<table>
<thead>
<tr>
<th>Requirement</th>
<th>Notes</th>
<th>Course #</th>
<th>Credits</th>
<th>Term</th>
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<tr>
<td>2-2.5 Year MS &amp; MSE Plan</td>
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<tr>
<td>Engineering</td>
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<tr>
<td>Environmental Engineering Core</td>
<td>18CR in CEE courses at the 500 or 600 level</td>
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<td></td>
<td>6CR in additional CEE courses</td>
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<tr>
<td></td>
<td>CEE 581</td>
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<td>CEE 582</td>
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<td>CEE 591</td>
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<tr>
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<td>CEE 881 (1st Fall in program)</td>
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<td></td>
<td>And one course from List A (next page)</td>
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<tr>
<td>Sustainable Energy Systems Major</td>
<td>12CR from, the “Sustainable Energy Systems” Major</td>
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<td>CEE 567 and 9CR from List A (see next page)</td>
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<td>Advanced Math Requirement</td>
<td>3CR in approved Mathematics or equivalent</td>
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<td>See Env. Eng dept. requirements and Cognates (next page)</td>
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<tr>
<td>SS Core</td>
<td>6CR in Systems Analysis for Sustainability</td>
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<td>NRE 557/CEE 586</td>
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<td>And one course from List 1 (next page)</td>
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<td>9CR total</td>
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<td>Sustainable Design &amp; Technology Minimum 3CR</td>
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<td>Required:</td>
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<td></td>
<td>NRE 574</td>
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<td>See List 2 for other acceptable courses (next page)</td>
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<td>Sustainable Enterprise Minimum 3CR</td>
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<td>See List 3 for acceptable courses (next page)</td>
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<td>Additional 3CR minimum from list A1, 2, or 3</td>
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<td>See attached list (A1-3) of acceptable courses in these specializations</td>
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<tr>
<td>Natural Resources and Environment</td>
<td>NRE 509</td>
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<td></td>
<td>NRE 510</td>
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<td>IAMS Requirement</td>
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<td>Two courses; 3CR minimum</td>
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<td>Please see page 3 for approved courses.</td>
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<tr>
<td>Analytics</td>
<td>One statistics course</td>
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<td>NRE 538 or equivalent required</td>
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<tr>
<td>Opus</td>
<td>Master’s Project/Thesis/Practicum</td>
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<td>At most 6CR of NRE 700/701</td>
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<td>Cognates [Rackham requirement]</td>
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<td>TOTALS</td>
<td>TOTAL CREDIT HOURS BY SCHOOL</td>
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<td>“NRE” – Minimum 25CR</td>
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<td>“CEE” – Minimum 18CR</td>
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<td>TOTAL CREDIT HOURS</td>
<td>Minimum 54 Credit Hours</td>
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</table>
A) Sustainable Energy Systems (12CR total)
Required:
CEE 567 (3)  
Civil and Environmental Engineering (choose one):
CEE 526 (3)  
CEE 549 (3)  
CEE 592 (3)  
Energy Electives (choose two):
CHE 548 (3)  
CHE 568 (3)  
EECS 463 (4)  
EECS 498 (4)  
ME 432 (3)  
ME 433 (3)  
ME 571 (3)  
ME 589 (3)  
NERS 531 (3)  
Energy Infrastructure Systems (W)
Design of Hydraulic Systems (W)
Geoenvironmental Engineering (F)
Biological Processes in Environ Eng (W)
Electrochemical Engineering (F)
Fuel Cells and Fuel Processors (F)
Power Systems Des & Operations (F)
Grid Integrations of Alt Energy Sources (W)
Combustion (W)
Advanced Energy Solutions (F,W)
Energy Generation and Storage (F)
Sustainable Des of Technology Systems (F)
Nuclear Waste Management (W)

Natural Resources and Environment

A) Sustainable Systems Core (1-3)
1) Systems Analysis for Sustainability (at least 6CR*)
NRE 501.036 (3cr)  
NRE 597 (3cr)  
NRE 557/CEE 586 (3cr)  
NRE 550/STRAT 566 (3cr)  
NRE 570 (1.5cr)  
NRE 501 (1.5cr)  
NRE 531 (4cr)  
*At least two courses need to be from the courses listed above
NRE 570 Consumption, Trade, and Environmental Input-Output
Analysis (W)
Environmental Systems Analysis (F)
Industrial Ecology (W)
Systems Thinking for Sustainable Development (W)
Environ Economics Quantitative Methods & Tools (WN A)
Five courses on selected topics in Env. Economics (FA B & WN A&B)
Principles of GIS (W)

2) Sustainable Design & Technology (3CR)
NRE 501.037(3cr)  
NRE 501.091 (3r)  
NRE 574/PUBPOL 519 (3cr)  
NRE 501.039 (3cr)  
NRE 576/UP 576 (3cr)  
NRE 605/BA 605 (3cr)  
NRE 687 (4cr)  
ARCH 575 (3cr)  
CEE 460 (3cr)  
CEE 582 (3cr)  
CEE 686/CHE 686 (2-3cr)  
MECHENG 589 (3cr)  
DESCI 502 (3)  
DESCI 790 (1-4)  
Urban Sustainability (F)
Renewable Electricity and the Grid (W)
Sustainable Energy Systems (F)
Land Use and Global Change (F)
Ecological Design Approaches to Brownfield Redevelopment (F)
Green Development (W)
Landscape Planning (F)
Building Ecology (F)
Design of Environ Engineering Systems (F)
Environmental Microbiology (F)
Case Studies in Environ Sustainability (W)
Sustainable Design of Technology Systems (F)
Design Process Models (W)
Design Science Colloquium (F or W)

Last Revised 07/14/2014
Grid Integration of Alternative Energy Sources (TBD)

3) **Sustainable Enterprise (3CR)**

- NRE 567 (3cr)
- NRE 512/LHC 536 (2.25)
- NRE 513/STRAT 564&564 (3cr)
- NRE 527/BE 527 (3cr)
- NRE 532 (3cr)
- NRE 533 (3cr)
- BE 555 (1.5)
- NRE 560/UP 560 (3cr)
- ENGR 521 (3cr)
- ES 520 (1.5cr)
- FIN 637 (2.25cr)
- STRAT 735-739 (1.5cr)
- FIN 583 (1.5cr)

- Transportation Energy & Climate (W)
- Ethics Corporate Management (F or W)
- Strategies for Sustainable Development (F)
- Energy Markets and Energy Politics (F)
- Natural Resources and Environ Conflict Management (F)
- Negotiation Skills (F)
- Non Market Strategy (F)
- Behavior and Environment (F)
- CleanTech Entrepreneurship (F)
- CleanTech Venture Opportunities (F)
- Finance and Sustainable Enterprises (F)
- Topics in Global Sustainable Enterprise (F)
- Energy Project Finance (W)

**B) Sustainable Systems Electives**

**B1) Additional SS courses (can count towards Non-Opus option)**

- NRE 514 (2cr)
- NRE 523(3cr)
- EHS 672 (3cr)
- NRE 558/CEE 587 (3cr)
- NRE 686/PUBPOL 563 (3cr)
- BA 612 (2.25cr)
- ESENG 501 (3cr)
- Econ 437 (3cr)
- UP 533/ARCH 506 (3cr)

- Environmental Impact Assessment (F)
- Environmental Risk Assessment (W)
- Life Cycle Assessment: Human Health & Environ Impacts (F)
- Water Resource Policy (TBD)
- Environmental Policy (W)
- Strategies for the Base of the Pyramid (F)
- Seminars in Energy Science, Technology, and Policy (F)
- Energy Economics & Policy (W)
- Sustainable Urbanism and Architecture (F)

**B2) Sustainable Systems Themes (see links for course listings):**

- Energy Systems - http://www.snre.umich.edu/node/7746/#energy
- Mobility Systems - http://www.snre.umich.edu/node/7746/#transportation
- Water Systems - http://www.snre.umich.edu/node/7746/#water
- Food Systems - http://www.snre.umich.edu/node/7746/#food
- Built Environment - http://www.snre.umich.edu/node/7746/#builtenv
- Climate Change - http://www.snre.umich.edu/node/7746/#climchange

**Integrated Analytic Methods and Skills Requirement**

Students are required, at some point during their time enrolled in the program, to take 2 courses composing at least 3 credits from a faculty-approved list of courses that focus on integrative analytic methods and skills. The faculty-approved existing courses that satisfy this requirement are listed below:

- **Fall**
  - 501 – Land Use and Global Change
  - 501 – Urban Stormwater
  - 501 – Ecosystem Services
  - 514 – Environmental Impact Assessment
  - 533 – Negotiation Skills
  - 536 – Mediation Skills

Last Revised 07/14/2014
597 – Environmental Systems Analysis
662 – Localization Seminar
677 – Climate Adaptation Seminar (2nd 7 week)

Winter
501 – Science and Management of the Great Lakes
501 – Biofuels and Sustainability
501 – Advanced LCA Methods and Software Tools (W14 – 2nd 7 weeks)
501 - Applied Ecosystem Modeling (W14 – 2nd 7 weeks)
550 – Systems Thinking for Sustainable Development
557 – Industrial Ecology
570 – Environmental Economics
581 – Advanced Environmental Education
589 – Ecological Restoration
641 – Interdisciplinary Research Methods
687 – Landscape Planning
787 – Metro Studio (MLA only)