Students who have class or work conflicts with orientation sessions will need to complete additional online work to meet contact hour requirements. Students who miss a session can find all materials from the orientation session folder on D2L. Excessive tardiness or missing sessions will result in lowered participation points unless alternative work arrangements are completed.

Once in Germany and Sweden, the instructors expect all students to arrive on time and prepared for the day’s activities, including having appropriate dress and academic materials. Students are responsible for obtaining any information or materials missed due to tardiness or an absence and should contact the instructor as soon as possible if they miss a session or visit. Please see the participation and engagement section and the late assignments section for more information. Excessive tardiness or missing official activities while abroad will result in lowered participation points.

For more detail on the official MSU policy related to missing class, please see the information on-line at http://www.msu.edu/unit/ombud/excuses.html. Please note that getting lost, alarm failure, or not owning a watch are not considered appropriate excuses for being late or missing a session. While in country, the instructor recommends working with your friends and roommates to make sure everyone is on time and in the right location.

Calling home for non-emergencies, buying supplies (i.e., batteries), eating, getting money, and other personal responsibilities are also not appropriate reasons for missing class or being late. Students must use their time wisely while abroad. Also, illness that results from an individual’s poor decision-making (e.g., being hung-over) may or may not be excused depending on the circumstances.

The instructor will work with students on a case-by-case basis for excessive absences due to official MSU
activities, religious reasons, illness, or other serious emergencies. In certain cases, instructors will require documentation of the event, illness, etc. Students missing orientation/overseas activity for a planned event (e.g., conference, religious holiday or observance, class trip, etc.) must submit a written request as soon as possible before missing the session. Students missing a session or activity for unexpected reasons should contact the instructor as soon as possible.

**Participation and Engagement**

During all sessions and visits, the instructors expect students to be fully engaged and prepared to discuss reading assignments. Students are strongly encouraged to ask questions of the instructor, guest speakers, and their peers. Active participation includes, but is not limited to, the following behaviors:

- Asking and answering questions of the instructors, peers, or guest speakers;
- Bringing forth new ideas, information, or perspectives to academic conversations;
- Discussing your readings and reflections with an instructors and peers;
- Meeting with the instructors to discuss your interests, assignments, or project;
- Questioning information presented and discussed;
- Participating in small group discussions and activities;
- Assisting in the daily running and maintenance of the program (i.e., helping out while overseas);
- Exhibiting leadership and volunteerism consistent with the goals and maintenance of the program;
- Assuming responsibility for personal behavior and learning.

While studying abroad, students should be mindful that things will change and that they are guests in another culture; therefore, it is important for all participants to exercise:

- Respect for themselves, each other, and our hosts;
- Openness and a positive attitude toward new ideas and experiences;
- Flexibility and tolerance of ambiguity; and
- Good communications amongst themselves and with the faculty.

Beyond our time together as a group, all students should conduct some research before departure in the areas of current events and on topics relevant to your days as leader or personal project. The instructors suggest that you purchase a travel guide relevant to Sweden and Germany or download materials from the web.

**Pre-Departure Work (15%)**

*Orientation Sessions* (65 points) - Students will attend the scheduled academic sessions and participate in activities and discussions related to the program’s themes. If students cannot attend a session for some reason, then they must complete the online work and take an on-line quiz to fulfill the contact-hour and content requirements. All pre-departure work must be submitted before leaving for Germany. Work not turned in prior to departure will receive a “0”.

*Blogs* (50 points) - http://deandse2014.wordpress.com/

Once the itinerary is finalized, students will be assigned a series of days for their day leadership. In preparation for their day leadership abroad, students will prepare a blog prior to our departure detailing an overview of what we expect to see while we are there. This information can include:

- Information about the site visits on our itinerary
- Information about the region and city hosting us on that day
- Pictures of the area (with citation for where you took them)
In addition to a series of days, each student will be assigned to a specific bioenergy process to blog about for the entire program period. Students will prepare a blog entry prior to our departure detailing an overview of their assigned process and what we expect to see while we are there.

Pre-departure information (35 points) - As a means of getting ready to depart on the program, students will complete several administrative tasks that will facilitate their travel including:

- Writing a biography and having a picture taken for posting on-line
- Providing the faculty with information about dietary and health needs
- Providing the faculty with emergency contact information
- Completing required forms - (e.g., photo release, faculty/student contract, etc.)
- Turning in a copy of your passport
- Completing an proposed topic for your final project

In-Country Work (50%)

Analytical Responses (150 points) Students will complete (3) 4-page short essays (1 on a Sweden topic, 1 on a Germany topic and 1 of your choice), with each one relating to a reading and course theme. Responses will be due May 18, May 24 and May 31. Each essay must have 3 sources from readings, 2 sources from expert and 2 sources of your choice. The purposes of the responses are to consider, compare and contrast, and question events and activities from the time spent abroad. The essays are intended to be building blocks for the final course project.

Students should not simply regurgitate a blow-by-blow of what they did for the day or what they read; rather, they should show an understanding of the connection between the reading, activities, and their own, original thinking. You will be provided with information and topics on how to write these reflections when we arrive in Germany and Sweden.

Oral Analytical Reflections (100 points) Students will in 2 oral reflections on course content on May 19 and May 25. The purposes of the responses are to consider, compare and contrast, and question events and activities from the time spent abroad. Students should not simply regurgitate a blow-by-blow of what they did for the day or what they read; rather, they should show an understanding of the connection between the reading, activities, and their own, original thinking. You will be provided with information on how to prepare for reflections when we arrive in Germany and Sweden.

Instructors will collect and evaluate reflections periodically while overseas. They may also use the reflections as the basis for discussions with students or with the entire group.

Weekly Engagement/Participation (2 @ 50 points each) Due May 18 and May 24. To earn full credit for daily engagement, students should actively participate in discussions before and during the trip. To participate effectively, students must contribute quality thoughts and ideas that connect ideas, not just talk (see participation and engagement section of the syllabus for more information). To evaluate engagement and provide students with feedback, students will complete entries about once a week. As with the analytic responses, students should turn in these forms when directed in-country no later than 9:30 p.m. at night. During all sessions and visits, the instructors expect students to be fully engaged and prepared to discuss reading assignments. Students are strongly encouraged to ask questions of the instructor, guest speakers, and their peers. Active participation includes, but is not limited to, the following behaviors:
1. Asking and answering questions of the instructors, peers, or guest speakers;
2. Bringing forth new ideas, information, or perspectives to academic conversations;
3. Discussing your readings and reflections with an instructor and peers;
4. Meeting with the instructor to discuss your interests, assignments, or projects;
5. Questioning information presented and discussed;
6. Participating in small group discussions and activities;
7. Assisting in the daily running and maintenance of the program (i.e., helping out while overseas);
8. Exhibiting leadership and volunteerism consistent with the goals and maintenance of the program; and

While studying abroad, students should be mindful that things will change and that they are guests in another culture; therefore, it is important for all participants to exercise:
- Respect for themselves, each other, and our hosts;
- Openness and a positive attitude toward new ideas and experiences;
- Flexibility and tolerance of ambiguity; and
- Good communications amongst themselves and with the faculty.

Day Leadership/Thank you notes (50 points) As detailed about in the pre-departure blog each student will be assigned a series of days for their day leadership. While in-country, each student will take responsibility for “leading” the group on their assigned days. These responsibilities will include:
- Briefing the group about the day’s schedule, restroom stops, etc.;
- Greeting, orienting, and introducing all guest speakers to the group;
- Shopping for food (when necessary);
- Assisting with meals;
- Obtaining guest speaker(s) addresses;
- Thanking guest speakers with gifts (provided) and handwritten thank you notes;
- Taking digital pictures; and
- Updating your pre-departure blog.

The student-leaders also will assist with additional duties, which may include helping distribute materials, organizing meals, making decisions, helping with check-in or check-out at accommodations, etc. The thank you note should be a unique, hand-written note to each host for the day (i.e., the main contact or senior person for each site: NOT all individuals at each site). These notes should be typed, emailed, and carbon copied to the instructors within 48 hours. Late notes or notes with incomplete information will receive a point deduction.

Good leaders will have done their “homework” for the day and have a general sense of the day’s schedule and content. They will also be prepared with appropriate numbers of gifts for each day. If leaders are late, forgetful of their duties, or perform unprofessionally, then they will receive a point deduction. Program faculty and student assistants will meet with the day leaders in the morning to brief them on any changes or special considerations, and a student assistant will be available at night to help with the web site.

Blog post(s) (2 @ 50 points each) http://deandse2014.wordpress.com/

Each student has the responsibility to update their 2 assigned blog topics while in country. It is blogger’s responsibility to take notes and pictures and then revise the pre-departure blog about their assigned days. The first blog should include:
1. A two paragraph summary or overview related to the day’s lessons or visits (If a student has a
day light on “academic content,” then she or he can use general country information or discuss personal observations related to program theme, cultural observations and/or standards of practice).

2. A more nuanced discussion (2 -3 paragraphs) of how the day’s activities related to renewable bioenergy (as with the above, if the day is light on actual visits, then the student can use personal reflections of his or her personal learning or something related to their personal project or major).

3. Four to six digital photos taken by the leader, with a caption that accurately describes the picture (1 or 2 sentences). Most of these photos should be somewhat serious, but 1 or 2 photo or photos can be fun and silly (yet appropriate!).

4. Any appropriate related links associated with our days. These can be left from your pre-departure blog.

Secondly, students should continuously update their topic specific blogs while in country. This blog must be completed by the time the program ends. The second blog should include:

1. A two paragraph summary or overview related to the topic and lessons learning from Germany and Sweden.

2. A more nuanced discussion (2 -3 paragraphs) of how the program’s activities related to assigned topic are applicable in the US and/or MI. The student should use personal reflections of his or her personal learning or something related to their personal project or major.

3. Four to six digital photos taken by the leader, with a caption that accurately describes the picture (1 or 2 sentences).

4. Any appropriate related links associated with the topic. These can be left from your pre-departure blog.

Blogs should be completed nightly, unless otherwise specified by the instructor. Blogs not completed within 48 hours will receive point deductions. Exceptions will be made if Internet access is unavailable; however, students can still have their posts written and photos selected.

Lastly, each student must moderate all blog entries and comments and questions and respond to at least 3 comments. Responses should be academic responses with content and not a simple yes/no response.

**Re-Entry Work (35%)**

*Course Project* (300 points) As part of the grade for this course, you will have a final project due June 25. All students will complete an original research project that involves investigation of a unique topic related to the German biogas or Swedish bioenergy industry of interest to you in consultation with the instructors. Each student will decide the focus for his or her effort, but each project must: (1) relate to the concept of renewable bioenergy; (2) involve the collection of primary data while in Germany and Sweden (i.e., you need to read, observe, ask questions, or interview people while abroad); and (3) focus on Germany and/or Sweden in a comparative or primary context (i.e., discuss Germany/Sweden or compare Germany/Sweden to the U.S.). The technical report will be based on your own literature research as well as information from our course readings, site visits, and classroom lectures that cover in detail the technology, service, or process. In your report, you should detail the technology development, government policy (if any), and implications of supply chain, environmental services provided by the technology or policy and the impact on profitability. This will be compared with this bioenergy sector in the US.

When completing this assignment, students should look toward completing a final paper of about 10 pages or the equivalent of this effort. This paper (or project) should include:

1. **Introduction** (1.5 pages)—Introduce topic, explain its importance, define key terms and the problem being investigated.

2. **Secondary research** (2 pages)—Provide background reading and ideas related to the topic based
When choosing a topic and designing a focus, students should consider the depth and breadth of the topic. Good projects are specific enough to be manageable but broad enough that students will be able to find primary and secondary material about them.

In relationship to the problem statement, students can think of the problem like a thesis statement for a typical analytical paper. The major difference here is that the students will do some primary research of their own and devise their own “solutions” to the problem investigated. The problem statement identifies the need for the study and helps outline the research process. Well written questions suggest a tension between two opposing “facts” or ideas. For example:

a. Statement 1: Fossil fuels are a scarce resource and increasingly of more value in Germany/Sweden
b. Statement 2: German/Swedish farmers rely on energy production from agriculture for an income source.
c. Problem Statement: Given limited fossil fuel reserves, what can be done in Germany/Sweden to address grassroots renewable energy production from an engineering standpoint?

Notice that the phrasing of the actual problem statement bounds the study. In this study, you are not going to look at energy in the context of just ecosystems; you are going to look at this issue as related to renewable natural resources. Similarly, you are not going to look at energy production as related to the environment, sustainability, or land use, you will specifically look at the engineering issues of renewable bioenergy production.

To assist you with writing the paper, you should consider creating an outline that will guide your writing and do some background reading before departure. To provide you with time while in country, we have set-aside some working time for you while abroad. To the extent that you plan ahead, we can work with you to identify locations or people that you could visit to augment your research on those times. You can also feel free to interview our hosts, guides, and guest lecturers, but you should plan ahead.

Papers should include a cover page and follow the guidelines detailed in the syllabus. All assignments should include a bibliography. Final assignments are due on June 30.

Post-Program Blog Update (50 points - due June 28) – Students will edit, revise and polish their in-country blogs. Since Internet can be limited in-county for research and content verification, upon returns students should revise their blog entry to include revised and additional content related to the course sustainability theme, add additional photos (perhaps better photos) related to the course theme, add 5-10 links to related content particularly to Sweden/Germany sites and provide a complete, formal bibliography to all sources. Any identified weaknesses or issues on the in-country blog grading rubric are to be corrected in this version.

**Grading**

The grade for this course will be determined based on the following assignment of points:

**Pre-departure work (15%):**

1) Orientation attendance/participation/quizzes - 65 points
2) Pre-departure blog post - 50 points
3) Pre-departure information - 35 points
   • Final project idea - 15 points
   • Bio - 5 points
   • Passport - 5 points
   • Forms/Office of Study Abroad Online Orientation - 10 points

In-country work (50%):
   1) Analytic Responses - 150 points (3 @ 50 points each)
   2) Oral Reflections – 100 points (2 @ 50 points each)
   3) Weekly Engagement - 100 points (2 @ 50 points each)
   4) Day leadership - 50 points
   5) Blog post(s) - 100 points

Re-entry work (35%)
   1) Project - 300 points
   2) Post Program Blog update - 50 points

Students will receive a numeric grade according to the point scale below. Instructors will update grades via D2L. Note: MSU will not post the official final grades until the course officially ends, depending on when the course officially ends (see the Schedule of Courses web site for more information).

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<tr>
<th>Grade</th>
<th>Points</th>
<th>Overall Percentage (%)</th>
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<tbody>
<tr>
<td>4.0</td>
<td>930 – 1000</td>
<td>93.0 – 100.0</td>
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<tr>
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<td>875 – 929</td>
<td>87.5 – 92.9</td>
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<tr>
<td>3.0</td>
<td>825 – 874</td>
<td>82.5 – 87.4</td>
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<td>under 62.4</td>
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Course Texts
For this course, we will cover the overviews of several biomass conversion technologies from the text:


In particular from the following chapters:

- Chapter 1: What is biomass and what is bioenergy?
- Chapter 5: Thermochemical conversion by combustion and the steam cycle
- Chapter 6: Thermochemical conversion by gasification and pyrolysis
- Chapter 7: Biochemical Conversion of Wet Biomass
- Chapter 8: Cogeneration of combined heat and power

This book will be on reserve in the BAE office (Farrall 216). Additionally, >80% of this book is available for online viewing at Google Books and select readings from this text may be available on D2L. Some online reports, presentations, and videos on bioenergy in Sweden and Germany are provided on the D2L site. A course pack will be provided.

Sweden/Germany General Information
Most Swedes have very good English speaking skills and native speakers of English will have no trouble making themselves understood. This is beyond the scope of this course, but students are encouraged to learn what they can in the short time we have. A few useful resources are given in the links below:

1. The World FactBook - Sweden
2. Swedish – A Brief Presentation. Stockholm School of Economics
   http://www2.hhs.se/isa/swedish/chap1.htm
3. Swedish Grammar Course. Universitetet i Tromsø
   http://www.hum.uit.no/a/svenonius/lingua/flow/co/gram/rfgsv/rfgsv.html
4. Online Swedish Dictionary from Språkrådet
   http://lexin2.nada.kth.se/swe-eng.html
5. Google Translate: Swedish-English
   http://translate.google.com/#sv|en|
6. Google Translate: English-Swedish
   http://translate.google.com/#en|sv|
7. The World FactBook - Germany
8. Google Translate: German-English
   http://translate.google.com/#de|en|
9. Google Translate: English-German
   http://translate.google.com/#en|de|
10. Online German Dictionary from Collins
    http://www.collinsdictionary.com/dictionary/english-german

English is common in major German cities and tourist sites. Outside of the major cities, most of the younger Germans speak English. Most text will be in German only (including restaurant menus), with the exception of major tourist sites.

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